

NEW WARTHOG ENCLOSURE BUILDING AT

FRESNO CHAFFEE ZOO

894 W. Belmont Ave, Fresno, CA 93728

Fresno, CA

PROJECT MANUAL



March 19, 2018

1616

**1616 FRESNO CHAFFEE ZOO
NEW WARTHOG & TURTLE EXHIBIT ENCLOSURE**

TABLE OF CONTENTS

SECTION

- 00 01 01 Cover Page
- 00 01 10 Table of Contents

FRESNO CHAFFEE ZOO – “Hard-bid Project”

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

- 00 31 32 Geotechnical Report

TECHNICAL SPECIFICATIONS

DIVISION 01 – THERMAL AND MOISTURE PROTECTION

- 01 30 10 RFI Form
- 01 32 16 Construction Progress Schedule
- 01 41 00 Regulatory Requirements
- 01 42 19 Reference Standards
- 01 50 00 Temporary Facilities & Controls
- 01 60 00 Product Requirements
- 01 60 31 Substitution Request Form
- 01 61 16 Volatile Organic Compounds (VOC) Content Restrictions
- 01 70 00 Execution and Closeout Requirements
- 01 74 19 Construction Waste Management and Disposal
- 01 78 00 Closeout Submittals
- 01 78 23 Operation and Maintenance Data

DIVISION 02 – EXISTING CONDITIONS

- 02 41 00 Demolition

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

- 07 42 13 Metal Wall Panels
- 07 53 00 Elastomeric Roofing Membrane
- 07 62 00 Sheet Metal Flashing and Trim
- 07 71 23 Manufactured Gutter & Downspouts
- 07 90 05 Joint Sealers

DIVISION 08 – DOORS AND WINDOWS

- 08 11 13 Hollow Metal Frames
- 08 62 23 Tubular Skylights
- 08 71 00 Door Hardware
- 08 80 00 Glazing (for Building)

DIVISION 09 – FINISHES

- 09 90 05 Paint & Coating (for Building) 10
- 09 96 56 Floor and Wall Sealants (for Building) 8

DIVISION 10 – (NOT USED)**DIVISION 11 – EQUIPMENT (NOT USED)****DIVISION 12 – FURNISHINGS (NOT USED)****DIVISION 13 – SPECIALTIES**

13 19 13 Animal Holding Partitions & Gates

DIVISION 22 – PLUMBING

22 00 00 Plumbing

DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING

23 00 00 Mechanical

23 00 13 General Mechanical Requirements

DIVISION 31 – EARTHWORK

31 10 00 Site Clearing

31 14 00 Soil Materials

31 20 00 Earthwork-Excavation, Filling, and Grading

31 23 00 Trench Excavation Backfill

31 31 00 Soil Sterilization

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 01 93 Tree and Planting Protection

32 11 23 Aggregate Base Course

32 12 16 Asphaltic Concrete Paving

32 13 16 Site Concrete Paving

32 15 40 Crushed Stone Surfacing

32 17 00 Painting & Marking Site Surfaces

32 31 13 Chain Link Fences & Gates

32 32 46 Natural Stone Installation

32 84 23 Underground Sprinklers

32 92 19 Seeding

32 93 00 Plants

32 96 43 Tree Transplanting

DIVISION 33 - UTILITIES

33 10 00 Site Water Systems

33 13 00 Disinfection of Water Distribution Systems

33 30 00 Site Sewer Systems

33 40 00 Storm Drainage Improvements

33 50 00 Offsite Street and Utilities



**GEOTECHNICAL ENGINEERING INVESTIGATION REPORT
PROPOSED WARTHOG EXHIBIT BUILDING
FRESNO CHAFFEE ZOO
FRESNO, CALIFORNIA**

BSK PROJECT G16-233-11F

PREPARED FOR:

FRESNO CHAFFEE ZOO CORPORATION
894 W. BELMONT AVENUE
FRESNO, CALIFORNIA 93728

DECEMBER 22, 2016

**GEOTECHNICAL ENGINEERING INVESTIGATION REPORT
PROPOSED WARTHOG EXHIBIT BUILDING
FRESNO CHAFFEE ZOO
FRESNO, CALIFORNIA**

Prepared for:

Chaffee Zoo Corporation
894 W. Belmont Avenue
Fresno, California 93728

BSK Project G16-233-11F

December 22, 2016

Prepared by:



Shawn Demmers, EIT
Staff Engineer



On Man Lau, P.E., G.E.
South Valley Regional Manager



BSK Associates
550 West Locust Avenue
Fresno, California 93650
Office: (559) 497-2880
Fax: (559) 497-2886
www.bskassociates.com



Table of Contents

1.0	INTRODUCTION	1
1.1	General.....	1
1.2	Project Description.....	1
1.3	Purpose and Scope of Services	1
2.0	FIELD INVESTIGATION AND LABORATORY TESTING	1
2.1	Field Investigation.....	1
2.2	Laboratory Testing	2
3.0	SOIL CONDITIONS.....	2
3.1	Site Description	2
3.2	Subsurface Conditions	2
4.0	CONCLUSIONS AND RECOMMENDATIONS.....	3
4.1	General.....	3
4.2	Soil Corrosivity	3
4.3	Seismic Design Criteria.....	3
4.4	Site Preparation and Earthwork Construction.....	4
4.5	Shallow Foundations.....	5
4.6	Lateral Earth Pressure and Frictional Resistance.....	6
4.7	Concrete Slabs-on-Grade	7
4.8	Excavation Stability	8
4.9	Utility Trench Excavation and Backfill.....	8
4.10	Surface Drainage Control.....	9
5.0	PLANS AND SPECIFICATIONS REVIEW	9
6.0	CONSTRUCTION TESTING AND OBSERVATIONS	9
7.0	LIMITATIONS.....	10

Tables

Table 1: 2013 California Building Code (CBC) Seismic Design Criteria

Table 2: Recommended Lateral Earth Pressure

Figures

Figure 1: Site Vicinity Map

Figure 2: Site Plan

Appendices

Appendix A: Field Exploration/Log of Test Borings

Appendix B: Laboratory Testing



1.0 INTRODUCTION

1.1 General

This report presents the results of our geotechnical engineering investigation for the site of the proposed pre-fabricated steel building. The site is situated within Roeding Park in the southeastern portion of the Fresno Chaffee Zoo facility in Fresno, California.

The geotechnical engineering investigation was conducted in general accordance with the Scope of Services outlined in our proposal GF16-14532 dated November 29, 2016.

1.2 Project Description

We understand that the project consists of the design and construction of a new 1,000 sf single-story concrete masonry unit (CMU) building. Details of the foundation system were not available at the time this proposal was prepared, as such, we assume the new building will be supported on shallow spread footings and concrete slab-on-grade floor. We also assume maximum wall and column loads will not exceed 2 kips/ft and 10 kips, respectively. Other improvements are anticipated to include underground utilities, landscaping, hardscaping, asphalt paved drives/parking. Fill elevations are anticipated to be less than 3 feet above natural grade to achieve level building pad and positive site drainage.

In the event that significant changes occur in the design or location of the proposed structures, the conclusions and recommendations presented in the report will not be considered valid unless the changes are reviewed by BSK and the conclusions and recommendations are modified or verified in writing as necessary.

1.3 Purpose and Scope of Services

The purpose of this geotechnical investigation is to assess soil conditions at the project site and provide geotechnical engineering recommendations for use by the project designers during the preparation of the project plans and specifications. The scope of the investigation included a field exploration, laboratory testing, engineering analysis and report preparation.

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 Field Investigation

The field investigation was conducted on December 12, 2016. Two (2) exploratory borings were drilled to depths of approximately 6.5 and 15 feet below ground surface (bgs). Hand auger equipment was used to excavate the borings. Relatively intact and bulk soil samples were obtained at the time of



excavation. The approximate boring locations are presented on Figure 2. Details of the field exploration and the boring logs are presented in Appendix "A".

2.2 Laboratory Testing

Laboratory testing of selected soil samples was performed to evaluate their engineering characteristics and properties. The testing program included: In-situ moisture and density; shear strength; particle size analyses, and corrosion potential. The in-situ moisture and dry density test results are presented on the boring logs in Appendix A. Descriptions of the laboratory test methods and test results are provided in Appendix B.

3.0 SOIL CONDITIONS

The following sections address site description, surface and subsurface conditions and groundwater conditions.

3.1 Site Description

The project site is situated at the southern portion of the existing zoo. The project site is bounded to the north by the existing lion exhibit, to the west by an existing asphalt paved access road, to the south by turf area and W. Belmont Avenue beyond, and to the east by turf area. At the time of the field exploration, the project site was undeveloped and partially landscaped to match the surrounding landscape.

3.2 Subsurface Conditions

The subsurface soil exposed in the test borings consisted primarily of fine to medium grained silty sand in the upper 3 to 13 feet, underlain by poorly graded sand, clayey sand and silty sand to the maximum depth of exploration, 14.5 feet bgs. Fine gravel was observed within the upper 6 feet of boring HA-1. Strongly cemented soils were encountered within boring HA-2 at approximately 6 feet bgs.

The boring logs in Appendix "A" provide a more detailed description of the soils encountered in the boring, including the applicable Unified Soil Classification System symbol.

Groundwater was not encountered in the test borings at the time of the field exploration. Well hydrograph data published by the State of California Department of Water Resources for the general area show depth to groundwater to exceed 100 feet bgs. The possibility of the groundwater table to rise or the presence of perched groundwater may occur due to irrigation, seasonal effects or other factors not evident or present at the time of the field exploration.



4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that there are no soil conditions that would preclude the construction of the proposed structure provided that the recommendations presented herein are incorporated in the design and construction of the project.

The use of shallow isolated and continuous reinforced concrete spread footings bearing on undisturbed native soil or approved engineered fill are considered appropriate for structure support.

4.2 Soil Corrosivity

Based on test results, on-site near-surface soils have low soluble sulfate and soluble chloride contents, a low minimum resistivity, and are alkaline. Thus, on-site soils are considered to have a low corrosion potential with respect to buried concrete and a high corrosion potential to unprotected metal conduits. Summarized test results are shown on Table B-1 in "Appendix B."

We recommend that Type I/Type II cement be used in the formulation of concrete and that buried reinforcing steel protection be provided with the minimum concrete cover required by the American Concrete Institute (ACI) Building Code for Structural Concrete, ACI 318, Chapter 7.7. Buried metal conduits must have protective coatings in accordance with the manufacturer's specifications. If detailed recommendations for corrosion protection are desired, a corrosion specialist should be consulted.

4.3 Seismic Design Criteria

There are no known active fault zones within the vicinity of the project site. In accordance with Section 1613.3.2 of the 2013 California Building Code (CBC) and Table 20.3-1 of ASCE 7-10, the site can be classified as Site Class D. The following parameters are considered applicable for the design of structural improvements:

TABLE 1
2013 California Building Code (CBC) Seismic Design Criteria*

Seismic Design Parameter	Value		Reference
MCE Mapped Spectral Acceleration (g)	$S_s = 0.665$	$S_1 = 0.264$	Figure 1613.3.1(1,2)
Amplification Factors (Site Class D)	$F_a = 1.268$	$F_v = 1.871$	Table 1613.5.3
Site Adjusted MCE Spectral Acceleration (g)	$S_{MS} = 0.843$	$S_{M1} = 0.495$	Equations 16-36, 37
Design Spectral Acceleration (g)	$S_{DS} = 0.562$	$S_{D1} = 0.330$	Equations 16-38, 39
Geometric Mean (g)	$PGA_M = 0.322$		ASCE Equations 11.8-1
Note: * Site Coordinates: 36.75101N, 119.81964			



4.4 Site Preparation and Earthwork Construction

The following procedures must be implemented during site preparation for the proposed building and improvements. References to maximum dry density, optimum moisture content, and relative compaction are based on ASTM: D1557-09 (or latest test revision) laboratory test procedures. Earthwork must encompass all areas to receive fill or to support proposed improvements and must extend horizontally a minimum distance of 5-feet beyond the perimeter of the improvements. If 5.0-foot lateral clearance is not accessible, the lateral limits of the earthwork may be decreased to a horizontal distance determined by the Geotechnical Engineer after reviewing site conditions.

1. Prior to any site grading, all surface vegetation, Portland cement concrete, and any miscellaneous surface obstructions must be removed from the project area. Near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped to a depth of at least 3-inches to expose a clean soil surface. Surface strippings must not be incorporated into fill unless they can be sufficiently blended to result in an organic content less than 3 percent by weight (ASTM: D2974). Stripped topsoil, with an organic content between 3 and 12 percent by weight, may be stockpiled and used as non-structural fill (i.e. landscaped areas). If placed in non-structural areas, strippings and organic rich soil must be placed within 2 feet of finished grade and at least 5 feet outside of building and roadway perimeters.
2. Soil disturbed as a result of site clearing, undocumented fill, debris, abandoned underground structures and pipe lines must be excavated to expose approved undisturbed native soil.
3. The building site must be over-excavated to a minimum depth of 18 inches bgs and then proof-rolled to detect soft or pliant areas. Soft or pliant areas must be excavated to expose firm unyielding subgrade. The subgrade at the base of excavations must be scarified at least 8 inches below subgrade elevation, uniformly moisture conditioned to 2 percent above optimum moisture, and compacted to not less than 90 percent of the maximum dry density.
4. After the completion of the required excavation, existing utilities, underground pipes, or substructures present beneath the proposed building area must be excavated and relocated to a point at least 5-feet horizontally or a distance equal to the depth of the trench horizontally from the edge of the proposed foundations, whichever distance is greater.
5. Excavated soils, free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 3-percent organic content by weight, may be returned to the excavations as engineered fill. Engineered fill placed as backfill in utility trench and substructure excavations, and for building emplacement grading, must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture-conditioned to 2-percent above optimum moisture content and compacted to at least 90-percent of the maximum dry density. Acceptance of engineered fill placement must be based on both moisture content and relative compaction.



Imported fill materials must be free of deleterious substances, and have less than 3-percent organic content by weight. The project specifications must require the contractor to contact BSK for review of the proposed import fill materials for conformance with these recommendations at least two weeks prior to importing to the site. Imported fill soils must be non-hazardous and be derived from a single, consistent soil type source conforming to the following criteria:

Maximum Particle Size:	3-inches
Percent Passing #4 Sieve:	65 – 100
Percent Passing #200 Sieve:	20 – 45
Expansion Index:	< 20
Low Corrosion Potential:	
Soluble Sulfates:	< 1,500 mg/kg
Soluble Chlorides:	< 400 mg/kg
Soil Resistivity:	> 5,000 ohm-cm

Grading operations should be scheduled as to avoid working during periods of inclement weather. Should these operations be performed during or shortly following periods of inclement weather, unstable soil conditions may result in the soils exhibiting a "pumping" condition. This condition is caused by excess moisture, in combination with compaction, resulting in saturation and near zero air voids in the soils. If this condition occurs, the affected soils must be over-excavated to the depth at which stable soils are encountered, and replaced with suitable soils compacted as engineered fill. Alternatively, the Contractor may proceed with grading operations after utilizing a method to stabilize the soil subgrade, which must be subject to review by BSK prior to implementation.

4.5 Shallow Foundations

Provided the site is prepared as recommended above, the proposed structure may be supported on reinforced concrete spread footings bearing on engineered fill or undisturbed native soil. The allowable bearing pressure applies to the dead load plus live load (DL + LL) condition and may be increased by 1/3 for short duration wind or seismic loads. The foundations must be designed with reinforcing steel as recommended by the Project Structural Engineer. Footing design must follow the criteria listed below:



Footings Embedment (inch)*	Minimum Footing Width (inch)		Allowable Bearing Capacity (psf)	
	Continuous Footing	Isolated Spread Footing	Continuous Footing	Isolated Spread Footing
12	12.0	24.0	2,000	2,500

Note: * - Measured with respect to the lowest adjacent subgrade surface

Estimated post-construction and differential settlement for the recommended spread footings is as follows:

Footings Type	Post-Construction Settlement (inches)	Differential Settlement (inches)	Angular Distortion
Continuous	0.50	--	0.001
Isolated	0.75	0.35	--

Isolated footing differential settlement is based on adjacent similarly loaded footings and is anticipated to be approximately 50 percent of the total settlement. The settlement values given above are applicable to the maximum loading conditions. For loads other than the maximum loads designated in Section 1.2, the settlements can be adjusted proportionally.

4.6 Lateral Earth Pressure and Frictional Resistance

Provided that the site is prepared as recommended in Section 4.4, the following earth pressure parameters may be used for designing foundations. Parameters are shown in the following table for drained conditions of select engineered fill or prepared native soil. In addition, the drained condition assumes that positive drainage will be provided away from the building improvements and that water does not accumulate around the structure and cause a build-up of hydrostatic pressure.

TABLE 2
RECOMMENDED LATERAL EARTH PRESSURES
(Drained Conditions)

Lateral Pressure Conditions	Equivalent Fluid Pressure (pcf)
Passive Pressure	390

Passive pressure refers to walls that are free to rotate. The coefficient of passive earth pressure (K_p) is a value of 3.12. The lateral earth pressure given above should be considered to have a triangular load distribution. A coefficient of friction of 0.60 may be used between soil subgrade and the bottom of footings or slabs.



The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. BSK recommends that a safety factor consistent with the design conditions be included in their usage. For stability against lateral sliding that is resisted solely by the passive earth pressure against footings or friction along the bottom of footings, a minimum safety factor of 1.5 is recommended. For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral stability against seismic loading conditions, a minimum safety factor of 1.2 is recommended.

4.7 Concrete Slabs-on-Grade

Structural concrete slab-on-grade floors must be a minimum of 4-inches thick and must be supported on a compacted soil subgrade or aggregate base prepared in accordance with the recommendations in Section 4.4. Existing on-site surface soils may be considered to have a low expansion potential for design purposes. In order to regulate cracking of the slabs, construction joints and/or control joints must be provided in each direction at a maximum spacing of 12 feet along with steel reinforcement as recommended by the Project Structural Engineer. It is recommended that steel reinforcement used in concrete slabs-on-grade consist of steel rebar. Structural concrete slabs-on-grade may be designed using a modulus of subgrade reaction equal to 200 pci.

Interior concrete slabs must be successively underlain by: 1-½ inches of washed concrete sand; a durable vapor barrier; and a smooth, compacted subgrade surface. The vapor barrier must meet the requirements of ASTM: E1745 Class A and have a water vapor transmission rate (WVTR) of less than or equal to 0.012-Perms as tested by ASTM: E96. Examples of acceptable vapor barrier products include: Stego Wrap (15-mil) Vapor Barrier by STEGO INDUSTRIES LLC; W.R. Meadows Pre-molded Membrane with Plasmatic Core; and Zero-Perm by Alumiseal. Because of the importance of the vapor barrier, joints must be carefully spliced and taped.

If upward migration of subgrade moisture through the slab is not a concern, then the vapor barrier and overlying sand may be deleted. The building subgrade must be kept in a moist condition until the vapor barrier or concrete slab is placed. BSK's representative must be called to the site to review soil and moisture conditions immediately prior to placing the vapor barrier or concrete slab.

As indicated in the PCA Engineering Bulletin 119, Concrete Floors and Moisture, and applicable ACI Committee reports (see ACI 360R-06, Design of Slabs-on-Ground, dated October 2006 and ACI 302.1R-04, Guide for Concrete Floor and Slab Construction, dated June 2004), the sand layer between the vapor barrier and concrete floor slab may be omitted. This should reduce the amount of moisture that can be transmitted through the slab (especially if the sand layer becomes very moist or wet prior to placing the concrete); however, the risk of slab "curling" is much greater. The "curling" may result from a sharp contrast in moisture-drying conditions between the exposed slab surface and the surface in contact with the membrane. As recommended in the referenced ACI Committee reports, measures must be taken to reduce the risk of "curling" such as reducing the joint spacing, using a low shrinkage mix design, and



reinforcing the concrete slab. The water: cement ratio of the concrete must not exceed 0.45. In order to regulate cracking of the slab, we recommend that full depth construction joints and control joints be provided in each direction with slab thickness and steel reinforcing as recommended by the project Structural Engineer.

Excessive landscape water or leaking utility lines could create elevated moisture conditions under concrete slabs, which could result in adverse moisture or mildew conditions in floor slabs or walls. Accordingly, care must be taken to avoid excess irrigation around the structures, as well as to periodically monitor for leaking utility lines. Likewise, positive surface drainage must be provided around the perimeter of the structures.

As stated above, the control of the deleterious effects of moisture vapor transmission on flooring materials can be substantially improved by the use of a low porosity concrete. This can be achieved by specifying a low water:cement ratio (0.45 or less by weight), 4,000-psi compressive strength at 28-days and a minimum of 7-days wet-curing.

4.8 Excavation Stability

Soils encountered within the upper 10-feet are generally Type C (silty sand, sandy silt) soil in accordance with OSHA (Occupational Safety and Health Administration). The slopes surrounding or along temporary excavations may be vertical for excavations that are less than 5-feet deep and exhibit no indication of potential caving, but must be no steeper than 1.5H:1V for excavations that are deeper than 5-feet, to a maximum depth of 10-feet. Temporary excavations for the project construction must be left open for as short a time as possible and must be protected from water runoff. In addition, equipment and/or stockpiles must be maintained at least 10-foot away from the top of excavations. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations 29 CFR Part 1926, or successor regulations). These excavation recommendations are based on soil characteristics derived from the borings. Variations in soil conditions will likely be encountered during excavation. At the time of construction, BSK must be afforded the opportunity to observe and document sloping and shoring conditions, and the opportunity to provide review of actual field conditions to account for condition variations not otherwise anticipated in the preparation of these recommendations.

4.9 Utility Trench Excavation and Backfill

Pipes and conduits must be bedded and shaded in accordance with the requirements of the pipe manufacturer. Where no specific requirements exist, we recommend a minimum of 6-inches of sand bedding material for pipe installations greater than 12-inches in diameter. For pipe diameters smaller than 12-inches, the bedding thickness may be reduced to 4-inches. The bedding material and envelope (up to 6-inches above the pipe) must consist of sand (Sand Equivalent greater than 30), be placed in



loose lifts not exceeding 8-inches in thickness, compacted to at least 90-percent of the maximum dry density, and moisture conditioned to within 2-percent of optimum moisture content. Water jetting to attain compaction must not be allowed.

Adequate excavation width must be provided to permit uniform compaction on both sides of utility lines installed within the trench. The trench backfill material may consist of engineered fill. Trench backfill outside the building footprint must be placed in loose lifts not to exceed 8-inches in loose thickness, compacted to at least 90-percent of the maximum dry density, and moisture conditioned to within 2-percent of optimum moisture content. The upper 12-inches of trench backfill below pavement sections must be compacted to at least 95-percent of the maximum dry density. Conduits extending through or below footings must be “sleeved” as determined by the Project Structural Engineer. Utility trench backfill beneath and within 5-feet of the building areas must be backfilled in accordance with Section 4.4 (Site Preparation and Earthwork Construction).

4.10 Surface Drainage Control

Final grading around site improvements must provide for positive and enduring drainage with a minimum of 2-percent slope for a minimum distance of 5-feet away from the building foundations. Ponding of water must not be allowed on or near the building or paved surfaces. Saturation of the soils immediately adjacent to or below the building area must not be allowed. Irrigation water must be applied in amounts not exceeding those required to offset evaporation, sustain plant life, and maintain a relatively uniform moisture profile around and below site improvements.

5.0 PLANS AND SPECIFICATIONS REVIEW

BSK recommends that it be retained to review the draft plans and specifications for the project, with regard to foundations and earthwork, prior to their being finalized and issued for construction bidding.

6.0 CONSTRUCTION TESTING AND OBSERVATIONS

Geotechnical testing and observation during construction is a vital extension of this geotechnical investigation. BSK recommends that it be retained for those services. Field review during site preparation and grading allows for evaluation of the exposed soil conditions and confirmation or revision of the assumptions and extrapolations made in formulating the design parameters and recommendations. BSK’s observations must be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. BSK must also be called to the site to observe foundation excavations, prior to placement of reinforcing steel or concrete, in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. BSK must also be called to the site to observe placement of foundation and slab concrete.



If a firm other than BSK is retained for these services during construction, that firm must notify the owner, project designers, governmental building officials, and BSK that the firm has assumed the responsibility for all phases (i.e., both design and construction) of the project within the purview of the geotechnical engineer. Notification must indicate that the firm has reviewed this report and any subsequent addenda, and that it either agrees with BSK's conclusions and recommendations, or that it will provide independent recommendations.

7.0 LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings performed at the locations shown on Figure 2. The report does not reflect variations which may occur between or beyond the borings. The nature and extent of such variations may not become evident until additional exploration and testing is performed or construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of the variations.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observation program during the construction phase. BSK assumes no responsibility for construction compliance with the design concepts or recommendations unless it has been retained to perform the testing and observation services during construction as described above.

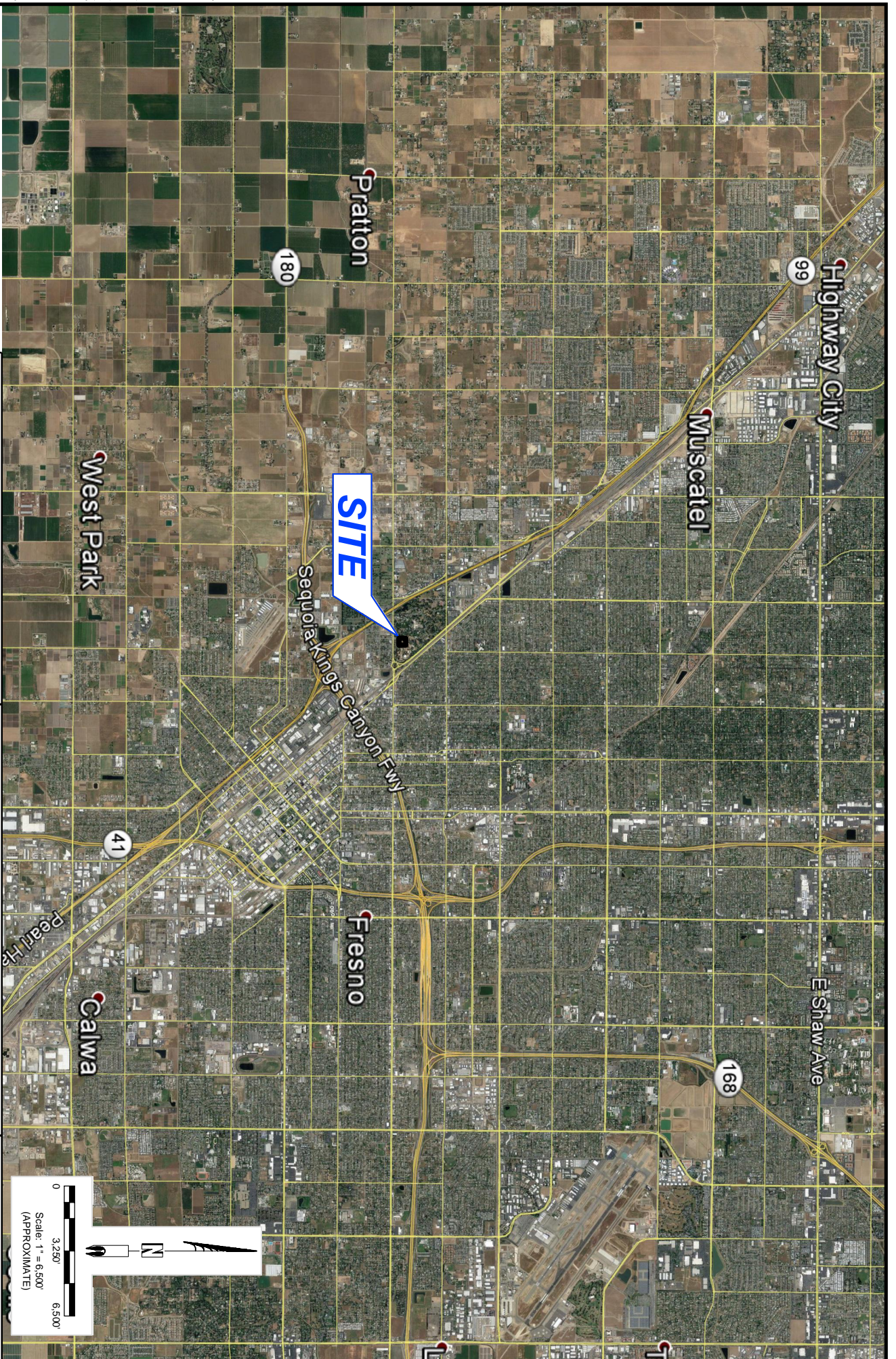
The findings of this report are valid as of the present. However, changes in the conditions of the site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Fresno County at the time the report was written. No other warranties either express or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.



FIGURES





REFERENCE IMAGE: Google Earth

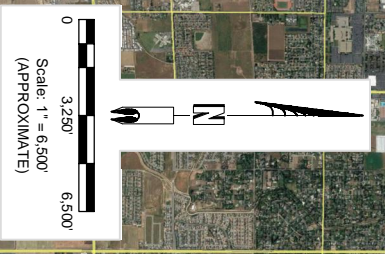
ESK ASSOCIATES
 550 West Locust Avenue
 Fresno, California 93650
 Tel. (559) 497-2880

SITE VICINITY MAP

Proposed Warthog Exhibit Building
 Fresno Chaffee Zoo
 Fresno, California

FIGURE 1

JOB NO. G16-233-11F
 DATE December 15, 2016
 DR. BY SD SHEET NO. 1
 CH. BY HN OF 1 SHEETS
 SCALE AS SHOWN





LEGEND:

- APPROXIMATE BORING LOCATIONS
- HA-2 (HAND AUGER)

REFERENCE IMAGE: Google Earth

W BELMONT AVENUE

APPROXIMATE LOCATION OF WARTHOG EXHIBIT BUILDING



ESK ASSOCIATES
 550 West Locust Avenue
 Fresno, California 93650
 Tel. (559) 497-2880

SITE PLAN

Proposed Warthog Exhibit Building
 Fresno Chaffee Zoo
 Fresno, California

FIGURE 2



JOB NO.	G16-233-11F
DATE	December 15, 2016
DR. BY	SD
CH. BY	HN
SCALE AS SHOWN	
SHEET NO.	1
OF	1 SHEETS

APPENDIX A
FIELD EXPLORATION



APPENDIX A

Field Exploration

The field exploration was conducted on December 12, 2016, under the oversight of a BSK staff engineer. Two test borings were advanced to approximate depths of 6.5 and 15 feet bgs. The borings were excavated with hand auger equipment. The approximate location of the test borings are illustrated on Figure 2, Site Plan.

The soil materials encountered in the test borings were visually classified in the field and logs were recorded during the excavation and sampling operations. Visual classification of the materials encountered in the test borings were made in general accordance with the Unified Soil Classification System (ASTM: D2487). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions.

Subsurface samples were obtained at the various depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) California Tube sampler. The samplers were driven approximately 12 inches. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Disturbed soil samples were obtained using the hand auger equipment and were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the soil cuttings, as set forth in BSK's proposal.



MAJOR DIVISIONS					TYPICAL NAMES
COARSE GRAINED SOILS More than Half > #200 sieve	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP		POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM		SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS
			SP		POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM		SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC		CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half < #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

	Modified California	RV	R-Value
	Standard Penetration Test (SPT)	SA	Sieve Analysis
	Split Spoon	SW	Swell Test
	Pushed Shelby Tube	TC	Cyclic Triaxial
	Auger Cuttings	TX	Unconsolidated Undrained Triaxial
	Grab Sample	TV	Torvane Shear
	Sample Attempt with No Recovery	UC	Unconfined Compression
CA	Chemical Analysis	(1.2)	(Shear Strength, ksf)
CN	Consolidation	WA	Wash Analysis
CP	Compaction	(20)	(with % Passing No. 200 Sieve)
DS	Direct Shear		Water Level at Time of Drilling
PM	Permeability		Water Level after Drilling (with date measured)
PP	Pocket Penetrometer		

SOIL CLASSIFICATION CHART AND LOG KEY





BSK Associates
 550 W Locust Ave
 Fresno CA 93650
 Telephone: 559-497-2880
 Fax: 559-497-2886

Project: Warthog Exhibit Building
Location: Chaffee Zoo, Fresno, CA
Project No.: G16-233-11F
Logged By: S. Demmers
Checked By: H. Ngo

Boring: HA-1

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								SM	<p>Silty SAND - dark yellow brown, moist, fine to medium grained, with fine to medium gravel, trace tree roots</p> <p>... no gravel</p> <p>... weakly cemented</p> <p>... fine to coarse grained, decrease in silt content</p> <p>... trace tree roots</p>	
2			99.5	8.5						
3										
4										
5			101.5	10.1						
6										
7										
8			100.7	10.9						
9										
10										
11										
12										
13							SP-SM	<p>Poorly Graded SAND - light brown, moist, fine to medium grained, with silt</p>		
14										
15									<p>Boring terminated at 14.5 feet bgs Borehole backfilled with soil cuttings No groundwater encountered</p>	
16										
17										
18										
19										

GEO BORING LOGS G16-233-11F.GPJ BSK.GDT 12/22/16

Drilling Contractor: BSK
Drilling Method: Hand Auger
Drilling Equipment: Hand Auger
Date Started: 12/12/16
Date Completed: 12/12/16

Surface Elevation:
Sample Method:
Groundwater Depth: Not Encountered
Completion Depth: 14.5 Feet
Borehole Diameter: 4"

* See key sheet for symbols and abbreviations used above.



BSK Associates
 550 W Locust Ave
 Fresno CA 93650
 Telephone: 559-497-2880
 Fax: 559-497-2886

Project: Warthog Exhibit Building
Location: Chaffee Zoo, Fresno, CA
Project No.: G16-233-11F
Logged By: S. Demmers
Checked By: H. Ngo

Boring: HA-2

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS
1								SM	Silty SAND - orange brown, moist, fine to medium grained	ø = 31", C = 40 psf
2				90.1	9.8			SM		
3								SC	Clayey SAND - red brown, moist, fine to medium grained	
4				94.6	11.2			SM	Silty SAND - light orange brown, moist, fine to medium grained, weakly cemented at 4.9' to 6.5'	
5								SM	... increase in silt content ... strongly cemented	Auger refusal
6									Boring terminated at 6.5 feet bgs Borehole backfilled with soil cuttings No groundwater encountered	
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										

GEO BORING LOGS G16-233-11F.GPJ BSK.GDT 12/22/16

Drilling Contractor: BSK
Drilling Method: Hand Auger
Drilling Equipment: Hand Auger
Date Started: 12/12/16
Date Completed: 12/12/16

Surface Elevation:
Sample Method:
Groundwater Depth: Not Encountered
Completion Depth: 6.25 Feet
Borehole Diameter: 4"

* See key sheet for symbols and abbreviations used above.

APPENDIX B
LABORATORY TESTING



APPENDIX B
Laboratory Testing

The results of laboratory testing performed in conjunction with this project are contained in this Appendix. The following laboratory tests were performed on soil samples in general conformance with applicable standards.

In-Situ Moisture and Density

The field moisture content and in-place dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM: D2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in accordance with ASTM: D2937 test procedures. Test results are presented on the boring logs in Appendix A.

Sieve Analysis Test

One (1) Sieve Analysis Test was performed on a selected soil sample in the area of planned construction. The test was performed in general accordance with Test Method ASTM: D422. The result of the test is presented on Figure B-1.

Soil Corrosivity

One (1) corrosivity evaluation was performed on a bulk soil sample obtained at the time of drilling in the area of planned construction. The soil was evaluated for minimum resistivity (ASTM G57), sulfate ion concentration (CT 417), chloride ion concentration (CT 422), and pH of soil (ASTM D4972). The test results are presented in Table B-1.

Table B-1: Summary of Corrosion Test Results				
Sample Location	pH	Sulfate, ppm	Chloride, ppm	Minimum Resistivity, ohm-cm
B-1 @ 0-5 feet bgs	8.9	Non-Detectable	25	3,010



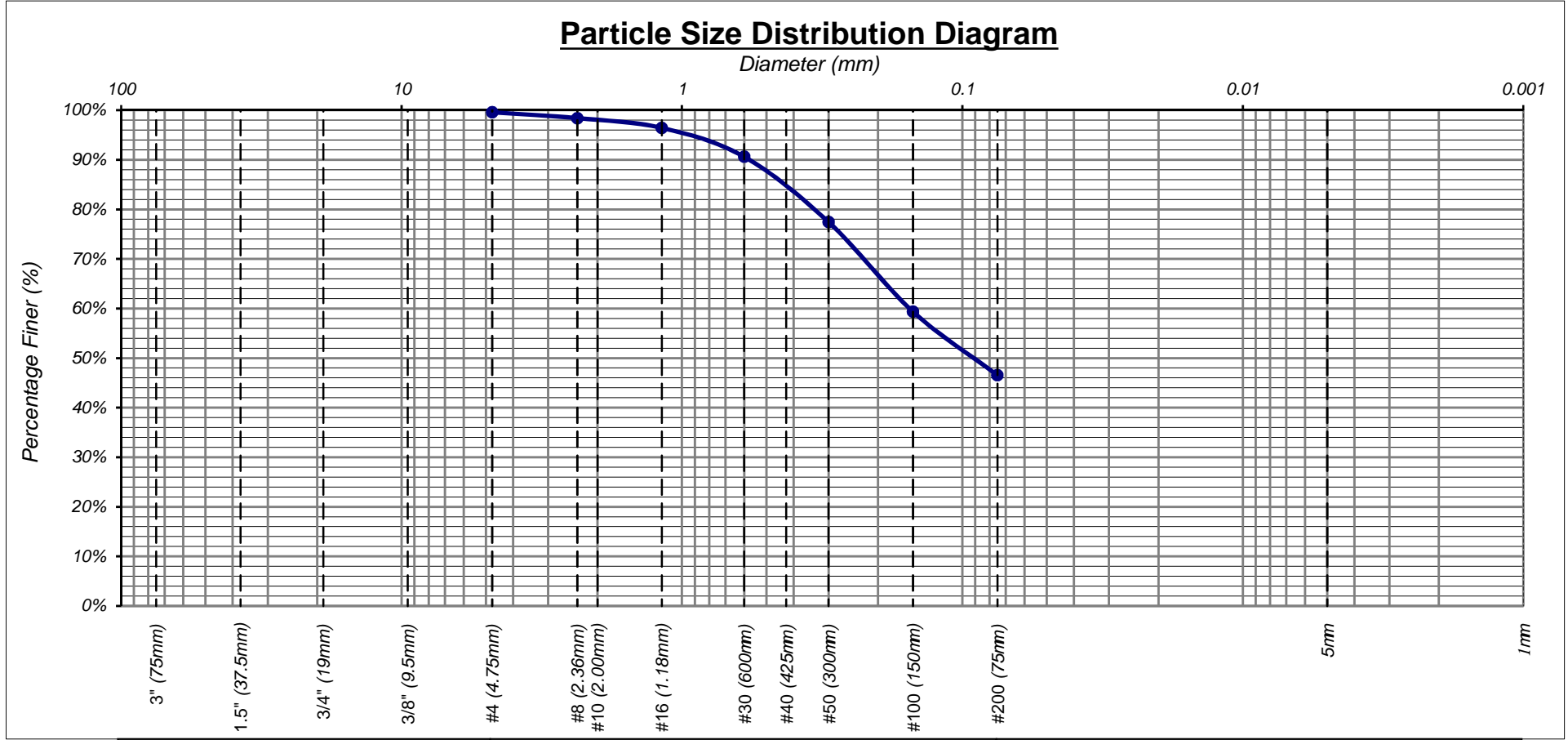


Gradation Analysis Report ASTM D-422 / ASTM C-136

FIGURE B-1

550 W. Locust Ave.
Fresno, CA 93650
Ph: (559) 497-2880
Fax: (559) 497-2886

Project Name:	Warthog Exhibit Building	Project Number:	G16-231-11F	Report Date:	12/15/2016
Sample Location:	B-2 @ 0-3'	Sample Lab ID:	F16-2166	Sample Date:	12/12/2016
Sample Description:	Silty SAND (SM), orange brown, fine to medium grained			Test Date:	12/14/2016



	Clear Square Openings (ASTM C-136)		US Standard Series (ASTM D-422)			Hydrometer Readings (ASTM D-422)
Cobble	Gravel		Sand			Silt (Non-Plastic) to Clay (Plastic)
	Coarse	Fine	Coarse	Medium	Fine	

% Gravel = 0	% Sand = 53	% Fines = 47
--------------	-------------	--------------

Direct Shear Test

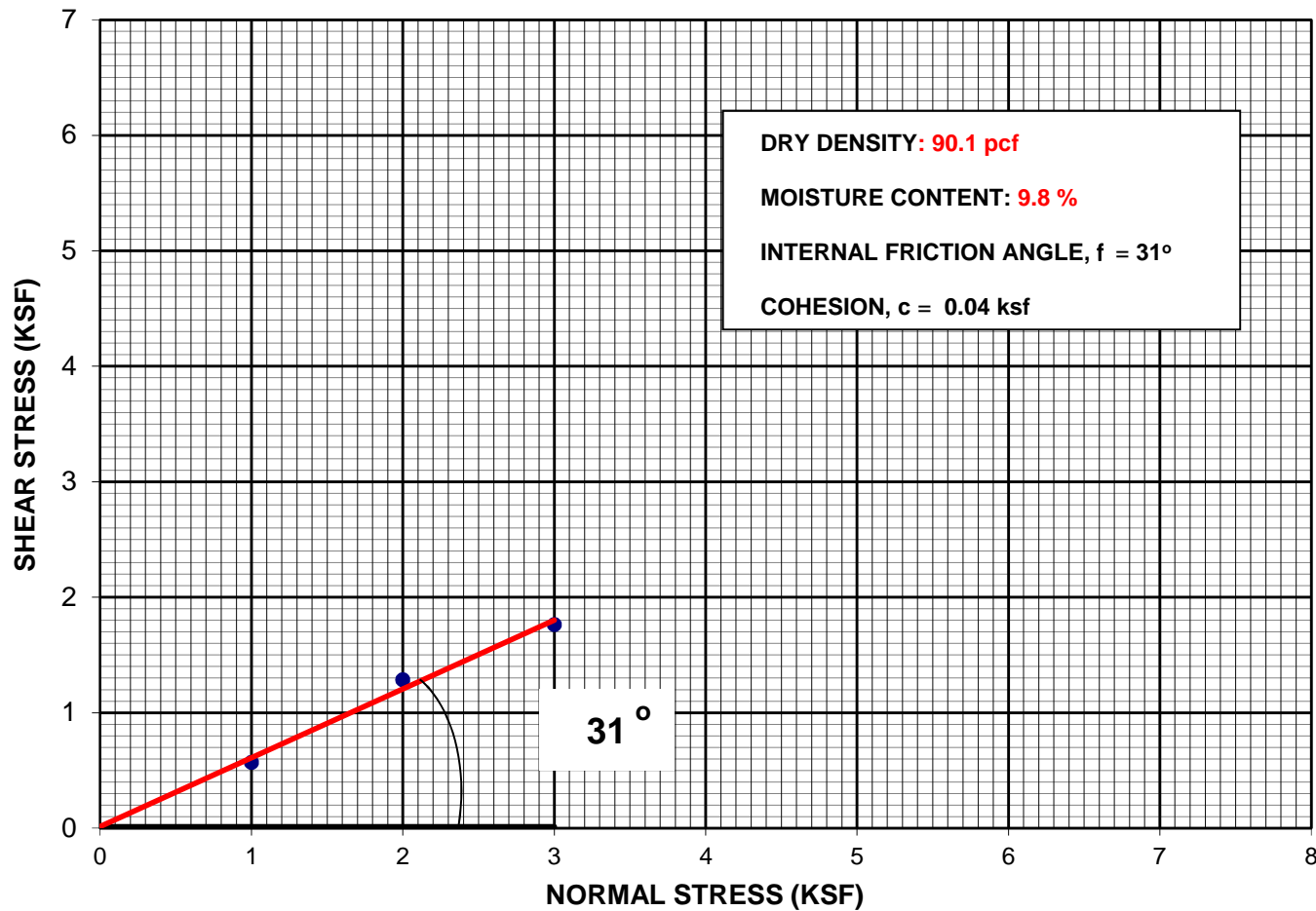
ASTM D-3080

550 W. Locust
Fresno, CA 93650
Ph: (559) 497-2880
Fax: (559) 497-2886

Figure B-2

Project Name:	<u>Proposed Warthog Exhibit Building</u>	Sampled By:	<u>S. Demmers</u>	Sample Date:	<u>12/12/2016</u>
		Tested By:	<u>M. Weiss</u>	Test Date:	<u>12/14/2016</u>
Project Number:	<u>G16-233-11F</u>	Lab Tracking ID:	<u>F16-2166</u>	Report Date:	<u>12/15/2016</u>
Sample Location:	<u>B2 @ 2.5'</u>	Sample Description:	<u>Silty SAND (SM), orange brown, fine to medium grained</u>		

SHEAR STRENGTH DIAGRAM



Project Name
REQUEST FOR INFORMATION (RFI)

Date Submitted: mm/dd/yy
Date Returned mm/dd/yy
RFI No: XX

DESCRIPTION OF REQUEST: See below.
(ATTACH ADDITIONAL SHEETS AS REQUIRED)

DRAWINGS NO.:
SPECIFICATIONS:

What is the question?

1.

CONTRACT No. _____

CONTRACT TITLE: Fresno Chaffee Zoo – Warthog & Tortoise Exhibit

CONTRACTOR: _____

POTENTIAL IMPACT TO SCHEDULE: _____ calendar days.

IMPACT TO PROJECT COST: _____ additional, _____ deduct

SUBMITTED BY: _____
(General Contractor) DATE: _____

ARCHITECT'S RESPONSE:

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

Response: Refer to attached response.

ATTACHMENTS: Response items 1-XXX.

REVIEWED BY: _____
DATE: _____

ARCHITECT: **TAM+CZ Architects, Inc.**

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 REFERENCES

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; Associated General Contractors of America; 2004.

1.03 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
- C. Submit updated schedule with each Application for Payment.

1.04 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.05 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm) or width required.

PART 2 PRODUCTS - NOT

USED PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Regulatory requirements applicable to this project are the following:
- B. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).
- C. 49 CFR 27, 37, and 38 - Transportation for Individuals with Disabilities; Final Rule; Department of Transportation; current edition.
- D. 29 CFR 1910 - Occupational Safety and Health Standards; current edition; as a work place.
- E. State of California amendments to some or all of the following.
- F. Codes as amended by the City of Fresno & the State of California:
 - 1. California Building Code – 2016
 - 2. California Electric Code – 2016
 - 3. California Mechanical Code – 2016
 - 4. California Plumbing Code – 2016
 - 5. California Energy Code – 2016
 - 6. California Green Building Standards – 2016
 - 7. Universal Design Standards

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements.

1.03 QUALITY ASSURANCE

- A. General:
 - 1. Throughout the Contract Documents reference may be made to codes which establish qualities and types of workmanship and materials and which establish methods for testing and reporting on the pertinent characteristics.
 - 2. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named code.
 - 3. It is also the Contractor's responsibility, when so required by the Contract Documents or by written request from the Architect, to deliver to the

Architect all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named codes. Such proof shall be in the form requested by the Architect, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Architect.

4. In procuring all items used in this Work, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and to verify that the items procured for use in this Work meet or exceed the specified requirement.
5. The Architect reserves the right to reject items incorporated into the Work, which fail to meet the applicable codes and ordinances. The Architect further reserves the right, and without prejudice to other recourse the Architect may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Architect if the non-complying item is accepted by the authorizing agency.

- B. Designer Qualifications: Where delegated engineering design is to be performed under the construction contract provide the direct supervision of a Professional Engineer experienced in design of this type of work and licensed in California.

1.04 REGULATORY AGENCIES

- A. Agencies Having Jurisdiction:
1. Agencies relevant to this Project include, but are not necessarily limited to the following agencies
 - a. City of Fresno Building Department
 - b. City of Fresno Fire Department
- B. Permits:
1. The Contractor will obtain copies of each permit and maintain a copy on the project site for review by AHJ, subcontractors, Owner, and Architect.

1.05 STANDARDS BY REFERENCE

- A. Any material and/or procedure specified by reference to the number, symbol or title of a specific standard such as a commercial standard, Federal specification, a trade association standard, technical society standard, or other similar standard, shall comply with the requirements of the latest revision thereof and any amendment or supplement thereto, in effect on the date of the Agreement, except as limited to type, class or grade, or modified in such reference. The standards referred to, except as modified in the Specification, shall have full force and effect as though printed in the Specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 19 REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reference standards full title and edition date.

1.02 RELATED REQUIREMENTS

- A. Document 00 7200 - General Conditions: Reference standards.
- B. Section 01 41 00 - Regulatory Requirements

1.03 QUALITY ASSURANCE

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards when required by the Contract Documents.
- D. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
- E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

2.02 AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

2.03 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2002).
- C. ACI 301 - Specifications for Structural Concrete for Buildings; 2010.
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- F. ACI 305R - Hot Weather Concreting; 2010.

- G. ACI 306R - Cold Weather Concreting; 2010.
- H. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- J. ACI 347 - Recommended Practice For Concrete Formwork;. K. ACI 347 - Guide to Formwork for Concrete; 2004.

2.04 AGC -- ASSOCIATED GENERAL CONTRACTORS OF AMERICA

2.05 AHA -- AMERICAN HARDBOARD ASSOCIATION

2.06 AHRI -- AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE

2.07 AIA - THE AMERICAN INSTITUTE OF ARCHITECTS

2.08 AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

2.09 AISI -- AMERICAN IRON AND STEEL INSTITUTE

2.10 AITC -- AMERICAN INSTITUTE OF TIMBER CONSTRUCTION

2.11 AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

2.12 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

2.13 APA -- APA - THE ENGINEERED WOOD ASSOCIATION

2.14 API -- AMERICAN PETROLEUM INSTITUTE

2.15 ASCE -- AMERICAN SOCIETY OF CIVIL ENGINEERS

2.16 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

2.17 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

2.18 ASSE -- AMERICAN SOCIETY OF SANITARY ENGINEERING

2.19 ASTM A SERIES -- ASTM INTERNATIONAL

- A. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

2.20 AWI -- ARCHITECTURAL WOODWORK INSTITUTE

2.21 AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

- A. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

2.22 ICBO -- INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

2.23 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

2.24 TPI - TURFGRASS PRODUCERS INTERNATIONAL

2.25 UL -- UNDERWRITERS LABORATORIES INC.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01 5000 - Temporary Facilities and Controls
- B. Section 32 0193 - Tree and Planting Protection: barriers, signs, and mulches

1.03 TEMPORARY UTILITIES - SEE SECTION 01 51 00

- A. Owner will provide the following:
 - 1. Electrical power and metering, consisting of connection to existing facilities.
 - 2. Water supply, consisting of connection to existing facilities.
- B. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- C. Existing facilities may not be used.
- D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Internet Connections: Minimum of one; T-1 line or faster.
 - 2. Email: Account/address reserved for project use.
 - 3. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to

areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

- A. Provide 6 foot high commercial grade chain link fence shown on drawings around construction areas adjacent to public areas; equip with vehicular and pedestrian gates with locks. At vehicle gates, provide Knox Box for fire department access at locations requested by fire department. Gates must be manned during construction and closed immediately after each entry.
- B. At pedestrian gates connection with existing zoo provide a key to the Construction Fencing lock to zoo staff for use in case of animal escape into the Construction area. See Section 01 1000 - Summary for further description of Owner Access issues and Temporary Facilities Layout Plan.

1.08 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Project work perimeter must remain secured by fence at all times. Gates must remain closed when not in use.

1.09 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner. B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. If Owner allows, provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- E. Designate one parking space for Owner and Architect use.

1.10 WASTE REMOVAL

- A. See Section 01 7419 - Waste Management, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

- A. Provide project identification sign.
 - 1. Sign shall be a maximum size of 4 feet by 8 feet, MDO plywood, and painted both sides. Provide (2) 4x4 treated wood posts, inserted 4' into grade and compacted backfill. Installed top of sign height above grade shall be approx. 8'.
- B. Erect on site at location indicated.
- C. No other signs or advertising are allowed without Owner permission except those required by law.

1.12 NOISE CONTROL

- A. General:
 - 1. Any operation producing noise in excess of 80 dB as measured at the project boundary is prohibited unless agreed upon in writing with the Owner's project representative. Blasting, power-driven fastening, and similar concussive noises are prohibited except by prior agreement in writing. Conform to requirements of Section 011000 - Summary with regard to Owner's facility events and operations.
- B. Written Notice:
 - 1. Written Notice and Agreement must be obtained from the Owner a minimum of 72 hours prior to commencing any operation producing excess noise.

1.13 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED PART 3

EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Lists of products to be removed from existing building.
- B. Section 01 4000 - Quality Requirements: Product quality monitoring.
- C. Section 01 6031 - Substitution Request Form
- D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products having any of the following characteristics:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.

5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- E. Substitution Submittal Procedure:
 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 3. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 2. Arrange and pay for product delivery to site.
 3. On delivery, inspect products jointly with Contractor.
 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 5. Arrange for manufacturers' warranties, inspections, and
- service. B. Contractor's Responsibilities:
 1. Review Owner reviewed shop drawings, product data, and samples.
 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 3. Handle, store, install and finish products.
 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

**01 60 31
SUBSTITUTION REQUEST FORM**

TO: TAM+CZ ARCHITECTS, INC.		
PROJECT: FRESNO CHAFFEE WARTHOG EXHIBIT		
SPECIFIED ITEM:		
<u>Specification Section</u>	<u>Paragraph</u>	<u>Description</u>

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION:
<ul style="list-style-type: none"> Attach complete dimensional information and technical data, including laboratory tests, if applicable. Include complete information on changes to Drawings and/or Specifications that proposed substitution would require for proper installation. Submit all necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance. Indicate differences in quality of materials and construction.

FILL IN ALL BLANKS BELOW (Attach additional sheets if necessary).
1. Does the substitution affect dimensions shown on Drawings? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, indicate changes:
2. What effect does the substitution have on other trades?
3. What effect does the substitution have on applicable code requirements?
4. Differences between proposed substitution and specified item. Include "Owner's Benefit" (cost, quality, or other) description, if applicable:
5. How do manufacturer's warranties compare between proposed and specified items(s)? Same <input type="checkbox"/> Different <input type="checkbox"/> (If Different, Explain on attachment.)
6. Maintenance services and spare parts are available for proposed product from:
7. Change to Contract Time, if proposed substitution is accepted: [] No Change [] Add ___ days [] Deduct ___ days
Submitted By:
Signature Title
Signature must be by person having authority to legally bind its firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.
Firm:
Address:
Lump sum installed cost difference between proposed substitution and least expensive specified item? \$ _____ [(decrease); increase]

The undersigned hereby certifies that the function, appearance, and quality of the requested substitute item equals or exceeds those of the specified item, and, except for those costs indicated above, agrees to pay for changes to the Work, if any, including design services, caused by its incorporation.

Approved For Architect Review:

Construction Manager's Signature

Substitution Accepted Substitution Accepted As Noted Substitution Not Accepted Date:

By:

Signature

Title

SECTION 01 61 16
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. VOC restrictions for product categories listed below under "DEFINITIONS."
- B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 – Joint Sealers.
- B. Section 09 9000 - Painting

1.03 DEFINITIONS

- A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site:
 - 1. Sealer coatings.
 - 2. Paints and other coatings.

1.04 REFERENCE STANDARDS

- A. State of California Air Resources Board Suggested Control Measure for Architectural Coatings

1.05 SUBMITTALS

- A. Not used.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.
- D. Installer Certifications for Accessory Materials: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.

1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
 - b. Current certification by any other agencies acceptable to CHPS.
 - c. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.

2. Exception: The product categories listed below are not required to comply with this requirement.

B. Joint Sealants: Provide products having VOC content as specified in Section 07 9005.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Conflicts between this section and the other sections of the project manual shall be brought to the attention of the Architect. Generally, this section will take precedence.

B. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

C. All additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, except payment procedures.
- J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures.
- B. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- C. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- F. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 2. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.
 4. Visual qualities of sight exposed elements.
 5. Work of Owner or separate Contractor.
- D. Coordination Drawings: Provide shop drawings showing coordinated installation of embedded items; equipment mounts and supports; access sleeves, blockout and doors; in floor slabs, on walls and shotcrete constructions. Required with submittal of assembly components.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

- A. For survey work, employ a land surveyor registered in California and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
1. At All Times: Excessively noisy tools and operations will not be tolerated on site anywhere at any time of day; excessively noisy includes jackhammers, pile drivers, and pneumatic hammers.
- H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing,

connecting to, and placing in service, such equipment.

- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.

- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and other items indicated.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations, and other items indicated.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.
- L. Upon Substantial Completion, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment ; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- D. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site

periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate with requirements of Section 01 91 13 - General Commissioning Requirements.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.
- B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Replace filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Notify Architect when work is considered ready for Substantial Completion. provide a punchlist of the items the Contractor recognizes as incomplete.
- C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.
- D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- E. Notify Architect when work is considered finally complete.
- F. Complete items of work determined by Architect's final inspection.

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable

operation. Clean, adjust, and lubricate as required.

- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- E. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to Owner.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

2.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 1. Pre-bid meeting.
 2. Pre-construction meeting.
 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 1. Provide containers as required.
 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

**SECTION 01 7800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 00 72 00 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.
- F. Individual Product Sections: Extra quantities for future maintenance by the Owner.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned 7 days after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 17 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

D. Products:

1. Provide clearly and permanently identified samples of each type of specialty fastener used in the project. Provide manufacturer and model name if any.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Measured depths of foundations in relation to finish first floor datum.
 2. All design-build and bidder-engineered documents.
 3. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 5. Stamp label "As-built"
 6. Field changes of dimension and detail.
 7. Details not on original Contract drawings.
- G. Submittal Format:

Scan all included information and format in PDF data files. Provide on (2) DVD disks labeled with the project name, "RECORD DOCUMENTS" and date of Substantial Completion.

Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect , Consultants, Contractor and sub-contractors. Identify sections for drawings, specs, addenda, and change orders.

3.02 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- C. Include color coded wiring diagrams as installed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.

- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Include test and balancing reports.
- N. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Electronic Format: Scan all included information and format in PDF data files. Provide on (2) DVD disks labeled with the project name, "OPERATION AND MAINTENANCE MANUALS" and date of Substantial Completion.
- F. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- G. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.

- f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
- 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.

- b. Air and water balance reports.
- c. Certificates.
- d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Originals Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
 - 1. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
 - 2. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
 - 3. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- F. Electronic Format
 - 1. Table of Contents: Use sequence from Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item
 - 2. Scan all included information and format in PDF data files. Provide on (2) DVD disks labeled with the project name, "WARRANTIES AND BONDS" and date of Substantial Completion.
 - 3. Provide full information, using separation sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

**SECTION 01 78 23
OPERATION AND MAINTENANCE DATA**

1.01 REQUIREMENTS INCLUDED

- A. Compile product data and related information appropriate for Owner's maintenance and operation of all equipment and products furnished under the Contract. These requirements include, but are not limited to, the following electric/electronic systems:
1. Building Automation System (Direct Digital Controls) and all HVAC Equipment
 3. Light Fixtures, Transformers, and other Electrical Equipment
 4. Fire Alarm System
 5. Intrusion Detection System
- B. Furnish any special tools provided by manufacturer for such maintenance and operation.
- C. Instruct Owner's personnel in operation of equipment and systems.

1.02 RELATED REQUIREMENTS

1.03 FORM OF SUBMITTALS

- A. Prepare data in form of an instructional manual for use by Owner's personnel. Prepare three copies of complete manual in final form.
- B. Format:
1. Size: 8-1/2 x 11 inches.
 2. Text: Manufacturer's printed data, or neatly typewritten.
 3. Drawings:
 - a. Provide reinforced punched binder tab, bind in with text.
 - b. Fold larger drawings to size of text pages.
 4. Provide fly-leaf for each separate product, or each piece of operating equipment.
 - a. Provide typed description of product, and major component parts of equipment.
 - b. Provide indexed tabs.
 5. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List the following:
 - a. Title of Project
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in the manual.
 6. Sequence: provide a Table of Contents, organizing Data by sequential specification section.
- C. Binders:
1. Commercial quality three-ring binders with durable and cleanable plastic covers.

2. Maximum ring size: 1 1/2 inch.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to content of the volume.
3. List, with each product, name, address and telephone number of:
 - a. Subcontractor or Installer
 - b. Maintenance Contractor, as appropriate.
 - c. Identify area of responsibility of each.
 - d. Local source of supply for parts and replacement.
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
 - a. Clearly identify specific product or part installed.
 - b. Clearly identify data applicable to installation.
 - c. Delete references to inapplicable information.

C. Drawings:

1. Supplement product data with Drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.
2. Coordinate Drawings with information in Project Record Documents to assure correct illustration of completed installation.
3. Do not use Project Record Documents as maintenance drawings.

D. Written text, as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.
2. Provide logical sequence of instructions for each procedure.

E. Copy of each warranty and service contract issued.

1. Provide information sheet for Owner's personnel, indicating:
 - a. Proper procedures in event of failure.
 - b. Instances which might affect validity of warranties.

F. Other information required by pertinent sections of the Project Manual.

1.05 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manuals shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

* * * * *

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.

1.02 RELATED REQUIREMENTS

- A. Section 00 31 00 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.
- B. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- C. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- D. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- G. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- H. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.
- I. Section 31 22 00 - Earthwork: Topsoil removal.
- J. Section 31 22 00 - Earthwork: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- K. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local

authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 2. Identify demolition firm and submit qualifications.
 3. Include a summary of safety procedures.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 22 00 - Grading

PART 3 EXECUTION

3.01 SCOPE

- A. Remove buildings and materials as indicated on the demolition drawings.
- B. Remove other items indicated, for salvage, relocation, recycling, and ___.
- C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 1. Obtain required permits.
 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 3. Provide, erect, and maintain temporary barriers and security devices.
 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 6. Do not close or obstruct roadways or sidewalks without permit.
 7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.

- 3. Stop work immediately if adjacent structures appear to be in danger.
- D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- E. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Dismantle existing construction and separate materials.
 - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 07 4213
METAL WALL PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured weathering steel panels for walls, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.06 MOCK-UP

A. Construct mock-up, 8 feet tall by 6 feet wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation, and panel joints in mock-up.

B. Mock-up may not remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Western States Metal Roofing; Product 7/8" corrugated, Corten.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.

1. Provide exterior panels, soffit panels, and subgirt framing assembly.

2. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall according to the 2013 CBC.

3. Maximum Allowable Deflection of Panel: 1/90 of span.

4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

B. Exterior Panels:

1. Profile: Vertical; style as indicated.
2. Side Seams: side lap sealed with mastic tape..
3. Panel Width: 34 + inches .

C. Subgirts:

D. Expansion Joints:

E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Stainless steel.

2.03 ACCESSORIES

A. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, koko brown cap.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 INSTALLATION

- A. Install panels on walls and soffits in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports. Lap panel ends minimum 2 inches (50 mm).
- E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

3.04 CLEANING

- A. Remove site cuttings from finish surfaces.

END OF SECTION

**SECTION 07 5300
ELASTOMERIC MEMBRANE (EPDM) ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Elastomeric roofing membrane, adhered conventional application.
- B. Insulation, flat and tapered.
- C. Not used.
- D. Deck sheathing.
- E. Flashings.
- F. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2011be1.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2012.
- D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Tension; 2006a.
- E. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2012).
- F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).
- G. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2012.
- H. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011.
- I. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene a pre-installation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

- A. Not used.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

1. LEED Submittal: Include testing documentation of solar reflectance index.
- C. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.
- D. Samples for Verification: Submit two samples 4 x 4 inches (____x____ mm) in size illustrating insulation.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

1.08 FIELD CONDITIONS

- A. All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

1.09 WARRANTY

- A. Provide 30 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. EPDM Membrane Materials:
 1. Carlisle Roofing Systems, Inc; Adhered Sure-White EPDM (90 mil.) Roofing System: www.carlisle-syntec.com.

- B. Insulation:
1. Carlisle Roofing
 2. Thermapink
 3. Foamular

2.02 MEMBRANE

- A. Cured non-reinforced EPDM (Ethylene, Propylene, Diene, Terpolymer) compounded elastomer.

90 mil. Thick FleeceBACK non-reinforced EPDM membrane Sure-White. Sure-White membranes are to be installed with the white face up.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); externally reinforced with fabric; complying with minimum properties of ASTM D 4637.

1. Thickness: 90 mil.
2. Solar Reflectance: 0.76, minimum, initial, and 0.64, minimum, 3-year, certified by Cool Roof Rating Council.
4. Thermal Emittance: 0.90, minimum, initial, and 0.87, minimum, 3-year, certified by Cool Roof Rating Council.
5. Color: White.
6. Tensile Strength: 1600 psi measured in accordance with ASTM D412.
7. Tear Strength: 200 lbf/in, measured in accordance with ASTM D624.

- B. Seaming Materials: All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

- B. Colored Finish Coating: Neoprene/hypalon, with aluminum powder concentrate; finish coat of white color.

- C. Membrane Fasteners: As recommended by and approved by membrane manufacturer.

- D. Flexible Flashing Material: All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

2.04 MEMBRANE UNDERLAYMENT

- A. Membrane Underlayment: Dens-Deck Prime, ASTM C1177/C1177M, fire resistant type, 1/4 inch thick. Install of insulation board.

2.05 INSULATION

- A. Insulation: Use 1 1/2" XPS extruded polystyrene over roof sheathing
1. As approved by the manufacturer.

2.06 ACCESSORIES

A. All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Carlisle's EPDM Roofing Systems Specification by manufacturer.

3.02 NOT USED

3.03 MEMBRANE APPLICATION

A. Refer to Carlisle's EPDM Roofing System Specification by manufacturer.

3.04 FIELD QUALITY CONTROL

A. All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

3.05 CLEANING

A. All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

3.06 PROTECTION

A. All accessories shall comply with the Carlisle's EPDM Roofing Systems Specifications by manufacturer.

END OF SECTION

**SECTION 07 6200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counter flashings, gutters, downspouts, sheet metal roofing, and other items indicated in Schedule.

1.02 RELATED REQUIREMENTS

- A. Section 07 4213 – Metal Wall Panels.
- B. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2011.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
- D. ASTM B32 - Standard Specification for Solder Metal; 2008.
- E. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2011e1.
- F. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2003 (Reapproved 2009).
- G. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.
- I. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As scheduled.
- B. Lead: ASTM B749, 2.5 lb/sq ft (0.99 mm) thick.
- C. Stainless Steel: ASTM A666 Type 304, soft temper, 0.015 inch (0.4 mm) thick; smooth No. 4 finish.

- B. Copper: ASTM B370, cold rolled 16 oz/sq ft (0.5 mm) thick; natural finish.**

2.02 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Underlayment: ASTM D226, organic roofing felt, Type I ("No. 15").
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.
- E. Protective Backing Paint: Zinc molybdate alkyd.

- F. Sealant: As specified in Section 07 9005.
- G. Plastic Cement: ASTM D4586, Type I.
- H. Solder: ASTM B32; Sn50 (50/50) type.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: SMACNA Architectural Sheet Metal Manual, Square profile.
- B. Downspouts: Round profile. Install as per NRCA manual. Provide adequate separation between dissimilar metals.
- C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 5 years in accordance with SMACNA Architectural Sheet Metal Manual. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA and/or NRCA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Straps.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.

- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
- E. Secure gutters and downspouts in place using concealed fasteners.
- F. Set splash pads under downspouts. Set in place with manufacturer's standard spike method.

3.04 FIELD QUALITY CONTROL

- A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. PVC gutters and downspouts.

1.02 REFERENCE STANDARDS

- A. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2012.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures. B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- C. Samples: Submit two samples, 8 ____ mm) long illustrating component design, inch (finish, color, and configuration.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation.
Slope to drain.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Polyvinyl Chloride (PVC): ASTM D2665, virgin vinyl, SDR 35 pipe and fittings, high impact type, colorfast; brown color.
- B. Primer and Solvent for Polyvinyl Chloride (PVC): As recommended by manufacturer.

2.02 COMPONENTS

- A. Gutters: Polyvinyl chloride (PVC); square profile:
- B. Downspouts: Polyvinyl chloride (PVC); rectangular profile:
- C. Connectors: Furnish required connector pieces for PVC (polyvinyl chloride) components.
- D. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: Type recommended by fabricator.
 - 2. Gutter Supports: Straps.
 - 3. Downspout Supports: Straps.

2.03 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Fabricate gutter and downspout accessories; seal watertight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. PVC: Solvent-weld lengths and connection pieces to form watertight joints. Solvent-weld gutters to downspouts and accessories.

END OF SECTION

**SECTION 07 90 05
JOINT SEALERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 08 8000 - Glazing: Glazing sealants and accessories.

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2010.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.06 MOCK-UP

- A. Provide mock-up of sealant joints in conjunction with window.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work if approved by Architect and Owner.

1.07 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.08 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gunnable and Pourable Sealants:

1. BASF Construction Chemicals-Building Systems:
www.buildingsystems.basf.com.
2. Bostik Inc: www.bostik-us.com.
3. Pecora Corporation: www.pecora.com.
4. Tremco Global Sealants: www.tremcosealants.com.

B. Silicone Sealants:

1. Bostik Inc: www.bostik-us.com.
2. Pecora Corporation; 890NST Ultra Low Modulus Architectural Silicone Sealant -
Class 100: www.pecora.com.
3. Tremco Global Sealants: www.tremcosealants.com.

C. Polyurethane Sealants:

1. Bostik Inc: www.bostik-us.com.
2. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com.
3. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant:
www.sherwin-williams.com.

D. Acrylic Sealants (ASTM C920):

1. Tremco Global Sealants: www.tremcosealants.com.
2. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant:
www.sherwin-williams.com.

E. Butyl Sealants:

1. Bostik Inc: www.bostik-us.com.
2. Pecora Corporation: www.pecora.com.
3. Tremco Global Sealants: www.tremcosealants.com.

4. Substitutions: See Section 01 6000 - Product Requirements.
- F. Epoxy Sealants:
1. Pecora Corporation; Dynapoxy EP-1200 Two-Part Epoxy Security Sealant:
www.pecora.com.
- G. Preformed Compressible Foam Sealers:
1. EMSEAL Joint Systems, Ltd: www.emseal.com.
 2. Sandell Manufacturing Company, Inc: www.sandellmfg.com.
 3. Dayton Superior Corporation: www.daytonsuperior.com.
 4. Tremco Global Sealants: www.tremcosealants.com.

2.02 SEALANTS

- A. Type Exterior - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
1. Color: Match adjacent finished surfaces.
 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal frames and other materials.
 - d. Other exterior joints for which no other sealant is indicated.
 3. Polyurethane Products:
 - a. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant: www.pecora.com.
 - b. Dymonic: Tremco.
 - c. Sikaflex 1a: Sika Corporation.
- B. Type Metal surfaces - Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
1. Product: BA-98 manufactured by Pecora.
 2. Product: Tremco butyl sealant
 3. Applications: Use for:
 - a. Concealed sealant bead in sheet metal work.
 - b. Concealed sealant bead in siding overlaps.
 - c. Bedding door thresholds.
- C. Type Interior - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
- D. Type Non-pick - Nonsag Tamper-Resistant Sealant: ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A; single or multi- component.
1. Type: Polyurethane.

2. Color: Match adjacent finished surfaces.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Products:
 - a. Pecora Corporation; DynaFlex Flexible Polyurethane Security Sealant: www.pecora.com.
 - b. Pecora Corporation; DynaFlex SC Polyurethane STPU Security Sealant: www.pecora.com.

E. Type Bath - Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; Single component, mildew resistant.

1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.
 - b. Joints between kitchen and bath countertops and wall surfaces.
2. Products: a. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
- b. Substitutions: See Section 01 6000 - Product Requirements.

F. Type Acoustic - Acoustical Sealant for Concealed Locations:

1. Composition: Acrylic latex emulsion sealant.
2. Applications: Use for concealed locations only:
 - a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
3. Products:
 - a. Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: www.pecora.com.
 - b. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.
 - c. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.

G. Type Floor - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.

1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
 - a. Expansion joints in floors.
3. Products:
 - a. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
 - b. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.

H. Type Pool - Sealant for Continuous Water Immersion: Polysulfide; ASTM C920, Grade NS, Class 25, Uses I, M, and A; approved by manufacturer for continuous water immersion; single component.

1. Color: To be selected by Architect from manufacturer's standard range.

I. Type Traffic - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.

1. Color: Color as selected.
2. Applications: Use for:
 - a. Joints in sidewalks and vehicular paving.
3. Products:
 - a. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
 - b. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

J. Type Butyl - Butyl Sealant: ASTM C920, Grade NS, Class 12-1/2, Uses NT, M, A, G, O; single component, solvent release, non-skinning, non-sagging.

1. Color: Match adjacent finished surfaces.
2. Products:
 - a. Bostik Inc: www.bostik-us.com.
 - b. Pecora Corporation: www.pecora.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

K. Type Glazing - Silicone Sealant: ASTM C920, Grade NS, Class 25, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.

1. Color: To be selected by Architect from manufacturer's standard range.

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 - 1. Width/depth ratio of 2:1.
 - 2. Neck dimension no greater than 1/3 of the joint width.
 - 3. Surface bond area on each side not less than 75 percent of joint width.
- F. Install bond breaker where joint backing is not used.
- G. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- H. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- I. Tool joints concave.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

3.06 SCHEDULE

- A. Exterior Joints for Which No Other Sealant Type is Indicated: Type **ExteriorColor as selected by Architect from manufacturer's standard range..**

END OF SECTION

SECTION 08 11 13 HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated steel doors and frames.
- B. Steel frames for wood doors.
- C. Thermally insulated steel doors.
- D. Steel glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- B. Section 09 9000 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.
- E. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
- F. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

1.04 SUBMITTALS

- A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- C. Samples: Submit two samples of metal, 2 x 2 inches (50 x 50 mm) in size showing factory finishes, colors, and surface texture.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:

1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
2. Republic Doors: www.republicdoor.com.
3. Steelcraft, an Ingersoll Rand brand; www.steelcraft.com.
4. Steelcraft; www.steelcraft.com.

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:

1. Accessibility: Comply with ANSI/ICC A117.1.
2. Door Top Closures: Flush with top of faces and edges.
3. Door Edge Profile: Beveled on both edges.
4. Door Texture: Smooth faces.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
8. Finish: Factory primed, for field finishing.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors

1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
2. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.

B. Interior Doors, Non-Fire-Rated:

1. Grade: ANSI A250.8 Level 1, physical performance Level C, Model 1, full flush.
2. Core: Mineral fiberboard.
3. Thickness: 1-3/4 inches (44 mm).

2.04 STEEL FRAMES

A. General:

1. Comply with the requirements of grade specified for corresponding door.
 - a. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage
2. Finish: Same as for door.
3. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (100 mm) high to fill opening without cutting masonry units.

B. Exterior Door Frames: Fully welded.

1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire-Rated: Fully welded type.

D. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 ACCESSORY MATERIALS

A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.

1. Style: Standard straight slat blade.
2. Louver Free Area: ____ percent.

B. Glazing: As specified in Section 08 8000, factory installed.

C. Astragals for Double Doors: Specified in Section 08 7100.

1. Exterior Doors: Steel, T-shaped.

D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
- B. Coordinate frame anchor placement with wall construction.
- C. Coordinate installation of hardware.
- D. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

**SECTION 08 1613
FIBERGLASS DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic (FRP) doors.
- B. Frames for fiberglass reinforced plastic doors.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Other door hardware.

1.03 REFERENCE STANDARDS

- A. ANSI A250.4 - American National Standard Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings; 2011.
- B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2010.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard details, installation instructions, and hardware and anchor recommendations.
- C. Shop Drawings: Show layout and profiles; include assembly methods.
 - 1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
 - 2. Indicate wall conditions, door and frame elevations, sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on Drawings to identify details and openings.
- D. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.
- E. Verification Samples: Submit door surface samples for each finish specified, 10

inch

(254 mm) by 10 inch (254 mm) in size, illustrating finishes, colors, and textures.

- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in installing products of the type specified in this section with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
1. Store at temperature and humidity conditions recommended by manufacturer.
 2. Do not use non-vented plastic or canvas shelters.
 3. Immediately remove wet wrappers.
- C. Store in position recommended by manufacturer, elevated minimum 4 inches (102 mm) above grade, with minimum 1/4 inches (6 mm) space between doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Molded Fiberglass Doors:
1. ChemPruf Door Company, Ltd : www.chem-pruf.com.
 2. Tiger Door LLC : www.tigerdoor.com.
 3. Warminster Fiberglass : www.warminsterfiberglass.com.

2.02 DOOR AND FRAME ASSEMBLIES

- A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.
1. Mechanical Durability: Tested to ANSI A250.4 Level A (1,000,000 cycles), minimum; tested with hardware and fasteners intended for use on project.
 2. Screw-Holding Capacity: Tested to 900 psi (6200 kPa), minimum.
 3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less; when tested in accordance with ASTM E84.
 4. Flammability: Self-extinguishing when tested in accordance with ASTM

D635.

5. Chemical Resistance: Resist degradation due to exposure to tap water, distilled water, and:
6. Clearance Between Door and Frame: 1/8 inch (3 mm), maximum.
7. Clearance Between Bottom of Door and Finished Floor: 3/4 inch (19 mm), maximum; not less than 1/4 inch (6 mm) clearance to threshold.

2.03 COMPONENTS

- A. Doors: Through-color gel coating on fiberglass reinforced polyester resin construction with reinforced core.
 1. Thickness: 1-3/4 inches (44 mm), overall.
 2. Subframe and Reinforcements: Fiberglass pultrusions or polymer foam; no metal or wood.
 3. Waterproof Integrity: All edges, cut-outs, and hardware preparations factory fabricated of fiberglass reinforced plastic; provide cut-outs with joints sealed independently of glazing or louver inserts or trim.
 4. Hardware Preparations: Factory reinforce, machine, and prepare for all hardware including field installed items; provide solid blocking for each hardware item; make field cutting, drilling or tapping unnecessary; obtain manufacturer's templates for hardware preparations.
 5. Gel Coating: Ultraviolet stabilized polyester, marine grade NPG-isophthalic, with slightly textured semi-gloss final finish.
 6. Gel Coating Thickness: Minimum 15 mils (0.38 mm) wet, plus/minus 3 mils (0.07 mm).
- B. Frames: Profiles and dimensions as indicated on drawings; same type and construction used in mechanical durability test for doors.
 1. Construction for Non-Fire-Rated Doors: Use one of the following:
 - a. Molded fiberglass with gel-coating matching doors.
 2. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; fiberglass and aluminum joined with screws; steel and stainless steel spot welded; sealed watertight with silicone sealant.
 3. At hardware cut-outs provide continuous backing or mortar guards of same material as frame, sealed watertight.
 4. Frame Anchors: Stainless steel, Type 304; provide 3 anchors in each jamb for heights up to 84 inches (2130 mm) with one additional anchor for each additional 24 inches (610 mm) in height.
- C. Hinge and Hardware Fasteners: Stainless steel, Type 304; wood screws.

END OF SECTION

SECTION 08 5313

VINYL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Factory fabricated tubular extruded plastic windows with fixed sash.
- B. Perimeter sealant.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.
- B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- C. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- D. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2000 (Reapproved 2008)

1.04 PERFORMANCE REQUIREMENTS

- A. System Design: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of window.
 - 1. Calculate design pressures in accordance with applicable code
 - 2. Measure performance of units by testing in accordance with ASTM E330, using test pressure equal to 1.5 times the design wind pressure and 10 second duration of maximum load.
- B. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.
- C. Water Leakage: None, when measured in accordance with ASTM E331.
- D. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

- E. Thermal Movement: Design sections to permit movement caused by thermal expansion and contraction of plastic to suit glass, infill, and perimeter opening construction.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week week before starting work of this section.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, anchorage and fasteners, glass, internal drainage details.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.
- D. Samples: Submit a corner sample, 8 x 8 inch (203 x203 mm) in size, illustrating window frame section.
- E. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.09 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and after installation of sealants.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tubular Plastic Windows:
 - 1. **Pella Corporation - Pella, IA: 873.473.5527: www.pella.com**
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VINYL WINDOWS

- A. Vinyl Windows: Factory fabricated frame and sash members of extruded hollow ultra-violet-resistant polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, and anchorage and attachment devices.
1. Configuration: As indicated on drawings, with **single hung, outward projecting awning, and fixed, non-operable sash.**
 2. Color: Color as selected.
 3. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
 4. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of extruded PVC, fitting tightly into frame assembly.
 5. Nailing Flange: Integral to frame assembly, providing weather stop around entire unit.
- B. Performance Requirements: Provide products that comply with the following:
1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 Class LC Performance Grade 25.
 2. Overall U-value, Including Glazing: 0.35, maximum, measured on the window size required for this project.

2.03 COMPONENTS

- A. Glazing: Double glazed, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.
- B. Windows: Extruded, hollow, tubular, ultra-violet resistant polyvinyl chloride (PVC) with integral color; factory fabricated; with vision glass, related flashings, anchorage and attachment devices.
1. Configuration: Fixed, non-operable, outward projecting bottom, and single hung sash.
 2. Color: Color as selected.
 3. **Pella Encompass or equal.**
- C. Insect Screens: Woven aluminum mesh; 14/18 mesh size.
- D. Operable Sash Weather Stripping: Wool pile; permanently resilient, profiled to effect weather seal.
- E. Fasteners: Stainless steel.

2.04 SEALANT MATERIALS

- A. Perimeter Sealant and Backing Materials: **exterior Type as specified in Section 07 9005.**
- B. Glazing Sealant: **butyl or acrylic** Type as specified in Section 08 8000.

2.05 HARDWARE

2.06 FABRICATION

- A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
- B. Form sills and stools in one piece. Slope sills for wash.
- C. Permit internal drainage weep holes and channels to migrate moisture to exterior.

Provide internal drainage of glazing spaces to exterior through weep holes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.02 INSTALLATION

- A. Install window units in accordance with manufacturers instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Coordinate attachment and seal of perimeter air and vapor barrier materials.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.04 FIELD QUALITY CONTROL

- A. Test installed windows for compliance with performance requirements for water penetration, in accordance with ASTM E1105 using uniform pressure and same pressure difference as specified for laboratory tests.
 - 1. **Test 2 percent of installed windows.**
 - 2. If any window fails, test additional windows at Contractor's expense.
- B. Replace windows that have failed field testing and retest until performance is satisfactory.

3.05 CLEANING

- A. Remove protective material from pre-finished surfaces.
- B. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 62 23 TUBULAR SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 5300 - Elastomeric Membrane Roofing: Flashing-in of skylight base.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.
- C. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2010.
- D. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2012.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.
- F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2011.
- G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- H. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002 (Reapproved 2010).
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- J. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engaged in manufacture of tubular skylights for minimum of 10 years.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. DayLite, Natural Lighting Technologies: www.dayliteco.com.

B. Solatube International, Inc: www.solatube.com.

C. Tubular Skylight Inc: www.tubular-skylight.com.

2.02 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.

1. All components made and assembled by one manufacturer.
2. Design to withstand the following loads without breakage or permanent damage to any parts, when tested in accordance with ASTM E330:
 - a. Positive and negative wind load of 10 psf (475 Pa).
 - b. No permanent deflection in excess of 0.2 percent of span.
 - c. Live load of 100 psf (4.8 kPa) on dome with safety factor of 3.
3. Air Infiltration: Maximum 0.10 cfm per foot (0.15 L/s/m) of crack length at 6.24 psf (299 Pa) pressure differential when tested in accordance with ASTM E283.
4. Water Resistance: No uncontrolled water leakage at 6.24 psf (299 Pa) pressure differential with water rate of 5 gallons/h/sf (206 L/h/sq m), when tested in accordance with ASTM E331; design to ensure that water will not accumulate inside assembly.
5. Thermal Movement: Fabricate to allow for thermal movement resulting from temperature differential from minus 30 to 180 degrees F (minus 34 to 82 degrees C).
6. Flammability: Non-metal parts complying with the following:
 - a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
 - b. Self-Ignition Temperature: Greater than 650 degrees F (343 degrees C), when tested in accordance with ASTM D1929.
 - c. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E84; or maximum rating of 75, when tested in accordance with ASTM D2843.

- d. Combustibility - Light Transmitting Parts: Burning extent of 1 inch (25 mm) or less (ICC Class CC-1), when tested in accordance with ASTM D635 in the thickness intended for use.
 - e. Combustibility - Non-Light Transmitting Parts: Minimum 2.5 inches/min (64 mm/min) (ICC Class CC-2), when tested in accordance with ASTM D635.
- B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
- 1. Glazing: Polycarbonate plastic, 0.125 inch (3.2 mm) minimum thickness.
 - 2. Low-Angled Sun Reflector: Concentric, light refracting etched lines, minimum 2 inches (51 mm) high, to improve light input when sun is low on horizon.
 - 3. Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
 - 4. Base Material: Sheet aluminum, ASTM B209 (ASTM B209M), 0.060 inch (1.5 mm) thick, minimum.
 - 5. Base Height: 4 inches
 - 6. Dome Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.
- C. Reflective Tube: ASTM B209 (ASTM B209M) aluminum sheet, thickness between 0.015 inch (0.4 mm) and 0.020 inch (0.5 mm).
- 1. Interior Finish: Exposed interior surfaces of high reflectance specular finish; specular reflectance 92, total reflectance 95 percent.
 - 2. Tube Diameters: As indicated on the drawings.
- D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
- 1. Ceiling Ring: Edge trim for ceiling opening; injection molded high impact ABS.
 - 2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
 - 3. Lens: Flush frosted lens.
 - 4. Lens Material: Polycarbonate plastic
 - 5. Visible Light Transmission: Minimum 90 percent.
 - 6. Seal: Closed cell EPDM foam rubber

2.03 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Joint Sealant: As specified in Section 07 9005..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Seal joints exposed to weather using procedures specified in Section 07 9005.
- C. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

END OF SECTION

SECTION 08 71 00: DOOR HARDWARE

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included in This Section: Provision of finish hardware as scheduled and required for this Work including all door hardware not described but required for a complete and operable facility.
- B. Related Work Specified Elsewhere:
 - 1. HOLLOW METAL DOORS AND FRAMES Section
- C. Finish Hardware Entirely Provided and Installed by Respective Sections
- D. Hardware provision complete by the following respective Sections (except for the following identified components, including exit devices, to be provided by this Finish Hardware Section):
 - 1. Padlocks per para. 2.03 F:
 - (a) Chain link Fence Gates
 - (b) Steel Fence Gates
 - (c) Roof Hatches

1.02 INCORPORATED DOCUMENTS

Standards and methods of the trade cited below shall apply to work of this Section.

- A. American Society of Hardware Consultants (AHC)

1.03 SUBSTITUTIONS

Only upon written approval of Owner will substitutions be permitted for materials specified.

1.04 QUALITY ASSURANCE

- A. Supplier Qualifications: Hardware Supplier to have a qualified Hardware Consultant available for project site meetings when requested by Owner.
- B. Requirements of Regulatory Agencies / Codes:
 - 1. All hardware shall comply with applicable fire and building codes.
 - 2. All exit hardware to be openable from inside without use of key, or any special knowledge or effort.
 - 3. All locks and locksets which allow access to classrooms, or any room with an occupancy of five and more person, shall be lockable from the inside against entry.
 - 4. Adjust door closers for speed and power. Closers shall operate at 5 pounds maximum effort on exterior doors and 5 pounds maximum effort on interior doors. The Authority having jurisdiction may increase the maximum effort to operate fire doors to achieve positive latching, but not to exceed 15 lbs max.

1.05 SUBMITTALS

Submittals shall be in accordance with these Specifications.

- A. Hardware Schedule: Prior to obtaining or purchasing any finish hardware submit a complete list of all items proposed to be furnished for this Work including the following:

1. Manufacturer's name and catalog number for each item.
 2. Separate Heading for each opening listing Architect's door number and hardware type with all hardware items for such opening.
- B. Provide manufacturer's printed material (catalog cut) on each item.
- C. Samples: Only as requested by the Contractor.
- D. Certificate: Hardware Supplier's certification of hardware inspection required in Paragraph 3.02, Field Quality Control.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Packaging, marking and labeling: Individually pack or wrap each item of finish hardware. Group small items together and mark package with door number, hardware schedule number, building number and location in work. Identify permanent keys similarly on attached tags.
- B. Delivery, handling and storage: Deliver packaged hardware to project site in strong containers. Handle with care to prevent damage. Store inside building in clean, dry, and secure space.

1.07 JOB CONDITIONS

- A. Sequencing, Scheduling:
1. Coordinate with related work of other sections.
 2. Furnish templates to other sections as required and in a timely fashion.
 3. Furnish reinforcing units and template hardware to metal frame and door manufacturer for application at factory.

1.08 GUARANTEE

1.09 CHANGES IN THE WORK

Should the Owner request that changes be made in the Finish Hardware, the Contractor shall credit the full purchase price. No restocking charge will be permitted or allowed.

PART 2: PRODUCTS

2.01 GENERAL

- A. Code and Criteria: It will be the responsibility of the hardware supplier to furnish hardware that will meet safety and fire regulations and all applicable codes.
1. Hardware to be complete, all items fully operable, new, in perfect condition; same manufacturer throughout for each product type. Hardware not specifically described shall be similar to items specified for similar uses and locations.
 2. Labeled Openings: Hardware shall conform to label requirements. All labeled doors shall be self-closing.
 3. Template Hardware. Mortise type hardware and components applied to metal frames and doors shall be made to template. Other hardware shall also be made to template wherever possible. Provide templates to appropriate parties.
 4. Latching and locking doors that are hand-activated and which are in a path of travel, shall be operable with a single-effort by lever hardware, panic bars, push-pull activating bars, or other hardware designed to provide passage without requiring the ability to grasp the opening hardware. The Authority having jurisdiction, may increase the maximum effort to operate fire doors to achieve positive latching, but not to exceed 15 lbs max.

- B. Fasteners: Furnish all finish hardware with all necessary screws, bolts and other fasteners of suitable size and type to anchor in position for long life under hard use. Fastenings shall be as recommended by the hardware manufacturer. At no time are self-tapping / threading fasteners allowed on panic / exit hardware or any of the parts of the device, including strike plate.

Screws:

1. To Wood: Wood screws, full-threaded typically.
2. To Metal: Machine screws.
3. For Butt Hinges: Phillips head, flat countersunk, full-thread.
4. For Strikes, Face Plates and Similar Items: Phillips head, flat, countersunk, except oval head on push-pull and kick plates.

Through Bolts and Grommets (sex-bolts): Use to fasten following items:

1. Closer and closer shoes to doors and panels-above-doors.
2. Panic hardware to doors.
3. Door stop-and-holders to doors.
4. Continuous hinges to doors.

Fastening to Concrete or Masonry: Use appropriate expansion anchors or lead shields, with machine screws.

Self-Tapping oval head screws (or wood screws on wood doors) can be used to fasten push/pull plates or kickplates only.

- C. Packing and Marking: Package each item of hardware and each lockset separately in individual containers, complete with necessary screws, keys, instructions and installation template for spotting mortising tools. Identify each container as to location.
- D. Keying:
1. All keying to be as directed by the Owner. The Contractor to coordinate keying with Owner, prior to submitting keying to lock manufacturer.
 2. Stamp all keys "Do Not Duplicate."
- E. Construction Keying:
1. All interior locks to be "0" bit keyed by Hardware Supplier with keying information provided by Owner and installed by Contractor. Construction keys to be provided by Hardware Supplier.
- F. Comply with standard Owner Hardware Requirements for fastenings, submittals and procedures.

2.02 HINGES

A. Butt Hinges

1. Hinges shall be sized of the weight and quality meeting approved manufacturers' published recommendations.
2. Types:
 - a. Exterior Hinges: Heavy duty, ball bearing, non-removable pins (NRP), flat button tips, sheardized or zinc-plated prior to final plating.
 - b. Interior Hinges: Ball bearing typical; flat button tips.
3. Sizes: As follows, unless otherwise indicated.
 - a. Typical Door Thickness and Frame Conditions:

Door Thickness	Door Width	Butt Size
1 3/4"	to 2' 4"	4"x 4"
1 3/4"	to 3' 4"	4 1/2" x 4 1/2"
1 3/4"	over 3' 4"	5" x 5"

- b. Thicker Doors and Frames with Projecting Trim: Size hinges to following criteria to provide proper width to clear trim projection when doors are fully open:
Doors 2 1/4" Thick or Less:
(2 x door thickness) + (trim projection) – (1/2").
- 4. Number of Hinges per Door Leaf:
Doors 4'0" to 7'5" High: 2 pair (4 Hinges)
Doors less high or wide: 1 1/2 pair (3 hinges)

2.03 LOCKSETS, LATCHSETS, PADLOCKS AND EXIT DEVICES

- A. General: All doors from all rooms or spaces shall have locks or latches of a type which are openable at all times from the inside by merely turning the lever and not requiring any special knowledge or effort, except those doors provided with exit devices.
- B. I/C Cores and Rim Cylinders: All exterior construction I/C Cores shall be furnished by contractor. All Rim Cylinders shall be furnished and installed by the Contractor. At final acceptance of work, all exterior I/C Cores shall be furnished and installed .
- C. Mounting height of latching hardware shall be 34" to 44" above finish floor per CBC.
- D. Locksets: To be Schlage 'L' series Mortise Lock with type 6 standard lever design.
- E. Exit Devices
- F. Not used
- G. Padlocks: master padlocks keyed per direction of Owner.
 - 1. Provide padlocks at all new gates, except those with exit devices, chain link fence gates, steel pan gates, steel picket fence gates; roof hatches or wherever else shown or specified.
 - 2. Padlock model number: Schlage KS43 with Primus I/C cylinder core system.
 - 3. For disconnect switches on air conditioning units: Master #7, Keyed P607
- H. Strikes:
 - 1. Furnish wrought box strikes at all locks, latches and deadlocks.
 - 2. Extended Lips: Provide extended lips on strike with length and shape as required to protect jamb and trim from marring by latch bolt and avoid possibility of tearing clothing.
 - 3. Provide strike cover plate at all exterior doors.

2.04 CLOSERS

- A. Closers hydraulically controlled, full rack and pinion operation with separate noncritical adjustable regulation for general closing and latching speed, backcheck control and spring power all in conformance with manufacturer's published recommendations for use and size. See Section 3 for required adjustment.
- B. Specified Manufacturer:
- C. Acceptable Manufacturers:
- D. Requirements:
 - 1. Arms to permit 180° door opening whenever possible; and be adjustable.
 - 2. Not used.
 - 3. Not used.
 - 4. Accessories: Shoes, adaptors, drop plates, and other necessary items to suit installation conditions.
 - 5. All labeled door shall be self-closing; closer to suit label requirements for opening.

6. Set Closer for operation by a maximum opening force of 5 lbs. for exterior doors and 5 lbs. for interior doors.
7. A minimum closing time of doors and gates with a closer shall be from the door being in the open position of 90° to when the door is within 12 degrees of latching shall require at least 5 seconds, per 2013 CBC per Sec. 11B-404.2.8.1.

2.05 PUSH-PULL

2.06 STOPS AND HOLDERS

- A. Type of anchors may vary depending on base surface to which stop or holder is applied; adjust selected device and verify exact type on initial hardware submittal. Do not use a holder on fire-rated doors.
- B. Floor Stops and Holders
 1. Floor stops shall not be located in the path of travel

2.07 BOLTS

2.08 KICK AND ARMOR PLATES

2.09 THRESHOLDS

Extruded aluminum, set as detailed on the Drawings.

2.10 WEATHERSTRIP / DOOR BOTTOM

- C. Provide protection as may be required for dissimilar metals.

2.11 MISCELLANEOUS

- A. Specified Manufacturer:
 1. IVE – IVES
 2. SCH – Schlage
 3. PEM – Pemko
 4. NGP – National Guard Products, Inc.
 5. Rockwood
 6. Stanley
- B. Misc. to be provided:

2.12 FINISHES

Finishes shall be US26D, stainless steel. Accessory hardware shall be lacquer spray painted to match basic hardware finish when the dull chrome or stainless are not manufactured.

PART 3: EXECUTION

3.01 INSTALLATION

Installation of finish hardware shall be executed in accordance with the following.

- A. Inspection: Examine areas to receive finish hardware and verify that doors, frames, and other surfaces are undamaged and correct, ready to receive the work of the Section. Do not start installation until all unsatisfactory conditions have been corrected.

- B. Install finish hardware in strict accordance with all pertinent codes, referenced standards, original design, and manufacturer's templates and instructions.
- C. Accurately and properly fit hardware. Securely fasten fixed parts for smooth, trouble-free, nonbinding operation and fit faces of mortised parts snug and flush. Operating parts shall move freely and smoothly without binding, sticking or excessive clearance.
- D. Protect hardware from damage or marring of finish during construction using strippable coatings, removable tapes or other approved means.

Quantity:	Item:	Part #:	Finish:	Mfr:
Hardware Group #1				
6'-0" x 7'-0" x 1 3/4" (HM x HM)				
6	Hinge	5BB1HW 4.5 x 4.5 NRP	630	IVE
1	Lockset	L9080T 06A	626	SCH
1	Core	20-740-XP	626	SCH
1	Automatic Flush Bolts	FB31P	630	IVE
1	Coordinator	COR52	628	IVE
1	Closer	4040XP	689	SCH
2	Astragal & Brush Seal/Meeting Stile	18041_NB(MS)	C	PEM
1	Door Rain Drip	346	C	PEM
2	Kick Plate	8400 10" x 35"	630	IVE
2	Door Bottom	35VA	CL	NGP
2	Floor Stop	FS18S	BLK	IVE
1	Seal	2525B 25'	BRN	NGP
1	Threshold	158	A	PEM
Hardware Group #2				
4'-0" x 7'-0" x 1 3/4"				
1	Lock-Joint Box Type Track	0376.00004HGS		Richard-Wilcox
1	Straight Door Pull (non wall side)	RM301	630	Rockwood
1	Flush Door Pull	0070.00005ZC		Richard-Wilcox
2	Truck/Hanger Assembly with Caged Roller Bearings	3300		Richard-Wilcox
Hardware Group #3				
3'-0" (adjust width as req'd) x 7'-0"				
4	Hinge	5BB1HW 4.5 x 4.5 NRP	630	IVE
1	Heavy Barrel Bolts			By door manufacturer
Hardware Group #4				
1	Side Wall			By door

	Track			manufacturer
1	Pully & Track System			By door manufacturer
Hardware Group #5				
		Latches, Stops and Keepers shall be provided for all paired gates for vehicular access or maintenance use. Latches shall have the plunger-bar and arranged to engage the gate stop, except that for single gates for openings less than 10' wide a forked latch may be provided. Latches shall have provisions for locking. Stops shall consist of a device arranged to be set in concrete and to engage the plunger of the bar latch, except that for a single leafs for openings less than 10' wide other approved types of stops may be provided. Keepers shall consist of a mechanical device for securing the free end of the gate when in the fully open position.		
		Hinges shall be a heavy pattern, of adequate strength for gate, and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person.		

END OF SECTION

* * * * *

**SECTION 08 80 00
GLAZING (FOR BUILDING)**

PART 2 PRODUCTS

1.01 GLAZING TYPES

- A. Type G-14 - Sealed Insulating Glass Units: Vision glazing.
1. Application(s): All exterior glazing unless otherwise indicated.
 2. Outboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: See Glazing Types on Frame Assembly Schedule.
 3. Inboard Lite: Annealed float glass, 1/4 inch (6 mm) thick, minimum.
 - a. Tint: See Glazing Types on Frame Assembly Schedule.
 4. Total Thickness: 1 inch (25 mm).

1.02 EXTERIOR GLAZING ASSEMBLIES

- A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with code.
1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
 2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 3. Thicknesses listed are minimum.

1.03 GLASS MATERIALS

- A. Float Glass Manufacturers:
1. Guardian Industries Corp: www.sunguardglass.com.
 2. PPG Industries, Inc: www.ppgideascales.com.
- B. Float Glass: All glazing is to be float glass unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
 3. Tinted Types: Color and performance characteristics as indicated.
 4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

1.04 SEALED INSULATING GLASS UNITS

- A. Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com.
 2. Viracon, Apogee Enterprises, Inc: www.viracon.com.
- B. Sealed Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Edge Spacers: Aluminum, bent and soldered corners.

3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
4. Purge interpane space with dry hermetic air.

1.05 GLAZING COMPOUNDS

A. Manufacturers:

1. Bostik Inc: www.bostik-us.com.
2. BASF Construction Chemicals-Building Systems:
www.buildingsystems.basf.com.

B. Butyl Sealant: Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.

C. Acrylic Sealant: Single component, solvent curing, non-bleeding; ASTM C 920, Type S, Grade NS, Class 12-1/2, Uses M and A; cured Shore A hardness of 15 to 25.

END OF SECTION

**SECTION 09 9000
PAINTING AND COATING (FOR BUILDING ONLY)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Mechanical and Electrical:
 - a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
- D. GreenSeal GS-11 - Paints; 1993.
- E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association ; current edition, www.paintinfo.com.
- F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association ; 2004.

1.05 SUBMITTALS

- A. See - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "drawdown" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
 - 3. Allow 15 for approval process, after receipt of complete samples by Architect.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Product Requirements, for additional provisions.
 - 2. Extra Paint and Coatings: 1 gallon (4 L) of each color; store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.
- C. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

1.09 EXTRA MATERIALS

- A. Supply 1 gallon of each color, if more than one sheen is used in the project supply one gallon for each color and sheen; store where directed.
- C. Label each container with color and sheen in addition to the manufacturer's label. Note location of use for each container.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Owner is obtained using the specified procedures for substitutions.
- C. Paints:
 - 1. Benjamin Moore & Co: www.benjaminmoore.com.
 - 2. Pratt & Lambert Paints: www.prattandlambert.com.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com.
- D. Transparent Finishes:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com.
 - 2. Varathane.

E. Stains:

1. Base Manufacturer: Cabot.
2. Olympic.

F. Block Fillers: Same manufacturer as top coats.

G. Substitutions: See Section Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
3. Supply each coating material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. Architectural coatings VOC limits of California.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Chemical Content: The following compounds are prohibited:

1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

F. Colors: As indicated on drawings

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
3. In finished areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color schedule.

G. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated for acceptable manufacturers.

1. Provide ready mixed paints and coatings , except field-catalyzed coatings.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

H. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

- I. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint - All Exterior Concrete and Masonry Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry, brick, and cement board.

1. Preparation as specified by manufacturer.
2. Two top coats and one coat primer recommended by manufacturer.
3. Primer On Concrete and Concrete Masonry: One heavy coat latex block filler (100 percent acrylic) squeegeed into pores.

B. Paint - Wood, Transparent, Varnish, No Stain:

1. One coat sealer.

C. Paint - Wood, Transparent, Varnish, Stain:

1. One coat of stain.
2. One coat sealer .

D. Paint - Concrete/Masonry, Opaque, Alkyd, 3 Coat:

1. One coat of block filler.

E. Paint - Galvanized Metals, Alkyd, 3 Coat:

1. One coat galvanize primer.
2. Semi-gloss: Two coats of alkyd enamel.

F. Timber Framing and Dressed Lumber:

1. General stain for pressure treated and peeled wood; handrail branch infill. Use Interior as well: EXT 6.3D Transparent Stain: Wood Stain MPI #13. Cabot's or Olympic Transparent stain, solvent based. Colors to be selected by contractor approved by owner, 2 coats.

2. Finish coat at columns and trusses: Timber Pro Coatings Clear UV Log & Siding Formula

2.04 PAINT SYSTEMS - INTERIOR

A. Paint - All Interior Surfaces Indicated to be painted as indicated:
Including marine grade plywood, concrete, concrete masonry, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.

1. Two top coats and one coat primer.
2. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
3. Primer(s): As follows unless other primer is required or recommended by manufacturer of top coats:
 - a. Gypsum Board: MPI #50, Interior Latex Primer Sealer.
 - b. Concrete: MPI #3, Alkali Resistant Water Based Primer.
 - c. Concrete Masonry: MPI #4, Latex Block Filler; heavy coat squeegeed into pores.
 - d. Plaster: MPI #50, Interior Latex Primer Sealer.
 - e. Clay Masonry: MPI #3, Alkali Resistant Water Based Primer.
 - f. Wood: MPI #39, Latex Primer for Interior Wood.
 - g. Wood: MPI #45, Interior Alkyd Primer Sealer.
 - h. Steel, Uncoated: MPI #79, Anti-Corrosive Alkyd Primer for Metal.
 - i. Steel, Uncoated: MPI #107, Rust-Inhibitive Water Based Primer.
 - j. Steel -- Shop Primer: MPI #76, Quick Dry Alkyd Primer for Metal.
 - k. Galvanized Steel: MPI #134, Water Based Galvanized Primer.
 - l. Galvanized Steel: Cementitious primer.
 - m. Aluminum: MPI #95, Quick Dry Primer for Aluminum.

B. Paint - Transparent Finish on Wood, Unless Otherwise Indicated:

1. 2 top coats, no stain.
2. Top Coat(s): MPI Clear Water Based Varnish; MPI #128, 129, 130.
3. Satin: MPI gloss level 4; use this sheen at all locations.

C. Paint - Concrete/Masonry, Opaque, Alkyd, 3 Coat:

1. One coat of block filler.
2. Semi-gloss: Two coats of alkyd enamel.

D. Paint - Ferrous Metals, Unprimed, Alkyd, 3 Coat:

1. One coat of alkyd primer.
2. Semi-gloss: Two coats of alkyd enamel.

E. Paint - Galvanized Metals, Alkyd, 3 Coat:

1. One coat galvanize primer.
2. Semi-gloss: Two coats of alkyd enamel.

F. Paint - Gypsum Board/Plaster, Latex, 3 Coat:

1. One coat of alkyd primer sealer.
2. Eggshell: Two coats of latex enamel.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural;
the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2 PRODUCTS, those indicated on the Drawings, and as follows:

1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.
7. Paint fasteners, boxes and other incidental metal at boardwalk. Color: flat black.
8. Paint all mechanical and electrical equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.
9. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
10. Paint interior surfaces of air ducts and convactor and baseboard heating cabinets with flat, nonspecular black paint where visible through registers, grilles, or louvers.
11. Paint dampers exposed behind louvers, grilles, and convactor and baseboard cabinets to match face panels.

C. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
2. Items indicated to receive other finish.
3. Items indicated to remain naturally finished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Anodized aluminum.

6. Polished and brushed stainless steel items.
7. Concrete masonry in utility, mechanical, and electrical spaces.
8. Acoustical materials.
9. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Plaster and Stucco: 12 percent.
 3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.03 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are

evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

N. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

O. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

P. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

Q. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's instructions.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

This specification covers **ZooSpec SealedWall Antimicrobial Wall System**, a high-performance antimicrobial system consisting of an antimicrobial vertical-substrate concrete pretreatment, an antimicrobial epoxy gel basecoat, and top coat of high-performance antimicrobial satin urethane. This system is suited for applications requiring a durable, cleanable and hygienic protective wall covering, such as animal holding areas, prep and exam rooms.

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of concrete or block substrate
- B. Apply antimicrobial concrete/block pretreatment
- C. Apply antimicrobial wall basecoat
- D. Apply antimicrobial satin urethane topcoat

Specifier Notes: Edit the following list as required by the project. List other sections with work directly related to the floor coating.

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete: [existing or] new slab.
- B. Section 03 35 00 – Concrete Finishing: specific chemicals on slab.
- C. Section 03 39 00 - Concrete Curing
- D. Section 03 01 00 – Concrete Rehabilitation

1.04 REFERENCES STANDARDS

- A. For reference standards tests & results refer to Manufactures Product Data Sheets

1.05 ADMINISTRATIVE REQUIRMENTS

- A. Pre installation meeting call if needed.
- B. Involve: Owner, Contractor, Consultant(s), sub-contractors effected

1.06 SUBMITTALS

- A. Samples: forward 4- 4" x 4" color samples representative of finish product for review.
- B. Manufactures' Instructions: submit to Consultant for review.
- C. Sustainable Design Submittals: as required by other sections.

1.07 CLOSEOUT SUBMITTALS

- A. Applicable testing/performance data certification(s)
- B. Certification(s) of compliance with owner's performance spec, if required
- C. Cleaning, care and maintenance instructions
- D. Material warranty information

1.08 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals
- B. Applicator: Use applicator experienced in application of specified materials for a minimum of [5] [Five] years on projects of similar size and complexity. Provide list of completed projects including project name and location, name of architect, name of material manufacturer, and approximate quantity of materials applied.
- C. Applicator's Personnel: Employ only persons trained for application of specified materials.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, batch or lot number, and date of manufacture. Do not store in direct sunlight or high heat conditions.
- B. Packaging Waste Management
- C. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Keep containers sealed until ready for use.
 - 3. Do not subject material to excessive heat or freezing; do not apply material that has been subjected to excessive heat or freezing. Material subjected to excessive heat or freezing shall be separated from inventory and destroyed by mixing all three components. The solid reacted product shall be disposed of in environmentally sound and regulatory compliant manner.
 - 4. Shelf life: 1 year after date of manufacture, in unopened containers, under normal conditions.
- D. Handling: Protect materials during handling and application to prevent damage or contamination.
- E. Condition materials for use to 65°F – 75°F (18°C - 24°C) for 24 hours prior to application.

1.11 SITE CONDITIONS

- A. Ambient Conditions
 - 1. Do not apply materials if floor or air temperature is below 65°F (18°C).
 - 2. Do not apply materials if relative humidity is above 85 percent or within 5° of dew point at time of application.
- B. Existing Conditions
 - 1. Utilities, including electric, water, heat and finished lighting to be supplied by General Contractor.
 - 2. Maintain room temperature between 65°F – 75°F (18°C - 24°C) for 48 hours before, during and 48 hours after installation, or until cured.
 - 3. At the time of application ensure the minimum substrate temperature is above 60°F (15°C) and the substrate temperature is 5°F (3°C) above the measured dew point at the time of application.

4. Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and cure period of the floor.
5. Protection of finished wall from damage by subsequent trades shall be the responsibility of the General Contractor.

1.12 MANUFACTURER WARRANTY

- A. Provide warranty covering materials for a period of [1] [one] year after date of installation
- B. Installer to provide suitable warranty covering workmanship

2.00 PRODUCTS

2.01 MANUFACTURER

- A. Protective Industrial Polymers www.protectpoly.com (866) 361-3331
- B. 7875 Bliss Parkway, North Ridgeville, Ohio 44039

2.02 MATERIALS

- A. Protect AM-PT-BW Antimicrobial Concrete/Block Wall Pretreatment
- B. Protect 1000 Gel AM Antimicrobial Wall Basecoat
- D. Protect 2100 AM Antimicrobial Satin Urethane Topcoat

2.03 QUALITY CONTROL

- A. Tests and Inspections: as required by Manufacturer.
- B. Non-Conforming Work: remove immediately and dispose off site.
- C. Coordination of Other Tests and Inspections

3.00 EXECUTION

3.01 APPLICATOR

- A. Must be a recognized contractor of Protective Industrial Polymers

3.02 EXAMINATION

- A. Substrate:
 1. Free of curing membranes, silicate surface hardener, paint, or sealer and be structurally sound.
 2. If you suspect concrete has been treated or sealed, proceed with complete removal process.
 3. Consult your PIP representative for further instruction if silicate hardeners or membranes have been utilized.
- B. Moisture:
 1. Use only if the concrete has a maximum internal relative humidity of 75% using ASTM F2170.

C. Vapor / Contamination:

1. Testing for MVT does not guarantee against future problems.
2. If there is no known vapor barrier or the vapor barrier is inadequate, there is an elevated risk of bond failure.
3. Other factors including the migration of oils, chemicals, excessive salts, or Alkali Silica Reaction (ASR) from the concrete from may also elevate the risk of adhesion difficulties.
4. Consult your PIP representative for approved mitigation treatments.

D. Temperature:

1. During the application and cure of the coating, the substrate temperature, material temperature and room conditions must be maintained between 18°C (65°F) and 32°C (90°F).

E. Humidity:

1. Relative Humidity (RH) should be limited to 30-80%.
2. DO NOT apply coatings unless the surface temperature is more than five degree over the dew point.

3.03 PREPARATION

- A. Remove surface dirt, grease, oil, and contaminates by detergent scrubbing and rinse with clean (clear) water.
- B. Mechanical Preparation: Blasting or grinding the surface is the preferred method of preparation.
- C. The success of industrial diamond grinding as a concrete preparation method will vary depending on technique and the hardness of the concrete.

3.05 MIXING

- A. Mix material in appropriate vessel as stated in the product's corresponding Technical Data Sheet.
- B. Mix material as directed in the product's corresponding Technical Data Sheet.

3.06 APPLICATION EQUIPMENT

- A. Protective equipment and clothing as called for in the MSDS
- B. Jiffy® Mixer Blade model ES
- C. Clean container for mixing material
- D. Low speed high torque drill motor
- E. High quality short nap roller covers - ¼ - 3/8 inch nap
- F. High Pressure Airless Sprayer

3.07 APPLICATION

A. Protect AM-PT BW Anti-Microbial Concrete Pretreatment

1. Dampen concrete with water by using the same sprayer set up and technique used to apply the AM-PT BW as seen below. Do not puddle water. Apply AM-PT BW with a high pressure airless sprayer using a 0.17 - 0.19" degree fan tip within 15 minutes of dampening the concrete for best results. Position the spray tip approximately 8"-10" (200-300mm) from the concrete surface, using an overlapping spray pattern. Apply at a rate of 200 sq. ft per gallon (5 SM/L by applying in two passes applying the second pass immediately after the first has penetrated the surface (normally 5 to 20 minutes). **DO NOT ALLOW TO DRY.** Apply the second application at 90° to the first (cross shape). Completely saturate the substrate but **DO NOT PUDDLE.**

B. Protect 1000Gel AM Epoxy Basecoat

1. Apply the properly mixed coating to substrate with a 3/8" nap roller.
2. A second coat may be applied to build system thickness and fill more porosity. If material is applied too thick, sags or runs may occur. Re-roll sags or runs with dry roller and continue application at thinner application thicknesses. Consumption varies according to substrate porosity and texture.

C. Protect 2100AM Satin Antimicrobial Satin Urethane Topcoat

1. Apply the properly mixed antimicrobial topcoat by pan rolling with a 3/8" non shed roller.

D. Tolerances:

1. ZooSpec Sealed Wall: 8-15 mils

3.08 SPEADING RATE

1. Antimicrobial Pre-treatment - the degree of porosity in the concrete will greatly affect coverage rates. Typical consumption rate for pre-treatment is 200 SF/gal).
2. Antimicrobial Epoxy Basecoat- is applied at 6-10 mils (160-267 SF/Gal.) Consumption varies according to substrate porosity and texture
3. Antimicrobial Topcoat is applied at 3 mils maximum (458 SF/gal).

3.09 CURING

- A. Allow the coating to cure (dry) for a minimum 24 hours after application at 24°C (75°F) and 50% RH before opening the wall to service.
- B. Full coating properties may take up to 7 days to develop.

3.10 REPAIR

- A. Repair gouges, chip outs, and scratches as soon as possible to prevent moisture and chemical under cutting and permanent damage to the coating.

3.11 RECOAT

- A. Refer to appropriate product's Technical Data Sheet for recoat timetables and allowable recoat parameters as presented by the manufacturer.
- B. If the re-coat window has expired, the prior cured coating surface must be sanded with 100 grit sand paper or sanding screen.
- C. Sand to a uniform dulled surface.
- D. Remove all sanding debris with a vacuum and damp mop.
- E. Scrub with detergent and rinse with clean (clear) water.
- F. Surface must be dry before recoating.

3.12 SITE QUALITY CONTROL

- A. Site Tests and Inspections: per manufacturer's guidelines
- B. Non-Conforming Work: remove immediately and dispose off site

3.13 ADJUSTING

- A. Permitted only upon manufacturer's approval in writing

3.14 CLEANING

- A. Remove masking, draping, and other protection from adjacent surfaces.
- B. Remove remaining materials and debris from job site and dispose of them according with local rules and regulations. Leave area in clean condition free of debris.

3.15 CLOSEOUT ACTIVITIES

- A. Notify manufacturer of completion of installation
- B. Forward operation and maintenance data to owner/owner's rep
- C. Forward effective warranty date and information to owner/owner's rep

3.16 PROTECTION

- A. Pointed items or heavy items impacting the wall may cause chipping or concrete pop out damage.

3.17 MAINTENANCE

- A. Allow coating to cure at least one week before cleaning by mechanical means (IE: sweeper, scrubber, disc buffer).
- B. Increased life of the wall will be seen with proper maintenance and will help maintain a fresh appearance of your new Protective Industrial Polymers wall.
- C. Regularly clean ground in dirt and grit which can quickly dull the finish, decreasing the life of the coating.
- D. Splashes from Spills should be removed quickly as certain chemicals may stain and can permanently damage the finish.
- E. Heavy objects dragged across the surface will scratch all wall coatings. Avoid gouging or scratching the surface.

END OF SECTION

See additional legal information below

Protective Industrial Polymers may change individual product properties without notice. All sales subject to Protective Industrial Polymers' current terms and conditions of sale. Current terms and conditions can be obtained by calling 866-361-3331. The user of the Protective Industrial Polymers' product(s) must test the product(s) for suitability for the intended purpose and application before proceeding with full application of the product(s).

The most current Technical Data Sheets, System Sheets and SDS information are available at www.protectpoly.com, or by calling 866-361-3331. Installers and handlers of any Protective Industrial Polymers material must read and follow all printed information on Product Labels, Technical Data Sheets, System Data Sheets and SDS Sheets. Nothing contained in any Protective Industrial Polymers material relieves the installer, handler, owner or owner's rep of the obligation to read and follow stated warnings and instructions as presented in these referenced documents.

All information provided by Protective Industrial Polymers concerning its products, including but not limited to, advice and recommendations relating to the application and use of Protective Industrial Polymers products, is provided in good faith based on Protective Industrial Polymers' knowledge of its products when properly transported, stored, handled and applied under normal conditions in accordance with Protective Industrial Polymers' written instructions. With regard to field practice, the differences in materials, substrates, storage and handling conditions, actual site conditions and other factors outside of Protective Industrial Polymers' control are such that Protective Industrial Polymers assumes no liability for the provision of such information, advice, recommendations or instructions related to its products, nor shall any legal relationship be created by or arise from the provision of such information, advice, recommendations or instructions related to its products.

This specification covers **ZooSpec TB** Antimicrobial Thick-Build Coating System. A high-performance flooring system consisting of an antimicrobial concrete pretreatment, an antimicrobial epoxy primer, antimicrobial epoxy build coat(s), and a top coat of aliphatic high-performance antimicrobial urethane. This system is formulated for use in areas such as production and packing rooms, walkways and laboratories where overall chemical resistance and light-reflectance are a requirement.

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of cast-in-place concrete slab.
- B. Apply antimicrobial concrete pretreatment
- C. Apply antimicrobial epoxy primer
- D. Apply antimicrobial epoxy basecoat(s)
- E. Apply antimicrobial urethane or polyaspartic topcoat

Specifier Notes: Edit the following list as required by the project. List other sections with work directly related to the floor coating.

1.02 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete: [existing or] new slab.
- B. Section 03 35 00 – Concrete Finishing: specific chemicals on slab.
- C. Section 03 39 00 - Concrete Curing
- D. Section 03 01 00 – Concrete Rehabilitation

1.04 REFERENCES STANDARDS

- A. For reference standards tests & results refer to Manufactures Product Data Sheets

1.05 ADMINISTRATIVE REQUIRMENTS

- A. Pre installation meeting call if needed.
- B. Involve: Owner, Contractor, Consultant(s), sub-contractors effected

1.06 SUBMITTALS

- A. Samples: forward 4- 4” x 4” color samples representative of finish product for review.
- B. Manufactures’ Instructions: submit to Consultant for review.
- C. Sustainable Design Submittals: as required by other sections.

1.07 CLOSEOUT SUBMITTALS

- A. Applicable testing/performance data certification(s)
- B. Certification(s) of compliance with owner's performance spec, if required
- C. Cleaning, care and maintenance instructions
- D. Material warranty information

1.08 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals
- B. Applicator: Use applicator experienced in application of specified materials for a minimum of [5] [Five] years on projects of similar size and complexity. Provide list of completed projects including project name and location, name of architect, name of material manufacturer, and approximate quantity of materials applied.
- C. Applicator's Personnel: Employ only persons trained for application of specified materials.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name, manufacturer, batch or lot number, and date of manufacture. Do not store in direct sunlight or high heat conditions.
- B. Packaging Waste Management
- C. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Keep containers sealed until ready for use.
 - 3. Do not subject material to excessive heat or freezing; do not apply material that has been subjected to excessive heat or freezing. Material subjected to excessive heat or freezing shall be separated from inventory and destroyed by mixing all three components. The solid reacted product shall be disposed of in environmentally sound and regulatory compliant manner.
 - 4. Shelf life: 1 year after date of manufacture, in unopened containers, under normal conditions.
- D. Handling: Protect materials during handling and application to prevent damage or contamination.
- E. Condition materials for use to 65°F – 75°F (18°C - 24°C) for 24 hours prior to application.

1.11 SITE CONDITIONS

- A. Ambient Conditions
 - 1. Do not apply materials if floor or air temperature is below 65°F (18°C).
 - 2. Do not apply materials if relative humidity is above 85 percent or within 5° of dew point at time of application.
- B. Existing Conditions
 - 1. Utilities, including electric, water, heat and finished lighting to be supplied by General Contractor.
 - 2. Maintain room temperature between 65°F – 75°F (18°C - 24°C) for 48 hours before, during and 48 hours after installation, or until cured.
 - 3. At the time of application ensure the minimum substrate temperature is above 60°F (15°C) and the substrate temperature is 5°F (3°C) above the measured dew point at the time of application.

4. Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and cure period of the floor.
5. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor.

1.12 MANUFACTURER WARRANTY

- A. Provide warranty covering materials for a period of [1] [one] year after date of installation
- B. Installer to provide suitable warranty covering workmanship

2.00 PRODUCTS

2.01 MANUFACTURER

- A. Protective Industrial Polymers www.protectpoly.com (866) 361-3331
- B. 7875 Bliss Parkway, North Ridgeville, Ohio 44039

2.02 MATERIALS

- A. Protect AM-PT Antimicrobial Concrete Pretreatment
- B. Protect 1000 AM Antimicrobial Primer
- C. Protect 1000 AM Antimicrobial Epoxy Coating(s)
- D. Protect 2100 AM or Protect 4300 AM Antimicrobial Topcoat

2.03 QUALITY CONTROL

- A. Tests and Inspections: as required by Manufacturer.
- B. Non-Conforming Work: remove immediately and dispose off site.
- C. Coordination of Other Tests and Inspections

3.00 EXECUTION

3.01 APPLICATOR

- A. Must be a recognized contractor of Protective Industrial Polymers

3.02 EXAMINATION

- A. Substrate:
 1. Free of curing membranes, silicate surface hardener, paint, or sealer and be structurally sound.
 2. If you suspect concrete has been treated or sealed, proceed with complete removal process.
 3. Consult your PIP representative for further instruction if silicate hardeners or membranes have been utilized.
- B. Moisture:
 1. The relative humidity of the concrete substrate shall be less than 75% (using ASTM F2170).

C. Vapor / Contamination:

1. Testing for MVT does not guarantee against future problems.
2. If there is no known vapor barrier or the vapor barrier is inadequate, there is an elevated risk of bond failure.
3. Other factors including the migration of oils, chemicals, excessive salts, or Alkali Silica Reaction (ASR) from the concrete from may also elevate the risk of adhesion difficulties.
4. Consult your PIP representative for approved mitigation treatments.

D. Temperature:

1. During the application and cure of the coating, the substrate temperature, material temperature and room conditions must be maintained between 18°C (65°F) and 32°C (90°F).

E. Humidity:

1. Relative Humidity (RH) should be limited to 30-80%.
2. DO NOT apply coatings unless the surface temperature is more than five degree over the dew point.

3.03 PREPARATION

- A. Remove surface dirt, grease, oil, and contaminants by detergent scrubbing and rinse with clean (clear) water.
- B. Mechanical Preparation: Blasting or grinding the surface is the preferred method of preparation.
- C. The success of industrial diamond grinding as a concrete preparation method will vary depending on technique and the hardness of the concrete.

3.04 JOINTS

- A. All non moving joints (control joints) may be filled with a semi-rigid joint compound such as Protect AM JF-Epoxy or Protect AM JF-Polyurea.
- B. Construction joints may need to be re-built and re-cut depending on conditions.
- C. Isolation or expansion joints should be left uncoated.

3.05 MIXING

- A. Mix material in appropriate vessel as stated in the product's corresponding Technical Data Sheet.
- B. Mix material as directed in the product's corresponding Technical Data Sheet.

3.06 APPLICATION EQUIPMENT

- A. Protective equipment and clothing as called for in the MSDS
- B. Jiffy® Mixer Blade model ES
- C. Clean container for mixing material
- D. Low speed high torque drill motor
- E. High quality short nap roller covers - ¼ - 3/8 inch nap
- F. Application squeegee
- G. High pressure airless sprayer

3.07 APPLICATION

A. Protect AM-PT Anti-Microbial Concrete Pretreatment

1. Dampen concrete with water by using the same sprayer set up and technique used to apply the AM-PT as seen below. Do not puddle water.
Apply AM-PT with a high pressure airless sprayer using a 0.17 - 0.19" degree fan tip within 15 minutes of dampening the concrete for best results. Position the spray tip approximately 8"-10" (200-300mm) from the concrete surface, using an overlapping spray pattern. Apply at a rate of 200 sq. ft per gallon (5 SM/L by applying in two passes applying the second pass immediately after the first has penetrated the surface (normally 5 to 20 minutes). **DO NOT ALLOW TO DRY.** Apply the second application at 90° to the first (cross shape). Completely saturate the substrate but **DO NOT PUDDLE.** Use a clean broom to distribute **ALL** puddles immediately.

B. Protect 1000-AM Anti-Microbial Epoxy Primer

1. Apply the properly mixed primer to the treated concrete substrate using a notched squeegee and level uniformly with a non shed 3/8" roller.
2. Leaving the material sit in the pail longer than 10 minutes will result in an increase of viscosity and reduce leveling properties.

C. Protect 1000-AM Antimicrobial Epoxy Basecoat

1. Apply the properly mixed Basecoat to the primed substrate using a notched squeegee and level uniformly with a non shed 3/8" roller.
2. Leaving the material sit in the pail longer than 10 minutes will result in an increase of viscosity and reduce leveling properties.
3. An optional second application may be applied if greater film build is desired.

D. Protect 2100-AM OR Protect 4300 AM Antimicrobial Topcoat

1. Protect 2100-AM -Apply the properly mixed antimicrobial topcoat by pan rolling only with a 3/8" non shed roller.
Protect 4300- AM apply with a notched squeegee and level uniformly with a non shed 3/8" roller.
 1. Leaving the material sit in the pail longer than 10 minutes will result in an increase of viscosity and reduce leveling properties.
2. Tolerances:
 1. ZooSpec TB: 25-45 mils

3.08 SPEADING RATE

- A. Pre-treatment - the degree of porosity in the concrete will greatly affect coverage rates. Typical consumption rate for pre-treatment is 200SF/gal).
- B. Epoxy Primer –is applied 8 mils (200 SF/gal).
 1. The best practice is to measure and grid the floor to be sure of consistent application rate.
- C. Epoxy Basecoat –is applied at 10-15 mils (107-160 SF/gal).
 1. The best practice is to measure and grid the floor to be sure of consistent application rate.

D. Urethane Topcoat

1. Protect 2100 AM is applied at 3.5-6 mils (267-458 SF/gal).
2. Protect 4300 AM is applied at 10 mils (160 SF/gal).
3. The best practice is to measure and grid the floor to be sure of consistent application rate.

3.09 CURING

- A. Allow the coating to cure (dry) for a minimum 24 hours after application at 24°C (75°F) and 50% RH before opening the floor to light traffic, allow more time for low temperatures and higher humidity or for heavier traffic.
- B. Full coating properties may take up to 7 days to develop.

3.10 REPAIR

- A. Repair gouges, chip outs, and scratches as soon as possible to prevent moisture and chemical under cutting and permanent damage to the floor coating.

3.11 RECOAT

- A. Refer to appropriate product's Technical Data Sheet for recoat timetables and allowable recoat parameters as presented by the manufacturer.
- B. If the re-coat window has expired, the prior cured coating surface must be sanded with 100 grit sand paper or sanding screen installed on a swing-type floor buffer.
- C. Sand to a uniform dulled surface.
- D. Remove all sanding debris with a vacuum and damp mop.
- E. Scrub with detergent and rinse with clean (clear) water.
- F. Surface must be dry before recoating.

3.12 SITE QUALITY CONTROL

- A. Site Tests and Inspections: per manufacturer's guidelines
- B. Non-Conforming Work: remove immediately and dispose off site

3.13 ADJUSTING

- A. Permitted only upon manufacturer's approval in writing

3.14 CLEANING

- A. Remove masking, draping, and other protection from adjacent surfaces.
- B. Remove remaining materials and debris from job site and dispose of them according with local rules and regulations. Leave area in clean condition free of debris.

3.15 CLOSEOUT ACTIVITIES

- A. Notify manufacturer of completion of installation
- B. Forward operation and maintenance data to owner/owner's rep
- C. Forward effective warranty date and information to owner/owner's rep

3.16 PROTECTION

- A. Pointed items or heavy items dropped on the floor may cause chipping or concrete pop out damage.
- B. Plasticizer migration from rubber tires can permanently stain the floor coating.
- C. If a rubber tire is planned to set on the floor for a long period of time, place a piece of acrylic sheet between the tire and the floor to prevent tire staining.
- D. Rubber burns from quick stops and starts from lift trucks can heat the coating to its softening point causing permanent damage and marking.

3.17 MAINTENANCE

- A. Allow floor coating to cure at least one week before cleaning by mechanical means (IE: sweeper, scrubber, disc buffer).
- B. Increased life of the floor will be seen with proper maintenance and will help maintain a fresh appearance of your new Protective Industrial Polymers floor.
- C. Regularly sweep to avoid ground in dirt and grit which can quickly dull the finish, decreasing the life of the coating.
- D. Spills should be removed quickly as certain chemicals may stain and can permanently damage the finish.
- E. Only soft nylon brushes or white pads should be used on your new floor coating. Premature loss of gloss can be caused by hard abrasive bristle Polypropylene (Tynex®) brushes.
- F. Heavy objects dragged across the surface will scratch all floor coatings. Avoid gouging or scratching the surface.

END OF SECTION

See additional legal information below

Protective Industrial Polymers may change individual product properties without notice. All sales subject to Protective Industrial Polymers' current terms and conditions of sale. Current terms and conditions can be obtained by calling 866-361-3331. The user of the Protective Industrial Polymers' product(s) must test the product(s) for suitability for the intended purpose and application before proceeding with full application of the product(s).

The most current Technical Data Sheets, System Sheets and SDS information are available at www.protectpoly.com, or by calling 866-361-3331. Installers and handlers of any Protective Industrial Polymers material must read and follow all printed information on Product Labels, Technical Data Sheets, System Data Sheets and SDS Sheets. Nothing contained in any Protective Industrial Polymers material relieves the installer, handler, owner or owner's rep of the obligation to read and follow stated warnings and instructions as presented in these referenced documents.

All information provided by Protective Industrial Polymers concerning its products, including but not limited to, advice and recommendations relating to the application and use of Protective Industrial Polymers products, is provided in good faith based on Protective Industrial Polymers' knowledge of its products when properly transported, stored, handled and applied under normal conditions in accordance with Protective Industrial Polymers' written instructions. With regard to field practice, the differences in materials, substrates, storage and handling conditions, actual site conditions and other factors outside of Protective Industrial Polymers' control are such that Protective Industrial Polymers assumes no liability for the provision of such information, advice, recommendations or instructions related to its products, nor shall any legal relationship be created by or arise from the provision of such information, advice, recommendations or instructions related to its products.

SECTION 13 19 13
ANIMAL HOLDING PARTITIONS AND GATES

PART ONE - GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, tools and equipment necessary for the following Work items:

1. Interior Mesh Partition Systems.
2. Interior Mesh Ceiling Panel Systems.
3. Hand-woven wire mesh at outdoor holding areas
4. Fabricated door and gate assemblies and control systems.
5. Not used.
6. Manually Operated Animal Transfer Door Systems.
7. Animal Transfer assemblies
8. Skylight Protection Screens

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - VOC Content Restrictions

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2010.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A240 / A240M - 11a Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- F. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes; 2010.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2010.
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.
- I. ASTM A 242/ A242M - 04(2009) Standard Specification for High-Strength Low-Alloy Structural Steel - 340MPa (50ksi) yield strength weathered steel
- J. ASTM A 588/A588M-10 - Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance. 480MPa (70ksi) yield strength weathered steel
- K. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
- L. ASTM A847/ A847M - 11 Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric

Corrosion Resistance

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination;

American Welding Society; 2007.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

O. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

Q. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 RELATED DOCUMENTS

A. USDA Animal and Plant Health Inspection Service, Title 9

B. American Zoo & Aquarium Association accreditation standards for safety and security.

1.05 DESIGN REQUIREMENTS

A. Animal loading: See structural drawings for applicable animal loading.

1.06 QUALITY ASSURANCE

A. Provide design of work under the direct supervision of a Professional Engineer licensed in the state of California. Design gates to remain operational under all load scenarios, including maximum animal loads.

B. Pulley system fabricator/installer must have 5 years previous experience with similar pulley systems.

C. Perform all shop and field welding required in connection with the Work of this section, adhering to the current pertinent recommendations of the American Welding Society, with welders who are qualified for making the weld types indicated.

D. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this section.

1.07 SUBMITTALS

A. Not used.

B. A complete list of materials proposed to be furnished and installed under this Section.

C. Manufacturer's specifications and other data needed to demonstrate compliance with specified requirements.

D. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

- E. All stainless steel items required manufacturer's certification of type of stainless steel used.
- F. Shop Drawings of all items proposed to be furnished and installed under this Section. Include plans, sections, elevations, and details as needed. Provide signed stamp of a registered professional engineer per 1.06A above.
- G. Structural calculations bearing stamp per 1.06A above
- H. Templates for anchor and bolt installation by other trades.
- I. Samples:
 - 1. Provide 24 inch square sample of each metal mesh fabric with proper finish as required for the Architect's review.

1.08 PRODUCT HANDLING

A. General:

- 1. Comply with pertinent provisions - Product Requirements.
 - a. Protection:
 - 1) Use all means necessary to protect the materials of this section before, during, and after installation and to protect the Work and materials of all other trades.
 - b. Replacements:
 - 1) In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

PART TWO - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Metal Surfaces, General:

- 1. For the Work of this Section use only those materials which are smooth and free from surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness.
- 2. Metal Finishes, Galvanized:
 - a. Unless specified otherwise, provide a zinc coating for all ferrous materials included in the Work of this Section, as follows:
 - 1) ASTM A153 for galvanizing iron and steel hardware.
 - 2) ASTM A123/123M for galvanizing rolled, pressed, and forged steel shapes, plates, bars, and strip 3 mm (1/8") thick and heavier and for zinc coating (hot dipped) on assembled steel products .
 - b. All galvanized work to be reformed true to line and level as required in shop before delivery to the job site.

B. Standards:

- 1. Steel plates, shapes, and bars: ASTM A36.
- 2. Steel plates to be bent or cold formed: ASTM A283, Grade C.
- 3. Steel tubing, cold-formed, welded, or seamless: ASTM A500.
- 4. Steel bars and bar-size shapes: ASTM A306, Grade 65, or ASTM A36.
- 5. Cold-finished steel bars: ASTM A108, grade as selected by the fabricator.
- 6. Cold-rolled carbon steel sheets: ASTM A336.

7. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.
8. Stainless steel: Type 302 or 304 of American Iron and Steel Institute, No. 4 finish.
9. Stainless steel sheets: Type 302 or 304, 24 gauge of American Iron and Steel Institute, No. 4 finish.
10. Grey iron castings: ASTM A48, Class 30.
11. Malleable iron castings: ASTM A47, Grade as selected by the fabricator.
12. Steel pipe: ASTM A53, type as selected, Grade B, black finish unless galvanizing is required, Schedule 40 unless otherwise indicated.
13. Concrete inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A47 or cast steel ASTM A27.
14. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A153.
15. Bushings and Thrust Washers: Oil impregnated, porous bronze, Oilite Bronze or equal.
16. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute; 1997.
17. Weathering steel at various components where indicated.

2.02 FASTENERS

- A. Provide zinc-coated or stainless steel fasteners unless specified otherwise.
- B. Select fasteners for the type, grade, and class required.
 1. All fasteners listed below shall comply with ASTM A307 and as follows::
 - a. Bolts and nuts: Regular hexagon-head type, Grade 5. Galvanized or SST
 - b. Expansion anchors in concrete:
 - c. Drilled, epoxied anchors in concrete:
 - d. Lag bolts: Square-head type, meeting Fed Spec FF-B-561.
 - e. Machine screws: Stainless steel or galvanized.
 - f. Wood screws: Flat-headed carbon steel.
 - g. Plain washers: Round, galvanized or SST, complying with Fed Spec FF-W-92.
 - h. Masonry anchorage devices: Expansion shields complying with Fed Spec FF-S-325.
 - i. Toggle bolts: Tumble-wing, type, class and style as required, but complying with Fed Spec FF-B-588.
 - j. Lock washers: Helical spring type carbon steel, complying with Fed Spec FF-W-84.
 - k. Stainless Steel Fasteners: Type 304 or 316/L.
 - l. Stainless Steel Compression Bands with treaded screw tightening.
 2. At all fasteners provide primerless thread locking compound (Loctite blue 243 medium strength or equal)

2.03 INTERIOR MESH PARTITION & ANIMAL TRANSFER SYSTEMS

A. General: Systems are as shown on the drawings and as described herein for reference. Provide all bolts, brackets, hardware and accessories needed for a complete installation.

B. Definition of Systems:

1. Animal Transfer Doors: TYPE Manual
 - a. System Type(s): Horizontal Sliding
 - b. Door Sizes: as indicated in the Drawings.
 - c. Operation: Manual (with cable or bar system) or handle
 - d. Track and frame material: Carbon Steel with a galvanized finish.
 - e. Track Lining: UHMW polyethylene
 - f. Door Panel Material and Thickness: Polyethylene sheet, 1 inch thick, in sandwich. Welded wire mesh 2x2x1/4 welded to steel frame where indicated.
 - g. Door Frame Material: Steel tube, welded corners. Thickness per Drawing.
 - h. Fabricate components subject to wear with Owner accessible and serviceable parts.
2. Not used.
3. Animal Transfer Doors
 - a. System Type(s): Horizontal.
 - b. Door Sizes: as indicated in the Drawings.
 - c. Operation: Manual (with cable or bar system)
 - d. Track and frame material: Carbon Steel with a galvanized finish.
 - e. Door Panel Material and Thickness: Polypropylene sheet, 1/2 inch thickness minimum.
 - f. Fabricate components subject to wear with Owner accessible and serviceable parts.
4. Transfer Chutes and Corridors:
 - a. Custom fabricated according to the Drawings.
 - b. Frame and infill mesh materials to match Mesh Partition materials unless noted otherwise.
5. Keeper and service Doors and Gates Hardware:
 - a. Custom steel frame and mesh as described in this Section and on the drawings.
 - b. Hinges: Stanley or Hager Heavy Duty. Three per door unless otherwise noted. Galvanized.
 - c. Latches at exterior gates: As detailed. Provide lockable hardware. All gates to have two point locks, some accessible from both sides as indicated.
 - d. Locking Mechanisms: Double throw-bolts designed to accept keyed deadbolts.
 - e. Not used.
 - f. Not used.

- g. Surface Slide Bolt with Padlock: Stanley # 763808, 6 1/2 inch zinc plated. Thru bolt with 1/4 inch diameter carriage bolts and cap screws. Owner to provide padlock.
- 6. Skylight Protection Screens at Holding Skylights
 - a. Attach per Drawings with galvanized fasteners.

C. APPROVED MANUFACTURERS (NO SUBSTITUTIONS)

- 1. **A thru Z**
8620 East Old Vail Road
Suite 100
Tucson, AZ 85747
529-434-8281
- 2. **LGL Animal Care Products**
721 Peach Creek Cutoff Road
College Station, TX
979-690-3434
- 3. **Scott Fence**
1255 Distribution Way
Vista, CA 92081
760-598-0070
Attention: Kent Scott
- 2. **Thermeg**
1070 Disher Drive
Waterville, OH 43566
419-340-0978
Attention: Bill Murry
wrmurry@thermeq.com

2.04 CONTROLS

- A. SLIDING DOOR TRUCKS
 - 1. Remote Controlled Polypropylene & Mesh Sliding Doors:
 - a. Richards-Wilcox hanger (truck), size as shown, or approved equal.
- B. SLIDING DOOR TRACKS AND BRACKETS
 - 1. Remote Controlled FRP & Mesh Sliding Doors:
 - a. Richards-Wilcox track, size as shown, or approved equal.
- C. WIRE ROPE: 6X41 GALVANIZED IMPROVED PLOW STEEL, Match 1/8" used at Hoofstock, Lion and Cheetah, 3/16" at Rhino and Giraffe.
- D. PULLEYS (BLOCKS) :
 - 1. Standard flat pulleys, zinc plated steel with plated steel sheaves and oil impregnated bronze bushings, grooved for wire rope,

2. Manufacturer: Richard-Wilcox (Basis of Design), Block Division Inc or approved equal.

a. Vertical Mount pulley : Galvanized 0234.00017

b. Flush Mount pulley: Galvanized 0234.00018

E. CONTROLS

1. Not used.

2. Door Tracks and Guides:

a. Integrate metal guides and tracks for Animal Doors into the framework of the Mesh Partition System.

b. Fabricate components subject to wear with Owner accessible and serviceable parts.

c. Fabricate Animal Transfer Doors for integration into Mesh Partition System as well as for Surface mounting on concrete walls.

PART THREE - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which metal fabrications are to be installed, and correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Furnish final design and setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate delivery of such items to project site.

3.03 FABRICATION

A. Provide fabrication drawings for all work fabricated under the provisions of this section including assemblies of manufactured items and modifications to manufactured items.

B. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability of adjacent or connecting material in the finished product.

C. Work to dimensions shown or as accepted on the Shop Drawings, using industry-proven methods of fabrication and support.

D. Use type of materials shown or specified for the various components of the Work.

E. Form exposed Work true to line and level, with accurate angles and surfaces and with straight sharp edges.

F. Ease the exposed edges to a radius of approximately 0.8 mm (1/32") unless otherwise shown.

G. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

H. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush; match and blend with adjoining surfaces.

I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown, or, if not shown, use Philips flat-head (countersunk) screws or bolts or flat head socket cap..

J. Provide for anchorage of the type shown. Coordinate with supporting structure. Fabricate and space the anchoring devices to provide adequate support for intended use.

K. Cut, reinforce, drill, and tap miscellaneous metal Work as indicated to receive finish hardware and similar items.

L. At any exposed surfaces, do not leave any sharp or pointed fabrication burrs, cuts, scraps, temporary erection bars, weld splatter or other materials which might cause injury to animals or keepers.

3.04 GALVANIZING

A. Provide a zinc coating for those items shown or specified to be galvanized, as follows:

1. ASTM A153 for Hot-Dip galvanizing iron and steel hardware.
2. ASTM A123 for Hot-Dip galvanizing rolled, pressed, and forged steel shapes, plates, bars, and strip 3 mm (1/8") thick and heavier. Also fabricated or assembled products.

B. All galvanized work to be reformed true to line and level, as required, in the shop before delivery to the job site.

C. Plug all exposed drainage holes from galvanizing process and grind smooth. Touch up with rolled application of cold galvanizing compound.

3.05 SHOP FINISHING

A. At exterior framing.

B. Shop paint metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, stainless steel, and galvanized surfaces, unless otherwise specified.

C. Remove scale, rust, and other deleterious materials before applying shop coat.

D. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 or SSPC-SP-3.

E. Remove oil, grease, and similar contaminants in accordance with SSPC-SP-1.

F. At ferrous metals, sand blast to near white metal in accordance with SSPC-SP-10 before applying zinc rich polyamid epoxy primer.

G. Ferrous metals to receive zinc rich polyamide epoxy primer require inspection by Architect or Inspection and Testing Agency prior to priming. Notify Architect 24 hours prior to prime coating.

H. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's recommendations, and at a rate to provide the recommended dry film thickness.

I. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

3.06 INSTALLATION

A. Provide anchorage devices and fasteners where necessary for securing partitions, door assemblies and other components to in-place construction including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting and Placement

1. Perform cutting, drilling, and fitting required for installation of metal fabrications.

2. Set Work accurately in location, alignment, and elevation, and make plumb, level, true, and free from rack, measured from established lines and levels.

3. Provide temporary bracing or anchors in formwork for items which are to be built into concrete or similar construction.

4. Fit exposed connections accurately together for form tight hairline joints.

5. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.

6. Grind exposed joints smooth, and touch up shop paint coat. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

END OF SECTION

SECTION 22 0000

PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Documents:

1. The other Contract Documents complement the requirements of this Section and apply to this Section
2. Division 1 - General Requirements, General Mechanical Section 21 0013 apply to the Work of this Section.
3. Where requirements of this Section exceed those in other Contract Documents, Contractor shall comply with the requirements of this Section.

B. Codes and Regulations:

1. California Plumbing Code (CPC).
2. California Mechanical Code (CMC).
3. California Building Code (CBC).
4. California Green Building Standard Code.
5. National Fire Code (NFC).
6. National Fire Protection Association (NFPA).
7. Local Building Department.
8. Local Fire Marshal.
9. Office of the State Fire Marshall.
10. Division of the State Architect.
11. Office of the Statewide Health Planning and Development.
12. California Energy Commission.
13. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirements will govern when so directed by the Architect.

C. Scope of Work: (Plumbing Section Division 22)

1. Material and labor including rough-in for and connection to fixtures, appliances and equipment are:
 - a. WASTE AND VENT
 1. Soil piping
 2. Drain waste and vent piping (DWV)
 3. Indirect waste piping
 4. Special waste and vent piping, and equipment for; on site sewage treatment and disposal system.

5. Trench drains.
 6. Area drains.
 7. Floor drains.
 8. Traps.
 9. Vent flashings.
- b. SEWERS (To five feet beyond building)
1. Including metallic or non-metallic piping used to convey sewage and other waste to, and including, connection with offsite utility or onsite treatment and disposal system.
 2. Manholes (pre-cast or pre-formed), cesspools, septic tank systems, and leaching lines, backwater valves and lift stations.
- c. STORM AND SUB-SOIL DRAINAGE
1. Roof and overflow drains, including flashing, rain water drainage piping. Exterior rainwater leader downspouts (10 gauge and heavier).
 2. Catch basins-pre-cast or pre-formed.
 3. Manholes (pre-cast or pre-formed).
 4. Drains and bubblers.
 5. Gravel basins.
 6. Interceptor and separators.
 7. Storm water sewers inside property lines.
 8. Metal grates and frames.
 9. Sub-soil drainage and ground water collection systems.
 10. Sump pumps, lift stations and backwater valves.
- d. WATER
1. Potable water piping systems including above and below grade tanks, pressure reducing valves, relief valves, balancing valves, water hammer shock absorbers, air chambers.
 2. Isolation, Zone and Control Valves.
 3. Hot water systems including heaters and storage tanks.
 4. Piping for water service.
 5. Backflow preventers.
 6. Disinfecting of water systems.
 7. Insulation of piping and equipment for heat, sound, and vibration.
- e. ALL PLUMBING FIXTURES AND SUPPORTS
1. Including, but not limited to:

- (a) Sinks, lavatories, water closets, urinals, tubs, service sinks, etc., - all materials
 - (b) Supports (backing) for all plumbing fixtures and accessories
- f. FUEL GAS PIPING
 - 1. Natural and manufactured gas distribution, liquefied petroleum distribution, meters, regulators and connections to all gas fired equipment.
- g. CONNECTIONS
 - 1. Utilities-Sanitary sewer, storm drain, water, gas
 - 2. The joining of pipe by any mode or method including, but not limited to, acetylene and arc welding, brazing, lead burning, plastics welding, soldering, wiped joints, caulked joints expanded or rolled joints, etc., used in connection with any of the work listed herein.
- h. LAYOUT AND CUTTING
 - 1. Holes, chases, channels, the setting and erection of bolts, inserts, stands, brackets, stanchions, supports, sleeves, escutcheon plates, thimbles, hangers, conduits, and boxes.
- i. EXCAVATION, TRENCHING AND BACKFILL
 - 1. In connection with plumbing and piping work shown herein
- j. TEMPORARY PIPING in connection with:
 - 1. Building and construction work
 - 2. Excavating and underground construction
 - 3. Demolition work
- k. PIPE HANGERS, SUPPORTS, ANCHORS, GUIDES, EXPANSION JOINTS
 - 1. Including:
 - (a) Supports for equipment to which pipe is connected, such as tank supports
 - (b) Isolators-dielectric and vibration
 - (c) Anchors and thrust blocks of concrete, metal, etc.
 - (d) Seismic bracing
 - (1) Anvil/Badger, Mason Industries, B-Line/TOLCO or approved equal.
 - (2) Seismic hanger system design shall comply with CBC 2016 requirements and ASE 7-05 and 7-10.
- l. SIGNS AND NOTICES
- m. MECHANICAL EQUIPMENT-GAS FIRED

- n. ROOF FLASHINGS FOR PIPING PENETRATIONS
- o. TESTS
 - 1. Piping, for tightness
 - 2. Equipment for performance
 - 3. Operating instructions
 - 4. Final operation

1.2 ACCESSIBLE PLUMBING FIXTURES

- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Section 11B-213, 11B-305, & 11B-308.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.
- C. Welder's Qualifications: Comply with ASME B31.8. The pipe welder shall have a copy of a certified ASME B31.8 qualification test report. Contractor shall also conduct a qualification test. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Affix symbols immediately upon completion of welds. Welders making defective welds after passing a qualification test shall be given a requalification test and, upon failing to pass this test, shall not be permitted to work this contract.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Architectural Sections.
- B. Product Data: Within 35 calendar days after the Contractor has received the Notice to Proceed, submit 6 copies of the following to the Architect for approval prior to acquisition:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications, catalog cuts, and other data needed to prove compliance with the specified requirements. All pieces of equipment shall be clearly identified on corresponding manufacturer's literature being submitted.
 - 3. Shop Drawings or other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
 - 4. All submittals for the entire project shall be submitted at the same time. Submittals shall be provided in a tabulated three ring binder or PDF format. Incomplete or noncompliant submittals may be rejected.

1.5 DESIGN CHANGES CAUSED BY PRODUCT SUBSTITUTIONS

- A. Contractor shall pay costs of design and installation for changes resulting from substitution of alternate products.
- B. Acceptance of alternate products by Architect does not change this requirement.

1.6 PRODUCT HANDLING

- A. Comply with pertinent provisions of Architectural Sections.

PART 2 - PRODUCTS

2.1 WASTE, VENT, SEWER AND STORM DRAINAGE

- A. Above Grade
 - 1. All waste, vent, sewer and storm lines shall be of cast iron soil pipe and fittings and shall conform to the requirements of CISPI Standard 301, ASTM A-888 or ASTM A-74 for all pipe and fittings
 - a. Acceptable Manufacturers:
 - 1. AB&I Foundry
 - 2. Charlotte Pipe and Foundry
 - 3. Tyler Pipe Company
 - b. Joints
 - 1. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions and local code requirements. Hubless coupling gaskets shall conform to ASTM Standard C-564.
 - 2. Heavy Duty Joints: for hubless pipe and fittings shall conform to the manufacturer's installation instructions and local codes requirements. Hubless couplings gaskets shall conform to ASTM C 1540 and FM 1680 Class 1. Couplings shall consist of a 304 stainless steel shields, clamp assembly and a high quality elastomeric gasket conforming to ASTM 564. Clamp shall be 4 band construction, Clamp-All, Tyler 4000 or approved equal.
 - 3. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM Standard C-564 or shall be installed with lead and oakum.
 - c. Mandatory Referenced Standards
 - 1. Cast Iron Soil Pipe Institute Standard Specifications - Latest Issue
 - (a) CISPI 301: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 - (b) CISPI 310: Couplings for use in connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

2. ASTM Standard Specifications - Latest Issue
 - (a) A-888: Standard Specifications for Hubless Cast Iron Soil Pipe and Fittings.
 - (b) A-74: Standard Specifications for Hub and Spigot Cast Iron Soil Pipe and Fittings.
 - (c) C-564: Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- B. Above and Below Grade:
1. Schedule 40 Solid wall PVC plastic DWV pipe with solvent-cemented drainage pattern fittings complying with ASTM D 1785 - Latest Issue.
 - a. SCH. 40 Cellular Core PVC plastic DWV pipe with solvent-cemented drainage pattern fittings complying with ASTM D 4396 may be used at Contractor's option for vent piping. -Latest Issue.
 2. Schedule 40 Solid wall ABS plastic DWV pipe with solvent-cemented fittings complying with ASTM D-2661 - Latest Issue.
 - a. SCH. 40 Cellular Core ABS plastic DWV pipe with solvent-cemented drainage pattern fittings complying with ASTM D 3965 may be used at Contractor's option for vent piping. -Latest Issue.

2.2 DOMESTIC WATER PIPING

- A. Below Grade (Water Service)
1. 3" NPS and smaller, Schedule 40 PVC Plastic Pipe and fittings. ASTM D1785, D2466, with Solvent Cement Joints ASTM D2564.
 2. 2" NPS and smaller, Type K Soft Annealed Temper Copper Tube ASTM B88 with Wrought Copper pressure fittings, ANSI B16.22. SIL-FOS - High temperature Brazing Metal Filler.
 3. 4" NPS and larger, PVC AWWA C900 Class 100 Plastic Pipe with Ductile-Iron fittings AWWA C110, C111 or Elastomeric Gasket Joints
- B. Above Grade (Distribution System)
1. Piping
 - a. For soldered, brazed and mechanical joints, 4" and smaller Copper Water Tube Type L Annealed Temper (Hard Drawn) ASTM B75 or ASTM B88.
 2. Fittings
 - a. Wrought Copper Pressure Solder Fittings, ASME B16.22 or ASME B16-25, 95-5 Tin-Antimony Filler Metal.
 - b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - c. Copper Unions: MSS SP-123, cast-copper alloy, hexagonal-stock body, with ball-and-socket, met-to-metal seating surfaces, and solder-joint or threaded ends.

- d. Press Fitting: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Press fittings shall have an inboard bead design.
 - 1. Copper Press Fittings: Viega/Rigid Tool Company, NIBCO, Elkhart/Apollo Xpress or approved equal.
 - 2. 2"NPS and smaller: Wrought copper fitting with EPDM-rubber O-ring seal in each end.
 - 3. 2-1/2" to 4"NPS: Cast-bronze or wrought copper fitting with EPDM-rubber O-ring seal in each end.

2.3 GAS PIPING

A. Below Ground

- 1. Schedule 40, Seamless, Black Steel Pipe, 2 1/2" and under ASTM A-120 with Malleable-Iron Threaded fittings ANSI-B16.3, Class 150. Pipe and fittings shall be coated and wrapped per IAPMO IS 13-91 or provide factory applied plastic coated pipe.
- 2. Schedule 40, Seamless Steel Pipe 3" and larger ASTM A-53 with Buttweld Steel fittings ASTM-A-234
- 3. Polyethylene (PE) Natural and Liquefied Petroleum Gas Yard Piping ASTM D2513 with Fusion Joints. Provide Steel Transition Risers and Detectable Warning Tape.

B. Above Ground

- 1. Schedule 40, Seamless Black Steel Pipe ASTM A 120 2 1/2" and smaller with Malleable Iron Threaded fittings ANSI B16.3 Class 150

2.4 VALVES

A. Acceptable Manufacturers: Milwaukee, Hammond, NIBCO, Watts, others as noted.

Type	Size Range	Part Number
Ball	2" and smaller (2 piece)	Milwaukee UPBA400 Hammond UP8301A NIBCO 585-80-LF
Ball	2½" and larger (3 piece)	Milwaukee UPBA300 Hammond UP8604 NIBCO 595Y-LF
Note: Stem extensions of non-thermal-conductive material and protective sleeve that meets UL 2043 approved for inside air plenum and allows operation of valve without breaking the vapor sleeve shall be used on insulated pipe. NIBCO NIB-Seal handle or acceptable equal.		
Gate	2" and larger	Milwaukee UP115 Hammond UP645 NIBCO T-113-LF
Gate	2½" or larger	NIBCO F-619-RW
Gate-Underground	3" and larger	Mueller A-2362 NIBCO F-619-RW

Check-Swing	2" and smaller	Milwaukee UP509 Hammond IB940 NIBCO 413Y
Check-Spring	2" and smaller	Milwaukee UP548T NIBCO 480Y-LF
Check-Swing	2½" and larger	Apollo 61YLF NIBCO F-918-B-LF
Check-Spring	2½" and larger	NIBCO F-938-33
Gas Cock	2" and smaller	Milwaukee BA475B Hammond 8901 NIBCO FP600
Gas Cock	2½" and larger	Homestead 611/612 Walworth 1796/1797 (with wrench) NIBCO T-580/585-70-UL

- B. All valves in copper piping shall be soldered in or have screwed threads. Threaded valves shall be installed with sweat to screwed adapters.
- C. All compressed air valves shall be ball valves especially made for compressed air service.
- D. All pump discharges shall have a check valve placed minimum 5 pipe diameter from the pump.
 - 1. NIBCO W920W or F910B
 - 2. Acceptable equal.
- E. All below grade ball valves shall have stainless steel handles.

2.5 HANGERS AND SUPPORTS

- A. In general, all pipe hangers and supports shall conform to the following except where special pipe hangers and supports are detailed on the Drawings. In all cases hanger and support details on the Drawings shall take precedent over the following:

Piping 6" Size and smaller:

<u>Items</u>	<u>TOLCO Figure</u>	<u>Anvil</u>
Pipe Hanger	1; 2; 200	260
Side Beam Clamp for Wood Joist	58	207
Beam Coupling for Steel Beams	65	92
Rod Coupling for Connection to "Hilti"	70	135
Inserts in Concrete Decks	107;109A;109AF	N/A
Trapeze Hangers	Tolstruct A12	AS200
Pipe Clamp	TOLCO Cush Clamp	AS004OD- AS098OD

- B. Similar items by Anvil International, Erico-Caddy or TOLCO/B-Line will be acceptable.
- C. Hanger Rods shall conform to the following table:

<u>Tube/Pipe Size</u>	<u>Rod Diameter</u>
1/2" to 4"	3/8"
5" to 8"	1/2"
10" to 12"	5/8"

- D. Trapeze hangers may be used where parallel runs of pipe occur. All rods on trapeze hangers shall be 1/2" minimum size.
- E. Hanger Support Spacing shall be as follows unless shown otherwise on the Drawings:
1. Horizontal:
 - a. Cast Iron: Every other joint unless over 4 feet, then at every joint.
 - b. Copper: Every 6 feet for 1-1/2 inch and smaller, and 10 feet for 2 inch and larger.
 - c. Steel, Gas: Every 6 feet for 1/2 inch, 8 feet for 3/4 inch and 1 inch, and 10 feet for 1-1/4 inch and larger.
 - d. Schedule 40 PVC or ABS DWV: Every 4 feet for all sizes. Provide for expansions every 30 feet.
 2. Vertical:
 - a. Cast Iron: Base and every floor not to exceed 15 feet.
 - b. Copper: Every floor not to exceed 10 feet.
 - c. Steel, Gas: Same as horizontal spacing except 1-1/4" and larger at every floor.
 - d. Schedule 40 PVC or ABS DWV: Base and every floor with mid-floor guides. Provide for expansion every 30 feet.
- F. Refer to the plumbing code for materials not listed above.
- G. At all points where insulated pipe contacts a hanger or support, the point of contact shall be protected by a metal insulation pipe shield #B3153 as manufactured by B-Line. Equivalent pipe protectors will be considered provided the substitute item meets the same standard of quality and performance as the specified item.
- H. Seismic Restraint Devices
1. Available Manufacturers:
 - a. Anvil/Badgr
 - b. Mason Industries
 - c. B-Line Tolco Division of Eaton
 2. Seismic hanger system design shall meet the requirements of IBC, CBC and ASCE 7-05 and 7-10.

2.6 WALL AND FLOOR PENETRATIONS

- A. Fire walls and floors:

1. Wall and floor penetrations shall be protected with a U.L. approved fire rated system. The system shall be per the Drawing Details, or other manufacturer's installation instructions.
 2. Fire stopping materials by Hilti, Metacaulk, or 3M are considered equal. The material shall be the same as called out for in the U.L. approved system.
- B. Poured concrete walls and floors.
1. Pipes penetrating poured concrete walls and floors shall be protected by providing the following:
 - a. A Schedule 40 PVC sleeve one (1) size larger than the pipe or one quarter (1/4) inch of foam material wrapped around and secured to the pipe or packed and caulked with mineral wool.
 - b. Protection shall end flush with the wall or floor surface.
- C. All walls and floors:
1. Piping passing through walls and floors exposed to view shall be provided with chrome plated split-ring escutcheon plates in finished areas. Brass or galvanized escutcheon plates may be used elsewhere.

2.7 FLASHING

- A. All flashing shall be 4 lb. sheet lead and all vents penetrating the roof shall be flashed and counter-flashed. Stoneman Co. roof flashing assembly with 10" skirt or equal may be used.
- B. The flashing for vents penetrating a metal roof shall have a corrosion resistant aluminum base compatible with the roofing system. A rubber type flashing by "Tech Specialties" shall be installed between the flashing and pipe.
- C. Individual roof storm drain overflows shall be flashed with Stoneman lead overflow Series #700 assemblies or flashed per vent above.
- D. For single ply roofing, provide flashing per roofing manufacturer recommendations or installation instructions.

2.8 VALVE BOXES

- A. Brooks Products Inc., Christy Co., or equal with the word "Water" or "Gas" cast in cover as applicable.

2.9 CLEANOUTS

- A. Provide cleanouts per Drawings and details on Drawings. Cleanouts as manufactured by J. R. Smith, Mifab, Wade, or Zurn are approved equals.
- B. Cleanout tops to be installed with tamper-proof screws.

2.10 FLOOR DRAINS, FLOOR SINKS AND ROOF DRAINS

- A. Provide drains as specified on the Plumbing Schedule. Drains as manufactured by J.R. Smith, Mifab, Josam, and Zurn will be acceptable provided they are equal.
- B. Floor sinks by J.R. Smith, Mifab, Josam, and Zurn or Commercial Enameling are acceptable provided they are equal.

2.11 WATER HAMMER ARRESTORS

- A. Provide Wilkins Piston Model #1200, Sioux Chief #65X-X or equal, as sized on the Drawings or required by PDI. Install per manufacturer's instructions.

2.12 AUTOMATIC TRAP PRIMERS

- A. Provide Precision Plumbing Products, J.R. Smith, Mifab or Sloan as specified on the Drawings. Install per manufacturer's instructions.

2.13 PLUMBING FIXTURES

- A. Fixture locations, quantities, types, sizes and connections shall be as shown on both the Plumbing and Architectural Drawings. If a conflict in fixture location is noted between the Plumbing and Architectural Drawings, the Architectural Drawings shall take precedence.
- B. Fixtures shall be thoroughly protected against damage to the chrome plate or enamel, by chipping, scratching or other damage during the entire period of construction. Roof drains, floor sinks and drains, toilet and sink drains, plumbing vents, and all other similar fixtures shall be covered to prevent trash from entering the pipes until final installation of grates, domes, fixtures or other protective devices.
- C. Provide fixtures as specified in the Plumbing Schedule. American Standard, Crane, Elkay, Kohler, or Zurn are acceptable substitutes provided they are equal if approved by Engineer.
- D. Fixture carrier numbers listed are as specified on the Plumbing Schedule; however, carriers as manufactured by J.R. Smith, Mifab, Wade, or Zurn are acceptable provided they are equal.

2.14 CONNECTORS

- A. Provide Brass Craft "Speedway" or equal heavy pattern iron pipe size brass stops, rigid or flexible supplies and chrome plated brass "P" traps. Stops in "Public" areas to have screwdriver slots and those in "Private" areas to have all cross handles.
- B. Provide Brass Craft or equal flexible stainless steel braided water supplies to appliances. They may also be used to fixtures as an option to rigid supplies. Aquaflo is an acceptable substitute.
- C. Provide Brass Craft flexible or equal, stainless steel gas appliance connectors. Dormont is an acceptable substitute.

2.15 ACCESS BOXES

- A. See section 21 0000 for access panels.

2.16 PRESSURE GAGES AND THERMOMETERS

- A. Provide Marsh Quality gages or equal with 3-1/2" dial, gage cock, in type required. For pump suction, provide compound type.
- B. Provide Trerice 7" BX or 3" Bimetal Dial series thermometers or equal, straight, angle, or oblique as required, equipped with separable sockets and well. Provide extension necks as required on insulated line.
- C. Arrange gages and thermometers for easy reading.

2.17 PRESSURE REGULATORS AND BACKFLOW PREVENTORS

- A. Provide the pressure regulator(s) and backflow preventor(s) as specified on the drawings and/or as required by the governmental authority having jurisdiction.
- B. Pressure regulators and/or backflow preventors by Febco, Hersey, Watts or Wilkins are considered equal when their pressure fall-off/loss is equal to or less than the specified regulators/preventor's loss for the given flow rate.
- C. Provide all potable water outlets with hose attachments with non-removable hose bibb backflow preventors per the C.P.C.

2.18 WATER HEATERS

- A. Provide water heaters as specified in Plumbing Schedule or approved equal of size, capacity, recovery, and KW/BTUH input. American, A.O. Smith and State are considered equal. Heater shall be A.G.A. or U.L. listed.
 - 1. Heater storage tank shall be provided with magnesium anodes, approved standard pressure/temperature relief valve and all standard factory trim.
 - 2. Gas heaters shall be provided with an A.G.A. approved 100% safety shut-off.
 - 3. Provide approved flexible copper supplies for the water heater water connections.
 - 4. Instantaneous tankless water heaters shall be with water flow activated switch to energize the electrical/gas power source, a safety high water temperature limit, and all standard factory trim.
- B. Provide a Smitty Co., Benjamin Co. with 1" drain outlet or equal, water heater pan as specified in the Water Heater Schedule.

2.19 PRESSURE-TEMPERATURE RELIEF VALVE

- A. Pressure-temperature relief valve shall be Wilkins TP220, or TP3000 Series or equal.

2.20 EXPANSION TANK

- A. Expansion tank shall be Wilkins WXTP series as specified on the Drawings or approved equal in size and capacity. Amtrol and Watts expansion tanks are considered equal.

2.21 WATER HEATER SEISMIC RESTRAINTS

- A. Seismic restraints shall be Spacemaker restraint system Model E-50 or E-100 as applicable for the water heater specified. Spacemaker Model #TSE-25 or Seismik Model #SR-2 may be substituted when first approved by the Engineer.

2.22 PROTECTIVE INSULATION (ADA FIXTURES)

- A. Provide approved manufactured, molded antimicrobial vinyl protective pipe and fitting covering for exposed waste and drain assembly and for hot and cold water supplies and stops. Protective system shall consist of pre-formed pipe or tubing sleeve and pre-formed fitting patterns for trap and stops. Assembly shall have integral snap fasteners.

- B. Provide protective covering for off-set drain assembly and disposer at kitchen sinks.
- C. Foam pipe wrap, duct tape, baggy-type covers, tie-strap fasteners are not acceptable.
- D. Acceptable manufacturers:
 - 1. Truebro "Lav-Guard"
 - 2. Plumberex "Pro-Xtreme"

2.23 INSULATION

- A. All pipe insulation shall conform to Section 123 of the California Energy Efficiency Standards except to the extent that this Specification supersedes the minimum standards as established by the Code, in which case this Specification shall take precedent. Outside insulation shall be protected with a hard plastic or metal shell covering.
- B. Domestic cold water piping shall be insulated with a minimum 1" insulation in unheated areas of the building and where exposed outside of the building.
- C. Domestic hot water piping shall be insulated with Owens-Corning Fiberglass heavy density pipe insulation 25 ASJ/SSL-II (All Service Jacket/Double/ Self-Sealing Lap). Insulation shall be UL rated non-combustible pipe insulation with a k factor of 0.24-0.28 @ 100 degrees F. mean temperature, an embossed vapor barrier laminated and pressure sealing lap adhesive. All lap and butt strips shall have integral pressure-sensitive strips and shall be applied in strict accordance with manufacturer's instructions.
 - 1. Closed cell polyethylene foam by IMCOA or equal may be used at Contractor's option provided it meets the above requirements.
- D. Insulation thickness' shown below are based on insulation having a conductivity range of 0.24 to 0.28 per BTU/inch per hour per square foot per °F temperature of 100 degrees F.
 - 1. Temperature Range: Above 105°F

Pipe Size	Minimum Insulation Thickness
Runouts* up to 2"	0.5"
1" and less	1.0"
1.25" to 2"	1.0"
2.5" to 4"	1.5"
5" and larger	1.5"

*Runouts are defined as being less than 2" in diameter, less than 12 feet long, and connected to fixtures or individual terminal units.

- E. Insulation materials not meeting the specified conductivity range shall be submitted for approval and determination of the insulation thickness required.

PART 3 - EXECUTION

3.1 GENERAL CONDITIONS

- A. Examine the areas and conditions under which Work of this Section will be performed. Conditions detrimental to timely and proper completion of the Work

shall be brought to the attention of the Architect before the installation of materials. Do not proceed until unsatisfactory conditions are corrected. Incorrectly installed materials requiring changes will be at Contractor's expense.

- B. All plumbing fixtures, appliances, and appurtenances furnished with manufacturer's installation instructions shall be installed per those instructions.

3.2 PLUMBING SYSTEM LAYOUT

- A. Lay out the plumbing system in careful coordination with the Drawings. Determine proper elevations for all components of the system and use only the minimum number of bends to produce a satisfactorily functioning system.
- B. Follow the general layout shown on the Drawings in all cases except where other Work may interfere.
- C. Lay out pipes to fall within partitions, walls, or roof cavities, and to not require furring other than as shown on the Drawings.

3.3 PIPING INSTALLATION

- A. Pipe sizes as shown on drawings are Nominal Pipe Size (NPS) or Iron Pipe Size (IPS). Drawings and fixture schedule indicate pipe sizing per the CPC and Standard Engineering Practice. Pipe sizes shall be maintained to fixtures, appliances and equipment. Approved reducing fittings shall be installed at all points of connections.
- B. Install piping generally square with building, free of traps or air pockets, and true to line and grade. Keep all piping tight to the building structure, unless pipe slope is required. Do not install piping in any locations where, in the Architect's opinion, it will interfere with the use of the building or create a safety hazard. Where space is inadequate, notify the Architect in time to avoid unnecessary Work. Install all exposed piping as high as possible without interfering with other trades.
- C. Make changes in direction with manufactured fittings; use long radius elbows. Street elbows, bushings, close nipples and bending of pipe or tubing will not be allowed.
- D. Provide "P" traps at sanitary sewer drainage devices without integral traps.
- E. All natural gas piping under structures or concrete slabs will be installed in a protective vent sleeve. Sleeves under a building will be vented to outside the building per detail on Plans. Sleeves under concrete slabs will extend a minimum of 1 foot beyond the slab. All sleeves will be sloped 1/8" per foot up toward the vented end. The vent end of sleeves under slabs will terminate under a landscaped or asphalted area.
- F. Gas piping shall be tapped off the top or side of pipe and ends of mains shall be provided with dirt legs.
- G. Underground plastic pipe will horizontally transition to metal pipe 5 feet before the above ground riser. Install plastic pipe with a minimum of 36" of cover when located under areas of possible vehicle traffic. Approved metallic pipe must be used if the minimum depth is not met. A tracer wire, terminating at each end at an exposed location, will be installed with all underground plastic pipe. Gas piping will also have a continuous tape marked "Gas" laid 6" above it.

1. Piping may terminate a maximum of one foot above ground when encased in a listed metallic transition riser.
- H. Use friction wrenches when installing brass, polished, or soft metal piping, and when installing piping exposed in finished areas. Replace piping showing wrench marks.
- I. Attach escutcheon plates to pipes with set screws or spring clamps with concealed hinges. Continue insulation through escutcheon plates.
- J. Compressed air piping shall be adequately supported in a manner that eliminates all sags and bowing of the line. All horizontal runs shall be straight and sloped at 1% to the indicated drain. All branch or individual drop lines shall be taken off the top of their supply line.
- K. General:
1. Proceed as rapidly as the building construction will permit.
 2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
 3. Cut pipe accurately, and work into place without springing or forcing, properly clearing windows, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.
 4. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
 5. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings.
 6. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment. Support the equipment independently from the pipe.
 7. Pipe the drains from mechanical equipment, drip pans, relief valves, air vents and similar locations, to an open sight drain, floor drain, or other acceptable discharge point, and terminate with an air break or air gap per C.P.C.
 8. Securely bolt all equipment, isolators, hangers, and similar items in place.

3.4 PIPE SUPPORT INSTALLATION

- A. Support pipes from structure with assemblies specified. Provide auxiliary members, anchors, guides, and sway braces necessary to maintain pipe alignment and prevent excessive movement or strain on piping system or components; allow for expansion and contraction of piping. Provide at least one hanger for each branch. Do not use powder driven fasteners, wire, perforated tape, nails, wood blocking, or other makeshift devices to support pipe.
- B. Attach supports to structure with bolts, screws or concrete anchors, per support manufacturer's requirements.

3.5 JOINTS AND CONNECTIONS

- A. Cut pipe shall be reamed to full inside diameter of pipe. Cut threads straight and true. Insure all filings have been removed from inside of the pipe. Apply liquid Teflon to male pipe threads and not inside fittings. Use graphite on cleanout plug threads.
- B. Joints in cast iron "No-Hub" soil/waste pipe and fittings shall be made up with neoprene gaskets and stainless steel bands conforming to CISPI 310, torque to the manufacturer's specification with an approved torque wrench. Joints in hub and spigot shall be made up with compression gaskets conforming to ASTM C-564.
- C. Joints in copper tube shall be made with 95-5 tin-antimony or lead-free solder, applied in strict accordance with the manufacturer's directions.
- D. Dissimilar metals shall be isolated with dielectric couplings, "EPCO" or approved equal. Provide access panels at all hidden couplings.
- E. All plastic pipe shall be joined in accordance with the manufacturer's recommendations for their pipe and IAPMO Installation Standard per the latest edition of the C.P.C.
- F. Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- G. Pipe Protection: Provide protection against abrasion where copper tubing is in contact with other building members by wrapping with an approved tape, pipe insulation or otherwise suitable method of isolation.
- H. Penetration Protection: Provide allowance for thermal expansion and contraction of copper tubing passing through a wall, floor, ceiling or partition by wrapping with an approved tape or pipe insulation, or by installing through an appropriately sized sleeve. Penetrations of fire resistance rated assemblies shall maintain the rating of the assembly

3.6 SANITARY SEWER, VENT AND INDIRECT WASTE SYSTEM INSTALLATION

- A. Install horizontal drainage piping at a minimum 2%, condensate 1%, slope unless otherwise noted. Where this is impractical notify the Architect before installing the pipes.
- B. Install vent piping to drain back into the sewer system.
- C. Provide cleanouts where shown on Drawings and where required by governmental agencies having jurisdiction.
 - 1. All cleanouts to grade shall be firmly secured by means of a concrete block 20" square by 5" thick, and shall be flush with finished grade, unless otherwise noted on the plans.
- D. Provide automatic trap primers as specified at floor sinks and drains as indicated on Drawings or where required by governmental agencies having jurisdiction. Provide access panels for all hidden mechanical trap primers.

3.7 VALVE INSTALLATION

- A. Provide valves in the water, air, and gas systems. Locate and arrange so as to give a complete regulation of apparatus, equipment, and fixtures.
- B. Provide valves in at least the following locations:
 - 1. In branches and/or headers of water piping serving a group of fixtures.
 - 2. On both sides of apparatus and equipment.
 - 3. For shutoff of risers and branch mains.
 - 4. For flushing and sterilizing the system.
 - 5. Where shown on the Drawings.
- C. Locate valves for easy accessibility and maintenance. Provide access panels for all hidden valves.
- D. Unions shall be installed downstream of all screwed valves.
- E. All gas pressure regulating valves shall be vented to the atmosphere.

3.8 WATER HAMMER ARRESTOR INSTALLATION

- A. Provide water hammer arrestor on hot and cold water lines.
 - 1. Install at all quick closing valves, solenoids, and supply headers at plumbing fixture groups.
 - 2. Locate and size as shown on Drawings, and where not shown, locate in accordance with Plumbing and Drainage Institute Standard WH-201.
 - 3. Install water hammer arrestor behind access panels.

3.9 BACKFLOW PREVENTION INSTALLATION

- A. Protect plumbing fixtures, faucets, hose connections, and other equipment having plumbing connection, against possible back-siphonage.
- B. Arrange for testing of backflow devices as required by the governmental agencies having jurisdiction.

3.10 PLUMBING FIXTURE INSTALLATION

- A. Connect plumbing services to fixtures as shown on Drawings and as specified.
- B. Install compression stops and flexible supplies per fixture manufacturer's recommendation or as high as possible on wall directly below fixtures.
- C. Install fixtures at right angles to, and tightly against, building surfaces, and in proper alignment. Fill gaps between fixtures and building surfaces with white grout. Mounting heights and locations shall be as shown on the Drawings, or, if not shown, as directed by the Architect.

3.11 INSULATION INSTALLATION

- A. Clean and dry surfaces prior to application of insulation or adhesives.
- B. Insulate piping, fittings, valves, and strainers. Leave unions exposed. Where insulation terminates, bevel ends of insulation and continue jacket over insulation

and secure to pipe. Do not interrupt insulation at hangers, supports, clamps, or penetrations through structure. Fittings shall be finished with "Zeston" or approved equal fitting closures. If fitting closures not available, use 8 oz. canvas dipped in "Seal-Fas".

- C. Attach longitudinal jacket laps and butt strips with factory applied pressure sensitive adhesive. On concealed piping only, outward clinching coated staples at two inch spacing may be used. Cover elbows with one piece polyvinyl chloride covers. Secure with tack fasteners. Tape ends of covers with matching tape on exposed piping. Seal off all cut ends with canvas and Benjamin Foster 30-36.
- D. Install closed cell polyethylene foam per manufacturer's instructions.

3.12 TESTING AND ADJUSTING

- A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction. See Section 21 0000 for test requirements.
- B. Where tests show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.
- C. Adjust the system to optimum standards of operation.

3.13 CLEANING (For potable water systems.)

- A. Disinfection: The copper hot and cold water distribution system shall be disinfected prior to being placed in service. The system shall be disinfected in accordance with AWWA C651 or the following requirements:
 - 1. The piping system shall be flushed with potable water until discolored water does not appear at any of the outlets.
 - 2. The system shall be filled with a water chlorine solution containing at least 50 parts per million of chlorine. The system shall be valved off and allowed to stand for 24 hours. Or, the system shall be filled with a water chlorine solution containing at least 200 parts per million of chlorine. The system shall be valved off and allowed to stand for 3 hours.
 - 3. Following the standing time, the system shall be flushed with water until the chlorine is purged from the system.

3.14 WARRANTY

- A. The contractor shall warranty all of the systems for proper operation installed by the contractor for not less than one calendar year from date of project completion. This completion date shall be set by the Architect or owner.

END OF SECTION 22 0000

SECTION 23 0000
HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Related Documents:

1. The other Contract Documents complement the requirements of this Section and apply to this Section.
2. Division 1 - General Requirements and Section 23 0013 apply to the Work of this Section.
3. Where requirements of the Section exceed those in other Contract Documents, Contractor shall comply with the requirements of this Section.

B. Codes and Regulations:

1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
2. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirements will govern when so directed by the Architect.

C. Included: Work includes, but is not necessarily limited to, the following.

1. The Work covered by this Specification shall include furnishing labor, material, equipment and services to construct, install and place in operation, the complete Heating, Ventilating and Air Conditioning Systems to the extent as indicated, and as shown on the Drawings and specified herein. The Work covered under this Section shall hereinafter be referred to as the Mechanical System.
2. A system of temperature controls shall be furnished and installed complete as hereinafter described. Low voltage wiring and conduit, complete with electrical accessories and materials as required for the installation of the temperature control system shall be furnished and installed under this Section of the Contract, but shall conform to the Specification requirements as set forth under Division 26.
3. Roof Top Evaporative Cooling Units
4. Radiant Heaters
5. Centrifugal Exhaust Fans and Roof Exhausters
6. Supply, return, and exhaust duct systems complete with grilles, registers and diffusers.
7. Duct, Pipe and Equipment Insulation
8. Space Temperature Controls

D. Work Not Included In This Section:

1. Blocking, framing and wood supports required for the purpose of accommodating the Mechanical System unless specifically called for under this Division. The contractor is responsible for the correct location of such

items and shall bear the expenses covering their omission or improper location.

2. Electrical connections to motors, electric starters, disconnect and over-current protective devices, unless specifically called for by this Section, or unless the equipment is furnished as an integral part of the Mechanical System Equipment, as hereinafter specified or noted on the Drawings.
3. Line voltage electrical wiring and conduit, except where specifically called for on the Drawings or hereinafter in this Section.
4. Painting, except when supplied as factory finish, or specifically called for in this Section or on Drawings.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

1.3 SUBMITTALS

- A. If the heating and/or air conditioning units are substituted with a different brand than that specified on the Drawings the Title 24 Calculation may have to be re-run. This re-calculation will cost \$500.00 payable in advance to 3C Engineering, Inc. If the revision is required by the local Building Department to verify the Title 24 Report still complies as originally run.
- B. Comply with pertinent provisions of Architectural Section.
- C. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit 6 copies of the following to the Architect for approval prior to acquisition:
 1. Materials list of items proposed to be provided under this Section including, but not limited to heating, ventilating and air conditioning equipment and mountings, air distribution equipment, ductwork and fittings, flexible ductwork, flue vent pipe, duct specialties, flexible connections, insulation, lining and adhesive, duct joint sealer, temperature controls, piping and accessories.
 2. Manufacturer's specifications, catalog cuts, and other data needed to prove compliance with the specified requirements. All pieces of equipment shall be clearly identified on corresponding manufacturer's literature being submitted.
 3. Shop Drawings or other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
 4. Submittals for entire Project shall be submitted at the same time or may be rejected until all are included in one submittal package.
 5. Submittals shall be submitted in PDF format.

- 1.4 DESIGN CHANGES CAUSED BY PRODUCT SUBSTITUTIONS
 - A. Contractor shall pay costs of design and installation for changes resulting from substitution of alternate products.
 - B. Acceptance of alternate products by Architect does not change this requirement.
- 1.5 PRODUCT HANDLING
 - A. Comply with pertinent provisions of Architectural Sections.

PART 2 - PRODUCTS

- 2.1 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT
 - A. Heating, Ventilating, and Air Conditioning Equipment: Equipment shall be as specified on the Drawings. All other equipment shall be pre-approved by the Mechanical Engineer.
 - B. It shall be the responsibility of the Contractor to see that any substituted equipment performs similarly to that which is specified and fits in the same area as specified. Cost of any additional Work caused by the substitution of equipment shall be borne by the Contractor.
- 2.2 AIR DISTRIBUTION EQUIPMENT
 - A. Grilles, registers and ceiling diffusers and other accessory equipment shown on the Drawings and "Grille, Register and Diffuser Schedule" shall be manufactured by Titus unless shown otherwise.
 - B. Any substitutions of the above equipment which may be proposed by the Contractor shall be re-sized to suit his equipment by the proposed manufacturer and submitted in tabular form listing components proposed for each location in the System, identifying each as to location, design, air quantity passing through the devices, pressure drop, noise criteria data, velocities of air leaving the device and "K" flow factors for each item. Manufacturer's data sheets showing dimensions and recommended method of installation for each component must also be included.
- 2.3 LOUVERS
 - A. 4" deep louvers, Greenheck, Model ESJ-401, or approved equal. Deflection blades shall be spaced on 4" centers having 1/2" high vertical baffle and an additional lateral center rain hood. The edges of louver blades shall be folded or beaded to exclude driving rain. Louvers blades shall be oriented to minimize the entrainment of rainwater. Louver blades, heads, sills, jambs, braces and mullions shall be made of aluminum. Louvers shall be provided with flanges.
 - B. Provide 1/2" aluminum bird screen on outside air intake louvers and 1/4" aluminum insect screen on combustion air louvers.
- 2.4 RECTANGULAR SHEET METAL DUCTWORK
 - A. Rectangular supply, return, outside air and exhaust ducts, single leaf dampers and plenums shall be fabricated from prime grade galvanized steel sheets of lock form quality and shall be constructed in accordance with appropriate tables of the latest ASHRAE "Guide and Data Book" and SMACNA "HVAC Duct Construction Standards" handbook and Chapter 6 of the 2016 CMC.
 - B. Transverse Duct Joints shall be made with The Ductmate System. When using The Ductmate System, construction of the duct such as gage, reinforcing, etc. shall be as indicated in the latest addition of the applicable SMACNA standards. With proper data, an equal may be submitted, providing the corners have a downset and corner clips to insure airtight integrity. Testing must be done by a nationally recognized testing laboratory. The standard Ductmate 35 System joint is the

equivalent of a SMACNA "J" connection. The Ductmate 25 System joint is the equivalent of a SMACNA "F" connection. The installation of the Ductmate System shall be in accordance with the latest manufacturer's printed Assembly and Installation Instructions.

- C. Each duct or plenum shall be diagonally cross-broken for rigidity.
- D. Duct bends, fittings, transitions, etc. shall be fabricated in accordance with Fabrication Standards as shown on the Drawings or in accordance with latest SMACNA "HVAC Duct Construction Standards" where not shown on Drawings.
- E. Support ducts to joists or similar structural members. Except where indicated otherwise, ducts with a side of 24" or more shall be supported on Ductmate trapeze duct hangers consisting of 2" high x 1-1/2" wide x 18" gauge channel and 3/8" diameter hanger rods hung from support brackets bolted to structural members. See also Special Fabrications as shown on the Drawings. Duct supports shall be eight (8) feet maximum on center.
- F. At branch ducts, provide manually operated dampers of the type and arrangement shown on the Drawings, two gages heavier than the duct (if single leaf type) in which installed, and equipped with locking quadrants and closed end bearings.
- G. Sizes shown on Drawings are net inside dimensions. Enlarge duct to accommodate lining.

2.5 ROUND DUCTWORK AND FITTINGS

- A. 2-10" w.g. round duct through 61" in diameter shall be United Sheet Metal spiral lockseam unseal duct, or approved equal, manufactured from galvanized steel meeting the ASTM A-527-71 in the following gages:

Diameter	Metal Thickness
3-13"	26 ga.
14-23"	24 ga.
- B. Round duct shall be new and exclusively obtained for this project. Each piece shall be in 20' lengths. Ducts shall be cut to length required with joints only at fitting locations, except on duct runs longer than 20 feet.
- C. Spiral duct and fitting connections, 15" diameter and larger shall be Ductmate Spiralmate round duct connectors. The connector system shall consist of two mating round duct connector flanges roll-formed from hot dipped galvanized steel with an integral sealant and closure ring roll-formed from hot dipped galvanized steel.
- D. Fittings shall be United Sheet Metal galvanized fittings in the following gauges:

Diameter	Metal Thickness
3-13"	24 ga.
14-23"	22 ga.
- E. Spiral duct fittings must be manufactured as separated fittings and shall not be saddle taps, stubs or tap-in fittings tapped into spiral duct, nor may they be dove-tailed tap-ins into pipe or fittings.
- F. Reducers shall occur after a branch tap occurs on the main portion of the fitting. Divided-flow fittings shall be used unless shown otherwise on the Drawings.
- G. Joints on ducts and fittings shall be covered and sealed with 4" wide, 6 oz. canvas saturated with Arabol lagging adhesive, or Hardcast DT tape in conjunction with Hardcast FTA-20, non flammable, non-toxic adhesive, or GlenKote duct sealer or other approved mastic type sealer. Duct tape will not be allowed. Where exposed to weather, paint lagging strips with two coats of silver enamel paint.
- H. All ductwork shall be constructed in accordance with appropriate tables of the latest ASHRAE "Guide and Data Book" and SMACNA "HVAC Duct Construction

Standards" handbook and Chapter 6 of the 2016 CMC. Duct gauges to be in accordance with 2.6.A and 2.6.D of this section.

- I. At branch ducts, provide manually operated dampers of the type and arrangement shown on the Drawings, two gages heavier than the duct (if single leaf type) in which installed and equipped with locking quadrants and closed end bearings.

2.6 DUCT SPECIALTIES

- A. Damper Regulators and Bearings: Duro-Dyne "Specline" SR-Series or approved equal, lever type with matching end bearing. Regulator set shall include rubber gasket between regulator and duct, spring washer between core and housing, wedge pin, dial indicator and handle. Matching end bearing shall be closed end with rubber gasket:

Model	Size
148	10" and Under
388	20" and Under

- B. Access Panels: Access panels shall be located at all points where adjustable mechanisms are installed internal to or on the surfaces of the ductwork. Where adjustable mechanisms are concealed by walls or ceilings, "Elmdor" or approved equal access doors shall be installed. Size shall be suitable for convenient servicing. Tile Walls: Doors and Frame: Stainless Steel. Other areas: recess type to receive ceiling or wall finish in order to provide "Blind Finish".
- C. Volume Dampers:
 1. In rectangular ducts greater than 1.5 sq. ft., provide Pottorff Model CD42, or equal, factory fabricated opposed blade damper, 16 gauge blades, and brass bearings. Blade width shall not exceed six inches.
 2. In rectangular ducts 1.5 sq. ft. and less, provide single leaf dampers as described in Section 230000, 2.3 (a. and g.).
 3. In round ducts 15" in diameter and less, provide shop fabricated galvanized sheet metal plate dampers. Plate shall be 18 gauge or shall be two even gauges heavier than duct; minimum thickness 22 gauge. Provide stiffening beads at 1/3 points in dampers lighter than 18 gauge.
 4. In round ducts 16" and greater, provide Pottorff opposed blade damper Model CD22R or approved equal.
 5. In round ducts 4" – 24" in diameter, above "hard" ceilings, provide DuroZone Cable Operated Damper. Cable length to be between 3 and 15 FT long. Contractor to determine proper length to be use.
- D. Provide 20 gauge galvanized sheet metal escutcheon plates at duct penetrations of finished building surfaces. Install tight against surface and securely attached to duct. Continue insulation through openings.
- E. Duct Mounted Access Doors:
 1. In rectangular duct provide, DuroDyne Model IAD, Ductmate "Sandwich", or equal, insulated, duct mounted access doors with Cam-Lock operated latches where shown on drawings or required for access to duct mounted equipment. Doorframe shall be 24-gauge with double wall door and 1/2" glass fiber insulation. Size doors to provide easy access to equipment.

2. In round ducts, provide Ductmate - METU round duct access doors, fully insulated, with attached gasket and springs between inner and outer door. Access doors shall be as large as practical as duct size will allow.

2.7 FLEXIBLE CONNECTIONS

- A. Provide fireproof, insulated, non-porous, flexible connections between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connections by zinc coated steel clinch-type drawbands. Flexible connections shall be DuroDyne "Insulfab" or "Insulflex" or approved equal.
- B. Provide a duct support next to each flex connector to prevent any strain on connection.

2.8 ELECTRICAL EQUIPMENT

- A. Motor starters shall be provided complete with properly sized thermal overload protection and other appurtenances necessary for motor control specified. Mount starter adjacent to equipment. See electrical drawing. Maintain minimum of 3' clearance to front of device.
- B. Motor Starters: Shall be NEMA I or III as appropriate, general purpose, weather-resistant, with watertight enclosure where required.

2.9 INSULATION

- A. General: Insulation and lining material shall meet requirements of flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by Procedure ASTM-E-84, NFPA 255 or U.L. 723 and shall conform to NFPA 90A and 90B.
- B. Heating and cooling duct and related heating and cooling equipment insulation shall conform to 2015 Building Energy Efficiency Standards, Administrative Regulations, Title 24, Part I, Section 124, except to the extent that this Specification supersedes the minimum standards as established by the Code, in which case this Specification shall take precedent.
- C. Unless noted otherwise, insulation shall be Fiberglass, or approved equal material. Application Work shall be performed in accordance with the best accepted practice of the trade and the manufacturer's recommendations. The performance of insulation Work shall be by experienced insulation applicators. Insulation shall be installed after the specified tests have been applied to the piping and duct systems, and the systems have been inspected and approved. Fiberglass trade names and/or numbers have been used to establish a standard of quality.
- D. External Duct Insulation – Outdoors, in a space between the roof and an insulated ceiling, in a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces, in an unconditioned crawlspace; or other unconditional spaces: Shall be applied to concealed heating and cooling, supply and return duct except duct that is internally lined. Insulation on duct shall be Manville Microlite FSK duct insulation, 3" thick, minimum installed R value of 8.0 or greater, FSK aluminum foil reinforced with fiberglass, scrim laminated to U.L. rated Kraft, or approved equal. Adhere to duct surfaces with Foster's 85-62 or approved equal, adhesive applied in strips of 6" wide on approximately 12" centers. Circumferential seams shall be butted together and sealed over joints with 3" wide pressure sensitive foil vapor barrier tape. Longitudinal edges shall be lapped 2" and secured with outward clinching staple 6" on center then sealed with pressure sensitive foil vapor barrier tape. Duct wrap shall be installed to allow maximum fullness at corners (avoid excessive compression) minimum thickness at corners shall be 1". Where ducts are over 24" in width, the duct wrap shall be additionally secured to

- the bottom of the rectangular ducts with mechanical fasteners spaced on 18" centers (Max.) to prevent sagging insulation.
- E. External Duct Insulation – All other locations not listed above: Shall be applied to concealed heating and cooling, supply and return duct except duct that is internally lined. Insulation on duct shall be Manville Microlite FSK duct insulation, 2" thick, type 100, minimum installed R value of 6.0 or greater, FSK aluminum foil reinforced with fiberglass, scrim laminated to U.L. rated Kraft, or approved equal. Adhere to duct surfaces with Foster's 85-62 or approved equal, adhesive applied in strips of 6" wide on approximately 12" centers. Circumferential seams shall be butted together and sealed over joints with 3" wide pressure sensitive foil vapor barrier tape. Longitudinal edges shall be lapped 2" and secured with outward clinching staple 6" on center then sealed with pressure sensitive foil vapor barrier tape. Duct wrap shall be installed to allow maximum fullness at corners (avoid excessive compression) minimum thickness at corners shall be 1". Where ducts are over 24" in width, the duct wrap shall be additionally secured to the bottom of the rectangular ducts with mechanical fasteners spaced on 18" centers (Max.) to prevent sagging insulation
- F. Internal Duct Insulation - Outdoors, in a space between the roof and an insulated ceiling, in a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces, in an unconditioned crawlspace; or other unconditional spaces: Shall be applied to all heating and cooling supply and return duct and plenums on roof or where shown on Drawings. Manufacturer shall be Manville Microlite, or approved equal. Duct Liner shall be Linacoustic R, 2" thick, 1.5 pcf, with a "K" value of 2.2 in. for a total "R" installed value of 8 or greater. Insulation shall withstand velocities of up to 5000 FPM and temperatures up to 250 degrees F.
- G. Internal Duct Insulation – All other spaces not listed above: Shall be applied to all heating and cooling supply and return duct and plenums where shown on Drawings. Manufacturer shall be Manville Microlite, or approved equal. Duct Liner shall be Linacoustic R, 1 ½" thick, 1.5 pcf, with a "K" value of 2.2 in. for a total "R" installed value of 6 or greater. Insulation shall withstand velocities of up to 5000 FPM and temperatures up to 250 degrees F
- H. Portions of duct receiving Duct Liner shall be completed with transverse joints neatly butted with no gaps or interruptions. The duct liner shall be adhered to the sheet metal with 100% coverage of adhesive and exposed leading edges and transverse joints coated with adhesive. Adhesive shall be a water based product. In addition this shall be secured with mechanical fasteners which shall compress the liner sufficiently in place. The liner shall be cut to assure overlapped and compressed longitudinal corner joints. Application procedures shall comply with the recommendations of the Sheet Metal and Air Conditioning Contractor's National Association's Duct Liner Application Standard, Second Edition.
- I. External Duct Insulation Exposed to Weather: Shall be applied to heating and cooling supply and return ducts and plenums exposed to weather if not noted to be internally insulated. Insulation shall be Knauf Type ASJ, or approved equal, rigid board fiberglass, 3.0 # per cubic foot minimum density, 2" min. thickness, 8.0 min. R value. The board shall be neatly cut and fitted to the surface with joints tightly butted together and against standing seams. The insulation shall be secured to the duct with adhesive and mechanical fasteners starting 3" from butt joints and 18" on center each direction. Vapor-barrier tape shall be then applied over joints, seams, breaks and any penetrations of the insulation vapor barrier jacket. A

weather-barrier mastic compound reinforced with fabric or mesh shall be applied as a finish coat. Finish by painting with two (2) coats of aluminum paint.

- J. Ducts: Ducts shall be constructed, installed, sealed and insulated in accordance with the 2010 CMC. Insulation requirements are shown in Table 605 of the CMC. The above paragraph(s) shall supersede if more stringent.

2.10 TEMPERATURE CONTROLS

- A. Temperature controls shall be furnished as indicated in schematic Drawing on Plans including room thermostats, relays and other necessary combustion, operating and safety controls.
- B. Wiring and Conduit
 - 1. Control wiring and conduit shall be the responsibility of this section and be installed as follows:
 - a. All conduits to be rigid galvanized steel with threaded fittings.
- C. Electric wiring, conduit and other electric devices required to complete the installation of the temperature control systems shall comply with requirements as set forth in the Electrical Section of this Specification.
- D. After completion of the installation, the Contractor shall adjust thermostats, motors and other equipment provided under this Contract. He shall place them in complete operating condition subject to approval of the Architect.
- E. The Control System herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of acceptance by the Architect, any of the equipment herein described is proved to be defective in workmanship or material, it will be adjusted, repaired or replaced free of charge by the Contractor.
- F. The final connections and supervision of control wiring and interlock wiring shall be the responsibility of this Contractor.
- G. The Contractor shall submit to the Architect for approval, the required number of shop drawings of the entire control system before starting Work.
- H. Upon completion of the Work, the Contractor will provide diagrammatic layouts of the Automatic Control Systems specified herein. Layouts shall show control equipment and the function of each item shall be indicated.
- I. The temperature control system shall be installed by persons in the direct employment of the temperature controls manufacturer(s) exclusive contracting representative. The Mechanical Contractor shall not install the temperature controls unless pre-approved by the Mechanical Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the Work of those trades for interface with the Work of this Section.

3.3 PREPARATION

- A. Holes in concrete:
 - 1. Provide sleeves, accurately dimensioned and shaped to permit passage of items of this Section.

2. Deliver such sleeves, with accurate setting drawings and setting information, to the trades providing the surfaces through which such items must penetrate, and in a timely manner to assure inclusion in the Work.
- B. Flashing:
1. Where items of this Section penetrate the roof, outer walls, or waterproofing of any kind, provide under this Section base flashing and counterflashing required at such penetration.
 2. Provide on each pipe passing through the roof a 4 pound seamless lead flashing and counterflashing assembly.
- 3.4 GENERAL INSTALLATION REQUIREMENTS
- A. Conceal piping, ductwork, and equipment in spaces provided unless specifically shown otherwise. If spaces are inadequate, notify Architect in time to avoid unnecessary Work. Do not cut or notch structural members without specific approval of the Architect.
 - B. Follow manufacturer's instructions on items not specifically covered in drawings and specifications. Report discrepancies to Architect for clarification before starting Work.
- 3.5 EQUIPMENT INTERFACE
- A. Provide required shut off valves, unions, and final connections of piping to the Work of this Section.
 - B. For electrically operated equipment, verify the electrical characteristics actually available for the Work of this Section and provide equipment meeting those characteristics.
- 3.6 PAINTING
- A. Paint inside of air outlets and connecting plenums with one coat of flat black paint, or provide all such items factory prepainted.
 - B. For roof-mounted equipment, provide factory pre-finish on exposed surfaces.
 - C. Touch-up scratches and abrasions to be invisible to the unaided eye from a distance of 5 feet.
- 3.7 INSTALLATION OF DUCTWORK
- A. Ductwork shall be delivered to the Project site with surfaces clean and free of loose dirt and rust. Special care shall be exercised by the Contractor to store the duct in a clean area to prevent the accumulation of dirt prior to installation. Fabricated or partially fabricated duct sections shall not be stored in open fields or on dirt areas surrounding the construction site. Paved areas may be used, if available, provided adequate protection is provided to prevent the accumulation of dirt on duct surfaces. If possible, the Contractor should arrange to deliver duct to the project site and store on the floor of the area in which it is to be installed.
 - B. Before installation of ductwork, the Contractor shall inspect each section of duct and wipe internal surfaces clean. At the end of each Work period, or when ends of duct are left installed for future extension, the open ends shall be tightly closed off with a plastic sheet and taped securely to the open end of the duct.
 - C. Construct and install sheet metal in accordance with latest SMACNA recommendations. Provide variations in duct size and additional duct fittings as required and approved by the Architect at no extra cost to the owner.
 - D. The throat radius of bends shall be 1-1/2 times the width of the duct. Provide turning vanes in any mitered turn greater than 45 degrees.

- E. Transition slopes shall be no less than one to five where space permits.
- F. Abrupt offsets in the duct system greater than 30 degrees will not be allowed.

3.8 TEMPERATURE CONTROL INSTALLATION

- A. Install wiring and tubing parallel to walls and floors and securely clipped to structure or mechanical system components. Group parallel runs for neat appearance.
- B. Install room thermostats and other control devices at 48 inches above finished floor unless a lower mounting height is required for access by handicapped. Or at the heights called for on the plans.
- C. Install outside air sensor in a location where it is not directly effected by radiation from the sun or any heat generating device or by a conditioned air stream or any other location that would produce a false reading.
- D. Upon completion of the installation calibrate all equipment and adjust controls for proper operation.

3.9 WARRANTY

- A. The contractor shall warranty all of the systems for proper operation installed by the contractor for not less than one calendar year from date of project completion. This completion date shall be set by the Architect or owner.

3.10 SHOP DRAWINGS

- A. The Contractor shall prepare shop drawings covering duct systems, equipment and Mechanical Room piping systems. The drawings shall be prepared in 3/8" scale and shall be submitted to the Architect for approval prior to any fabrication. In preparing the shop drawings, the Contractor shall coordinate the location of duct, piping and equipment with the Work of other trades.

3.11 MECHANICAL SYSTEM START-UP RESPONSIBILITY

- A. Start up Mechanical Systems, and perform any such Work as may be required to adjust the systems to meet the requirements of the Contract Documents. Air distribution balancing shall be performed in accordance with Article "MECHANICAL SYSTEMS BALANCING".
- B. Install new clean specified filters in equipment containing filters immediately prior to owner occupancy. Contractor to bear all costs for this work.

3.12 MECHANICAL SYSTEMS BALANCING

- A. Testing and air balancing shall be performed by an independent balancing company certified by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Testing and balancing shall be performed by a company other than the mechanical system installers/contractor. The name of the firm that the Contractor proposes to engage to perform this Work of balancing the system shall be submitted to the Engineer for approval prior to commencing the Work.
- B. Conduct tests in presence of Architect/Engineer.
- C. After Systems have been tested as outlined, air and water flow rates shall be balanced, and control devices adjusted. Balance and testing shall not begin until systems have been completed and are in full working order. Upon completion of the balancing operation and prior to final acceptance of the systems, the balancing firm shall submit a report, with six (6) copies, certifying to the proper performance of the system for approval by the Mechanical Engineer.
 - 1. The following information shall be included in the Air Side Report:
 - a. Fan speeds.

- b. Motor current readings and voltage readings.
- c. Air quantities in CFM at supply, return, exhaust terminals, and outside air intakes, both at design value and actual measured value. Test and adjust each terminal to within +10% of design requirements.
- d. Air velocities in FPM at supply, return, and exhaust terminals at design value and actual measured value.
- e. Positive static pressure, negative and total pressures and total air quantities for each fan system.
- f. Equipment nameplate data.

END OF SECTION 23 0000

SECTION 23 00 13
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Related Documents:
 - 1. The other Contract Documents complement the requirements of this Section.
 - 2. Division 1 - General Requirements applies to the Work of this Section.
 - 3. Where requirements of this Section exceed those in other Contract Documents, Contractor shall comply with the requirements of this Section.
- B. Codes and Regulations:
 - 1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
- C. Included: Work includes, but is not limited to the following:
 - 1. Heating, Ventilating, Air Conditioning and System Balancing
 - 2. Plumbing
 - 3. Carpentry and metal Work required for Work of this Section and not specifically shown under another Section. Openings in concrete or masonry construction shall be either core drilled or saw cut unless indicated otherwise on Drawings.
 - 4. Excavation and Backfill
 - 5. Coordination Drawings
- D. Related Work:
 - 1. Cutting and Patching (Division 30)
 - 2. Electrical (Division 26)
 - 3. Low voltage electrical control (Division 26)

1.2 DEFINITIONS

- A. Furnish: Purchase and deliver to job site in new condition.
- B. Install: Receive and store at job site until required; place secure and connect; furnish required appurtenances.
- C. Provide: Furnish and install as defined above.
- D. Section: Refers to a Section of these Specifications.
- E. Standards: The issue in effect as of the date of the contract documents.

1.3 PROJECT RECORD DRAWINGS

- A. Comply with pertinent provisions of Architectural Sections (Division 01).

1.4 SERVICE INTERRUPTIONS

- A. When Work of this Section requires temporary shutdown of existing systems for connections, the shutdown shall be made only during pre-arranged time agreeable to the Owner.

1.5 CORRELATION, INTERPRETATION AND INTENT OF CONTRACT DOCUMENTS

- A. The Mechanical Drawings are, in general, made to scale and the Contractor may obtain approximate distances and dimensions by scaling the Plans. It is distinctly understood, however, that it is done entirely at the Contractor's responsibility. Refer to Architect's Plans and Specifications for construction details, which will affect the Work and equipment. Examine the Architectural, Civil, Structural, Mechanical, Electrical, Landscape, Irrigation, Data, Fire Protection and Plumbing Plans and Specifications to ensure that this work does not conflict with the above trades. Plumbing, Mechanical and Electrical Plans are diagrammatic and, therefore, do not necessarily represent the exact installation. However, pipe sizing for utility services and ductwork are calculated per their respective codes and Standard Engineering Practice and shall be installed as sized from point of origin to terminal point. It shall remain the Contractor's responsibility to submit Shop Drawings if he/she has any questions about the final arrangement. Nothing on these Plans or Specifications shall be construed to permit work not conforming to all applicable codes and regulations.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. If not called for under other Sections, furnish Milcor, Elmdor, or Jay R. Smith access panels where shown on the Drawings or required for maintenance access to completed Work of this Section. Submit size, type, and location of proposed access panels not specifically shown, for review by Architect.
- B. Access panels shall be constructed of 16 gauge prime coated steel or stainless steel with screwdriver operated cam latch, concealed hinges, and fire rating equal to adjacent construction.
- C. Provide flush type doors with:
 - 1. Stainless steel finish for tiled surfaces.
 - 2. Prime coated finish for other surfaces.

2.2 FLASHING

- A. Provide watertight flashing at all openings through exterior walls and roof. Refer to Architectural Drawings.

2.3 BELT DRIVES

- A. All belts shall be "Vee" type, or approved equal. Sheaves shall be adjustable and shall be sized to drive fan at scheduled RPM when set at midpoint of adjustment range. All belt drive assemblies shall be rated at 150% of drive motor horsepower. OSHA approved belt guards shall be provided over all drive assemblies. The Contractor shall change any belts and drives as required to produce the specified CFM.

2.4 VIBRATION ISOLATION AND NOISE CONTROL

- A. All fans, heating and ventilating units, air conditioning units, blowers and similar equipment shall be securely mounted to and/or supported from the structure.
- B. Isolate all bare water piping from structural members or hangers with "Trisolators" or submitted and approved equal insulating sleeves. Install hangers on outside of insulated jacket on all insulated lines.

2.5 WEATHERPROOFING

- A. All equipment exposed to weather shall be protected by means of a suitable finish (i.e. paint). All fan cabinets, roof-mounted equipment, and ductwork shall be fabricated in such a manner to prevent leakage through seams and joints. Water rated, exterior hoods shall be provided over motors, belts, and other devices to insure against damage by water. At all locations where pipes and/or ducts penetrate exterior walls, or roofs, suitable rain tight flashing shall be provided.

2.6 PIPE WRAPPING

- A. All pipe, metal components, and joints buried in ground shall be primed and protected with 10-mil tape double wrapped or approved equal per IAPMO IS 13-2006. Before tape application, all bare pipe and fittings to be wrapped must be coated with pipe wrap primer. Stretch first layer of tape to conform to the surface while spirally half-lapping, apply a second layer, half-lapped and spiraled as the first layer with spirals perpendicular to first wrapping. In lieu of tape wrap, heat shrinkable 10-mil minimum thick polyethylene sleeve may be used.
- B. When applying tape, use only enough pull to cause the tape to properly conform to the irregular surfaces of the item. The proper amount of pull is reached when the tape surface is smooth without any wrinkles. Continue tape 4" above grade. End overlaps should point down. Tape shall be applied per manufacturer's installation instructions.

2.7 ELECTRIC MOTORS AND ELECTRICAL DEVICES

- A. All Electric motor current characteristics are as shown in equipment schedules on drawings and as specified hereinafter in this Specification. The Contractor shall refer to the Electrical Plans and shall confirm all motor voltage, amperage and phase characteristics before processing submittals or ordering equipment. If any equipment is installed different from the

supplied electrical power, it is the contractor's responsibility to correct equipment to the required electrical characteristics.

- B. All electrical devices of a type normally listed by Underwriters Laboratories, Inc. shall bear U.L. label of approval.

PART 3 - EXECUTION

3.1 GENERAL EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install equipment to provide neat appearance, required manufacturer's access, and required space to allow replacement or maintenance. Provide bases, supports, anchor bolts, and other items required to install equipment. Installation shall be level and braced per CBC.
- B. Equipment shall operate quietly and without objectionable vibration. Excessive vibration, other than from specified equipment operating at optimum conditions, shall be the Contractor's responsibility and shall be eliminated as directed by Architect.

3.2 COORDINATION OF WORK

- A. Coordinate Work of this Section with Work of other Sections to avoid conflicts. If required, provide shop drawings and submit to Architect for approval.
- B. Insure that Work of other Sections is suitable to accommodate Work of this Section.

3.3 ADEQUACY OF FURRING

- A. Conceal piping and ductwork in spaces provided unless specifically shown otherwise. If spaces are inadequate, notify Architect prior to ordering materials and fabrication of components.

3.4 PROTECTION AND CLEANING

- A. Protect equipment from dirt, moisture, and mechanical damage during construction. Restore or replace damaged equipment to original condition.
- B. Keep interior of piping and ductwork free of foreign material during construction. Flush piping systems with test medium specified under Piping Tests before installing equipment and appurtenances or making final connections.

3.5 CLOSING-IN OF UNINSPECTED WORK

- A. Do not conceal or cover Work before tests and observations are completed. Uncover Work prematurely closed in and repair resulting damage to all Work, if requested by Architect, Engineer, or Project Inspector.

3.6 DAMAGE

- A. Repair or replace items damaged by leaks or overflow from Work provided under this Section and for any damage to any part of the project site, for a period of 1 year after notice of completion date. This is in addition to and not

a limitation of other rights the Owner may have against the contractor under the Contract Documents.

3.7 PAINING AND FINISHING

- A. The contractor shall examine carefully all surfaces to be finished under the contract; and before beginning any of his work shall see that the work of other trades has been left or installed in a workmanlike condition to receive paint, or a particular finish.
- B. The contractor shall take the necessary steps to protect his work and the work of other contractors during the time his work is in process and the contractor shall be responsible for any and all damage to the work or property of other contractors caused by his employees or by himself.
- C. Provide protective covers or drop cloths to protect floors, fixtures, and equipment. Exercise care to prevent paint being spattered on to surfaces which is not to be painted. Surfaces, from which such paint cannot be satisfactorily removed, shall be painted or repainted, as required to produce a finish satisfactory to the Architect.
- D. Cracks, holes, or imperfections in concrete or plaster are to be filled with patching plaster and smoothed off to match adjoining surfaces.
- E. All surfaces shall be in a proper condition to receive finish. Clean surfaces as necessary to receive paint. Remove all grease from metal surfaces before painting.
- F. Each coat of paint shall be applied at proper consistency and brushed evenly, free of brush marks, sags, runs, and with no evidence of poor workmanship. Color between coats of paint shall differ; (Color variations between coats should be enough to impair hiding.) Care shall be exercised to avoid lapping of paint on glass or hardware. Paint to be sharply cut to lines. Finished paint surfaces to be free from defects or blemishes.
- G. Exposed piping, ducts, and mechanical equipment (except for factory finished items) shall be painted. Exposed piping, except for identification banding, shall be painted to match surfaces adjacent. Each coat to be inspected when dry and subsequent coat not to be applied until approval received.
- H. Paint all surfaces visible through grille, diffuser and register faces, flat black.
- I. The contractor shall store all painting materials and equipment outside of the building. The receiving and moving of all paint materials and mixing shall be done outside of the building. Any other arrangements shall be made only with Architects approval.
- J. All necessary precautions shall be taken to prevent fire. Rags, waste, etc., soiled with paint or cleaning material shall be removed from the premises at the end of each day's work.

3.8 MECHANICAL SYSTEM TESTING

- A. Furnish all test pumps, gauges, and equipment. Test all safety controls and devices.
- B. For air tests, install a calibrated test pressure gauge in the piping system to observe any loss in pressure. Calibrate the test pressure gauge with a dead weight tester within 15 days before use and certify by initial and date on a sticker applied to the dial face. Maintain the required test pressure for the time indicated. Brush joints with a soapy water solution to check for leaks if the required pressure cannot be maintained.
- C. After any test, repair all leaks found as directed and re-test as necessary until the system is proven tight.
- D. Before applying test pressure to any piping systems the Contractor shall be responsible for isolating all equipment e.g. control valves, regulators, relief devices, tanks and any other line accessories, which would otherwise be damaged by the test pressure.
 - 1. Soil, Waste, Vent, Roof, and Condensate Drainage:
 - a. Entire System: Tightly close all openings except the highest one. Fill to overflowing with water.
 - b. Sections of System: Tightly close all openings except the highest opening of the section under test. Fill section with water to test each section with a minimum 10-foot head of water except for the uppermost 10 feet of the system.
 - c. Allow to stand for (4) hours or longer, as required to complete the inspection.
 - 2. Domestic Water: Fill with water and test at 150 psig. Retain for (4) hours.
 - 3. Gas Piping: Air test to pressure equal to one and one-half times the design pressure, but in no case less than 50 psig. Retain for four hours.
- E. After all Systems have been tested as outlined, all flow rates shall be balanced, and all control devices adjusted. See Section 23 0000.
- F. The equipment and installations shall be operated by the Contractor and he shall demonstrate that all Systems are performing according to the requirements of the Plans and Specifications and to the satisfaction of the Architect, Engineer and Owner.
- G. Acceptance Testing Requirements: For applicable mechanical acceptance tests see the T-24.0 plan sheets. All forms, regulation and requirements are available online at www.energy.ca.gov/title24.

3.9 CUTTING AND PATCHING

- A. The Contractor shall do all cutting and patching which may be required for the installation of the Work under this Division of the Specifications. Patching shall be of the same quality, materials and finish as, and shall match accurately, all surrounding construction. No cutting of the Structure shall be permitted without the approval of the Architect.
- B. Wherever concrete or paved surfaces are cut to provide for the installation under this Section, the Contractor shall restore the surfaces to their original condition. Subgrade materials, concrete, and paving materials, along with the placement of same, shall be in accordance with the respective Sections of this Specification as they apply to the installation of such material.

3.10 EXCAVATION AND BACKFILL: (Buried pipes within the building walls and to 5 feet from the building.)

- A. Dig trenches straight and true to line and grade; bottom shall be left smoothed of rock points. Pipe shall be supported for the entire length on undisturbed, original earth. The minimum trench width shall be 16" and all pipe shall be 2 feet below the finished grade, minimum, wherever conditions permit. Sewer pipes to be below grade as necessary to meet the slope and invert on the Drawing. Whenever substantial variations of pipe bury is indicated by field conditions, the proposed changes in depth of bury shall be submitted, in writing, to the Architect for approval.
- B. All piping shall be laid on a bed of clean dry sand not less than 6" thick. The space between the pipe and the sides of the trench shall be backfilled with clean dry sand to a point 6" above the crown of the pipe. Both sides of the pipe shall be filled at the same time.
- C. The remainder of the trench shall be backfilled with native soil in lifts no greater than 12" and shall be mechanically compacted by tamping so to maintain a minimum relative dry density of 95%, determined by California Impact Test Method No. 216.
- D. All backfilling shall be brought flush with finished subgrade.
- E. Excess material shall be removed from the site. Trenches shall be backfilled immediately after approval.

3.11 EXCAVATION AND BACKFILL: (Buried pipes beyond 5 feet from the building walls.)

- A. The Contractor shall excavate for the installation of underground plumbing piping, and shall perform all Work to accomplish required excavation. Should it be required to cut asphalt pavement, such pavement shall be sawed or cut, to a depth necessary to bring about a straight-line break parallel to sides of the trench, so as not to disturb the adjoining pavement. All Work during its progress and after its completion shall conform truly to lines and grades given by the Architect.

- B. The width of the trench shall not be less than twelve (12") inches, no more than twenty-four (24") inches greater than the outside diameter of the barrel of the pipe to be laid therein. Where sheeting is required, this width shall be increased by the thickness of the sheeting.
- C. Should the trench be excavated to a greater depth than that given by the Architect, the Contractor shall bring such excavation to the required grade with such material as the Architect may designate, notwithstanding that it may be necessary to bring such material from other localities or to purchase suitable material; and the trench shall be tamped, as directed by the Architect. The required work shall be at the Contractor's expense, with no additional time.
- D. The material excavated shall be deposited along the side of the trench in such a manner as to create the least inconvenience possible.
- E. Special care shall be taken to have all fire hydrants and gate valves on water mains kept accessible at all times. The Contractor shall not obstruct the gutter or any street or driveway, but shall use all proper means to provide for the free passage of surface water along the gutters into storm water inlets. He shall provide channels where necessary, suitable to the Architect.
- F. Wherever required, the side of the trench shall be sheeted and braced in strict accordance with the rules, orders, and regulations of the Division of Industrial Safety of the State of California. If water or quicksand is encountered, it may be necessary to sheet the trench solid with the type of sheeting suitable to the Architect.
- G. The Contractor shall cooperate with the Architect and maintain access to all areas required by the Architect. The Contractor shall be liable for all damages suffered by the Architect resulting from the contractor's negligence or lack of cooperation.
- H. Excess earth from the trenches, after compacting, shall be removed and disposed of by the Contractor unless otherwise directed by the Architect.
- I. Where groundwater or soft, yielding or otherwise unsuitable material is encountered in the bottom of the trench, which in the opinion of the Architect is an unsuitable foundation for the pipe, such material shall be excavated from the full width of the trench to a depth satisfactory to the Architect. Said depth shall be a minimum of six (6") inches. The resulting space shall be backfilled with imported bedding properly compacted to give adequate pipe support.
- J. All piping shall be laid on a bed of clean dry sand not less than 6" thick. The space between the pipe and the sides of the trench shall be backfilled with clean dry sand to a point 6" above the crown of the pipe and both sides of the pipe shall be filled at the same time.
- K. The remainder of the trench shall be backfilled with native soil in lifts no greater than 12" and shall be mechanically compacted by tamping so as to

maintain a minimum relative dry density of 95% as determined by California Impact Test Method No. 216.

- L. Any asphalt pavement cut for the purpose of installing underground piping shall be replaced and shall conform in kind and quality to the type of pavement removed, but, in no case less than 12" of base rock be placed beneath the pavement. Where plant mix or asphalt concrete surfacing exists, pavement shall not be less than 3" in thickness unless otherwise authorized by the Architect.

3.12 INSTALLATION OF PIPING, DUCTWORK AND EQUIPMENT

- A. The installation of piping, ductwork, and equipment shall be made in such a manner to clear beams and obstructions. Do not cut into or reduce the size of plates or any load carrying members without approval of the Architect. Check Drawings and Work of others to prevent interference. Deviations of the Work determined by the Architect shall be installed by the Contractor without additional cost.
- B. Install piping and ductwork promptly, cap or plug open ends of pipe. No piping shall be permanently covered by construction before inspection and approval. Piping and ductwork shall be installed in accordance with best practice and recommendations of the manufacturer.
- C. Conceal piping and ductwork unless indicated otherwise. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions. Remove defective material from site. Install piping generally level, free of traps and unnecessary bends to conform with building requirements, and provide space for other work. Piping to be free of unusual noises. Avoid any possible galvanic action by isolating dissimilar metals with suitable Dielectric Insulating Fittings.
- D. Unless called for otherwise, hereinafter in this Specification or by specific detail on the Drawings, all water pipes in contact with structure and/or hangers shall be suitably isolated. In the case of uninsulated pipe, "Trisolators" or equal shall be used.
- E. Protect enameled or polished equipment from damage, tool marks, etc.

3.13 STERILIZATION OF PIPES

- A. After preliminary purging of the Systems, the entire domestic potable water system pertaining to Work under this Contract shall be chlorinated in accordance with American Water Works Association, State of California Health and Safety Code procedure for disinfecting water mains. A thorough flushing operation shall be run upon completion of sterilization. Contractor shall then arrange with local health authority for test on mains and water systems and provide three (3) copies of test results to the Architect.

3.14 EQUIPMENT IDENTIFICATION TAGS

- A. Major pieces of equipment shall include, but are not limited to: water heaters, air conditioners, unit heaters, supply and exhaust fans, and shall be tagged.
 - 1. Tags shall be 2" x 2" x 1/8" thick Formica/plastic engraving stock beveled on both sides and with two 3/16" diameter holes near the top uppermost tag corners.
 - 2. Tags shall be white with 3/8" high red engraved letters.
 - 3. Tags shall be attached to the equipment with bolts, screws or chains as per valves.
 - 4. Tags shall have the following information:
 - a. Equipment number and nomenclature corresponding to the information on the mechanical contract drawings.
 - b. Examples:

WATER HEATER	EXHAUST FAN	AIR CONDITIONER
1	2	3

3.15 SEISMIC BRACING

- A. It shall be required that pipes, ducts and conduits be supported and braced per the SMACNA "Seismic Restraints Manual Guidelines for Mechanical Systems", 1998 Edition.
- B. When the SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems" does not specifically address the size of duct or pipe to be braced, the following shall apply:
 - 1. All ducts shall be braced and guyed to prevent lateral or horizontal swing to the satisfaction of the Architect, Engineer, and State Inspector.
 - 2. All pipes shall be braced and guyed to prevent lateral or horizontal swing to the satisfaction of the Architect, Engineer, and State Inspector. Absolutely, no "Plumber's Tape" shall be used anywhere on this project.
- C. The SMACNA Manual can be obtained through SMACNA (VA) at (703) 803-2989. Contractor shall obtain manual prior to the start of any work.

3.16 OPERATION AND INSTRUCTION

- A. The Contractor shall furnish competent Technicians to supervise start-up operations of equipment specified by the Architect or Engineer and to instruct Owner's operators. The Contractor shall furnish six complete sets of operating instructions and service manuals to the Architect.

- B. Instruction period shall be started after instruction books and service manuals have been submitted to and approved by the Architect and shall be at hours (regular and non-regular) arranged by the Architect.
- C. Service manuals shall include oiling, cleaning, and servicing data, compiled in clearly and easily understood form and in a durable binder. Data shall show all serial numbers of every piece of equipment and complete list of replacement parts.

3.17 WARRANTY

- A. The contractor shall warranty all of the systems for proper operation installed by the contractor for not less than one calendar year from date of project completion. This completion date shall be set by the Architect or Owner.

END OF SECTION 23 0013

SECTION 26 00 00

GENERAL ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Contact requirements of the foregoing GENERAL CONDITIONS, SPECIAL CONDITIONS and supplements thereto and all requirements of Division 1 of these Specifications shall form a part of this Section with the same force and effect as though repeated herein. The provisions of this Section shall apply to all of the following Sections of Division 26 and 27 of these Specifications. All applicable portions of the work under Divisions 26 and 27 shall conform fully to all provisions of all other Division 26 Sections along with other Sections of these Specifications.

1.02 SUMMARY OF WORK

The Contractor shall provide all materials, tools, equipment, labor and services necessary to furnish and install complete working electrical systems as shown on the plans and described within these Specification. All systems, at project completion and before final acceptance, shall be demonstrated to have a complete and working functional operation. The work includes but is not specifically limited to items indicated on Drawings and specified herein.

1.03 DESCRIPTION AND INSTALLATION OF SYSTEMS

- A. The electrical drawings are diagrammatic and do not necessarily show all raceway, wiring, number or types of fittings, offsets, bends or exact locations of items required by the electrical systems. Items not shown or indicated which are clearly necessary for proper operation, payment or installation of systems shown shall be provided at no-increase in contract price.
- B. The exact routing of systems and location of devices and equipment shall be governed by coordination with other trades, structural and architectural conditions. The Architect or Electrical Engineer reserves the right, at no increase in contract price, to make reasonable changes in location of electrical equipment or wiring systems; so as to coordinate with other systems, group them into orderly relationships, or to increase their utility. Contractor shall verify requirements in this regard prior to roughing in.
- C. Install electrical work in cooperation with other trades and make proper provisions to avoid interferences and coordinate with structural and architectural features, in a manner approved by the Architect or Electrical Engineer. All changes caused by neglect to make such provisions shall be at Contractor's expense. Provide offsets and special fittings, as required to facilitate installation of the work.
- D. When a particular product or type of product is specified with a manufacturer's designation, the latest published specifications, installation, and construction information of the manufacturer shall constitute the minimum acceptable standard. Any substitutions shall be made in accordance with Section 1.09 SUBSTITUTIONS.

1.04 RELATED DOCUMENTS

- A. Codes and Regulations: All electrical equipment and material and its installation shall conform to the current requirements of the following authorities and CODES AND STANDARDS:
 - 1. Occupational Safety and Health Act (OSHA).

2. 2016 California Electric Code (CEC) based on the NEC and California Amendments.
3. California Code of Regulations (CCR).
 - a. Title 8, Safety Orders.
 - b. Title 19, Public Safety State Fire Marshal Regulations.
 - c. Title 24, Part 1, Administrative Regulations.
4. 2016 California Fire Code (Based on the International Fire Code and California Amendments).
5. 2016 California Building Code (Based on the International Building Code and California Amendments).

NOTE: Where two or more codes, designs, or statements conflict, the most restrictive shall apply. Nothing in these Drawings and Specifications shall be construed to permit work not conforming to applicable codes.

- B. Tests and Standards: The tests, standards, or recommended procedures of the following agencies shall relate to all parts of these Specifications and shall be considered a minimum:
1. American National Standards Institute (ANSI).
 2. Underwriters Laboratories, Inc. (UL).
 3. National Electric Manufacturers Association (NEMA).
 4. Electrical Testing Laboratories (ETL).
 5. National Fire Protection Association (NFPA).
 6. Insulated Power Cable Engineers Association (IPCEA).
 7. Institute of Electrical and Electronic Engineers (IEEE).
 8. Illumination Engineering Society (IES).

1.05 EXAMINATION OF DOCUMENTS AND SITE

Before submitting a proposal, each bidder shall carefully examine the electrical, mechanical, architectural, and structural drawings and specifications. He shall also visit the site and fully inform himself as to all existing conditions and limitations applying to the work. If, after such examination and study, it appears that any change from the drawings and specifications should be allowed, the bidder shall so state in writing together with any change in cost involved.

By the act of submitting a proposal, each bidder shall be deemed to have made such examinations of the drawings and specifications and premises, and it will be assumed that he is therefore familiar with the entire scope of the project and has based his proposal upon the work described in the Drawings and Specifications and upon all existing conditions and limitations applying to his work.

1.06 EXECUTION

- A. Workmanship: The work shall be performed by competent workmen, skilled in the particular phase of the work entailed. The work shall be first class throughout, neat, accurate and in full accordance with the intent of these Specifications and the satisfaction of the Architect or Electrical Engineer.
- B. Safety: All standard safety procedures as set forth by OSHA, CCR, and California Division of Industrial Safety shall be strictly adhered to.
- C. Coordination: The Contractor shall familiarize himself with the work of other crafts so as to be able to provide electrical service of correct size and voltage and other requirements to any equipment to be installed. The installations shall be coordinated as to location and time, and interference causing delays and non-acceptable construction shall be avoided.

Prior to commencing construction the Electrical Contractor shall arrange a conference with the general and sub-contractors as well as equipment suppliers and shall verify types, sizes, locations, requirements, controls, and diagrams of all equipment furnished by them.

Exact equipment rough-in locations shall be verified from shop drawings.

- D. Cutting and Repairing: The Electrical Contractor shall do all cutting necessary for the proper installation of his work, repair any damage done by himself or his workmen, and coordinate his work with that of others. Do no cutting or patching without approval of the Architect or Electrical Engineer. Round holes through concrete slabs or walls shall be core drilled with a diamond drill, rectangular openings shall be cut with a diamond saw. In no case shall any concrete beam or column be cut.
- E. Sleeves and Openings: Electrical Contractor shall be responsible for all sleeves and openings through walls and floors required by electrical work. All openings around conduits in sleeves shall be sealed with a material of equal fire rating as the surface penetrated. Openings not utilized shall be temporarily sealed in a similar manner. All required sleeves shall be furnished to and coordinated with the General Contractor.
- F. Cleaning and Painting: All exposed work shall be thoroughly cleaned upon completion of work. All panelboards and equipment not located in electrical or mechanical rooms or closets shall be field painted per painting specifications, color as selected by Architect. Panelboard enclosures, fixtures, and equipment, where finish has been marred in shipment or installation, shall be completely refinished. Minor finish damage shall be rectified as indicated by the Architect or Electrical Engineer. Contractor shall remove all waste and rubbish resulting from his work from the site.

1.07 QUALITY CONTROL

- A. Supervision: The Contractor shall personally, or through a competent representative, constantly supervise the work from beginning to completion and final acceptance. He shall cooperate fully with the inspection authorities in the provision of information and access to the work. He shall, to the best of his ability, maintain the same job foreman throughout the life of the project unless a replacement is requested or authorized by the Architect or Electrical Engineer.
- B. Inspection and Tests: The Contractor shall furnish all labor and test equipment required to fully test and adjust the equipment installed under this specification and demonstrate its proper operation.
 - 1. Arrange for all tests and inspections and provide minimum 48 hours notice to the

Architect or Electrical Engineer.

2. A test must demonstrate that each piece of equipment, outlet, fixture, device, and appurtenance is in sound operating condition and in proper cooperative relation to associated equipment.
 3. All tests shall be conducted under supervision of the Architect or Electrical Engineer, and any defects of any nature which are apparent as a result of such test shall be made correct to the satisfaction of the Architect or Electrical Engineer before final acceptance is made.
 4. No equipment shall be tested, or operated for any other purpose, such as checking motor rotation, until it has been fully checked in accordance with the manufacturer's instructions.
- C. Warranty: The Contractor agrees to replace or repair, to the satisfaction of the Owner, any part of the installation which may fail due to defective material and/or workmanship or failure to follow Drawings and Specifications, for a period of one year after final acceptance. Any damage to other work resulting from such failure or the correction thereof shall be remedied at the Contractor's expense. The Contractor shall, further, secure from the manufacturers of special equipment, such as signal systems, their respective guarantees and deliver same to Owner. Guarantees between Contractor and his suppliers shall not affect warranties between Contractor and Owner.

1.08 GROUNDING

- A. The conduit system supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded by means of approved ground clamp, in accordance with the electrical safety orders of the Department of Industrial Relations of the State of California.
- B. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded around the boxes with a #6B&S gauge, rubber covered, double braided wire with ground clamps.
- C. Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations.
- D. A separate grounding conductor shall be run in all receptacle circuits.

1.09 SUBSTITUTIONS

- A. The Specifications or Drawings are in no way to be construed as being proprietary toward one product. Those products, or types of products, listed are intended to set the standard for quality, design, and installation procedure. However, no right is implied upon the part of the Contractor to substitute other materials, products or systems without the written approval of the Architect or Engineer.
- B. All requests for substitution shall be made in accordance with Section of the General requirements: SUBSTITUTIONS.
- C. All requests for substitutions shall be in writing, received at least 14 days prior to bid date, and shall indicate all information required thereon including differences from the specified item. The request for substitution shall be accompanied by cuts, product literature, performance data, specifications, drawings, samples or other means as may be required

for proper evaluation by the Architect or Electrical Engineer.

- D. All proposed substitutions shall be standard product of the firm under current manufacture and be a catalog item at time of bid.
- E. Acceptance of substitution shall not relieve the Contractor from responsibility for complying with requirements of the Contract Documents. The Contractor shall be responsible for changes in other parts of the work occasioned by his substitutions and shall bear their expense.
- F. Representative samples may be required for determination of equality.

1.10 SUBMITTAL

- A. Make submittal for all material to be used on the project, whether as specified or substitutions, within thirty five (35) days after award of Contract by the Owner, in accordance with Section: SUBMITTALS, and the following:
 - 1. All submittal shall be neat and bound in a suitable folder or binder.
 - 2. Identify each item by manufacturer, brand, trade, name, number, size, rating, and whatever other data is necessary to properly identify and check materials and equipment. Words "as specified" are not sufficient identification.
 - 3. Identify each submittal item by reference to specifications section paragraph in which item is specified, or Drawings and Detail Number.
 - 4. All submittal shall be submitted in coherent groups, e.g. all light fixtures at one time. No partial, or incomplete submittal will be accepted.
 - 5. Organize submittal in same sequence as they appear in specification sections, articles or paragraphs.
- B. Product Data: Submit eight copies, in groups, as follows:
 - 1. Boxes, conduits, and raceway types required, including fittings
 - 2. 600 Volt Conductors and terminations
 - 3. Lighting fixtures and controls.
 - 4. 600 Volt Switchboards, Panelboards, Power Pedestals, Disconnects, Transformers.
 - 5. Wiring devices
 - 7. Pull Boxes and Vaults
 - 8. Data equipment
- C. Shop Drawings: Shop drawings shall show physical arrangement, wiring diagram, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, weight, power sources, circuit numbers, and shall be compatible with the Contract Drawings and Specifications.

Show wiring as actually installed, connected, and identified for this specific project. Include identification of cables and cable conductors.

Shop and instruction drawings shall cover the equipment or device to be installed and not merely the general class of such equipment or device.

1.11 DOCUMENTATION

- A. Construction Record Drawings: The Contractor shall furnish to the Architect or Engineer, in accordance with the GENERAL REQUIREMENTS, a complete set of "as constructed" drawings which clearly indicate all deviations from the basic contract drawings, including exact dimension locations and depths for all stubbed conduits, location and size of spare conduits, & conductors, all new and uncovered existing work outside the buildings, power feeder runs, and communications "primary" conduit runs. Corrections and changes shall be kept up to date at all times.
- B. All submittal and shop drawings will be resubmitted with record drawings showing all revisions and changes made, clearly marked with field termination wire so as to reflect actual construction record conditions. Revisions and changes will be enumerated and new dates of drawings shown.

1.12 PORTABLE OR DETACHABLE PARTS

The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of his work. These parts shall be itemized and delivered to the Owner at Project Closeout.

END OF SECTION

SECTION 260500

BASIC MATERIALS AND METHODS:

PART 1 - GENERAL

1.01 SCOPE

Furnish and install material and equipment as indicated on the drawings and as specified.

1.02 MATERIALS AND EQUIPMENT

Shall be new and of the best quality used for the purpose in good commercial practice.

1.03 UL APPROVAL

All material and equipment within the scope of the UL re-examination service shall be approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

1.04 STORAGE

All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

1.05 DRAWINGS

Drawings for all equipment are intended to be diagrammatic only. Any location not actual dimension is not to be considered as necessarily final or accurate. Exact locations must be determined in the field from the requirements of the equipment that is to be installed.

1.06 COORDINATION

Before rough-in of any utility lines, services, and feeders, or of any equipment, this Contractor must coordinate his work with that of other crafts and trades so that these services shall be installed in their proper locations and without interference to the equipment or building structure. This will require cooperation among all crafts and trades, the inspector, and General Contractor, along with study of shop drawings and the building drawings.

1.07 ELECTRICAL WORK EXPOSED TO WEATHER

- A. All electrical devices and equipment installed in exposed locations shall be protected by suitable NEMA type 3R enclosures, cast boxes with gasketed covers, or other Engineer approved methods.
- B. All ferrous metal portions of electrical work exposed to weather including conduits, clamps, supports, etc. shall be hot-dip galvanized.

1.08 SEISMIC ANCHORAGE

- A. Provide complete seismic anchorage and bracing for the lateral and vertical support of conduit and electrical equipment, as required by Section 2312 of the California Building Code, and the following.

- B. Anchorage of Equipment: All mechanical and electrical equipment shall be braced or anchored to resist a horizontal force acting in any direction using the following criteria:
 - Fixed equipment on grade - - - - 33% of operating weight
 - Fixed equipment on structure - - 50% of operating weight
 - Emergency power and communication equipment on grade - - - - - 50% of operating weight
 - Emergency power and communication equipment on structure - - - - 75% of operating weight
 - For flexibly mounted equipment use 2 x the above values.
 - Simultaneous vertical force - use 1/3 horizontal force.
- C. Submit calculations prepared and signed by a Structural Engineer licensed in the State of California, showing compliance with the above for all electrical equipment weighing more than 50 pounds, excepting items corresponding exactly in configuration and weight to those specified and detailed. Where anchorage details are not shown on drawings, the field installation shall be subject to the approval of the Electrical Engineer.
- D. Conduit that crosses structural separation between buildings or building units shall be installed with flexible connections, suitable to accommodate longitudinal and transverse displacements.

1.09 SUBMITTAL

- A. Product Data: Submit manufacturer's data including specifications, installation instruction and general recommendations for each item submitted under Submittal, Section 16010, 1.10. Submit calculations in accordance with Section 1.08.

PART 2 - PRODUCTS

2.01 CONDUIT MATERIALS AND COMPONENTS

- A. Rigid Metal: All exposed exterior damp locations, in concrete walls and slabs, in concrete block walls, or elsewhere shown on plans. Rigid metal conduit shall be new galvanized thickwall threaded, furnished in 10 foot lengths.
- B. Thin Wall E.M.T.: Interior dry locations above ground, exposed only in non-finished areas. E.M.T. shall be new galvanized, furnished in 10 foot lengths. E.M.T. shall be coupled with steel screw type connectors in concealed locations, and plastic bushed sealing type couplings in exposed locations. Crimp and die cast type connectors are not acceptable.
- C. Flexible Metallic Conduit: Connections from junction boxes to lay-in fluorescent fixtures to 6 feet or less in accessible ceilings. conduits shall be flexible interlocking single strip zinc coated, or steel with copper ground wire.
- D. Flexible Liquidtight Metallic Conduit: Connections to machinery. Conduit shall be flexible interlocking single strip steel conduit with liquidtight exterior cover, with all connections made with plastic bushed fittings and with copper ground wire (maximum length 30").
- E. Plastic P.V.C., Schedule 40: Underground locations and below vapor barrier of slabs, and in solid grouted masonry walls where wall entry and exit points are made with rigid galvanized steel. No plastic conduit shall be installed in slab floors or in exposed locations. P.V.C. conduit shall be Type 40 heavy thickwall polyvinyl chloride conduit, minimum 3/4" size, Underwriters' Laboratories tested, furnished in 10 foot lengths.

2.02 OUTLET AND SWITCH BOXES

- A. Boxes shall be one piece die formed galvanized steel of shape and with fittings necessary to suit location and use. Boxes shall be of sufficient size to contain all wires, devices, and connection fittings required without crowding. Ceiling and surface mounted boxes shall be minimum 4" square or octagonal. Plaster rings shall be provided where required.
- B. Exposed boxes shall be cast type with gasketed weatherproof cover.

2.03 WIRING DEVICES

- A. Wall Switches:
 - 1. 120/277 Volt Switches: Quiet slow make, slow break design, toggle handle, with totally enclosed case, rated 20 ampere, specification grade. Provide matching two pole, 3 way, and 4 way switches.
 - 2. Acceptable types are:

	Hubbell
One pole	1221-I
Two-pole	1222-I
Three-Way	1223-I
 - 3. Color: Device color to match existing, verify exact device colors with Architect prior to purchase and installation.
 - 4. Dimmers:
 - a. Solid state, vertical sliding, semi-conductor type capable of controlling lighting intensity over the complete range from off to full brightness with integral on/off switch at low end.
 - b. Lutron #N-1000, 2000 or equal for incandescent circuits.
 - c. Lutron #NF-10 or equal for fluorescent circuits.
- B. Receptacles:
 - 1. Standard Duplex Receptacles: Full gang size, polarized duplex, parallel blade, U-grounding slot, specification grade, nylon face, rated at 20 amperes, 125 volts, designed for split feed service.

Acceptable types are:

Type (Hubbell no.s):	Specification grade
Normal power	5362-I
Isolated Ground	IG 5362-I
Ground Fault	GF 5362-I

2. Nameplates: Provide engraved or embossed plastic for receptacles other than standard duplex receptacles, indicating voltage, phase and amperes.
3. Color; Normal Power Circuits: Device color to match existing. Verify colors of all devices with Architect prior to purchase and installation.

2.04 WALL PLATES

- A. Scope: Provide plate for each wiring device and for each signal or communication outlet.
- B. Interior Flush: All locations unless noted otherwise; smooth stainless steel.
- C. Weatherproof Plates: Cast metal, gasketed; for receptacles, provide spring loaded gasketed doors. Provide at all weatherproof locations.
- D. Where two gang boxes are required for single gang devices, provide special plates with devices opening in one gang and second gang blank.
- E. Plates with Engraving: Provide black paint filled engraving for the following.
 1. Switch plates for all outlets not within sight of switch. Engrave with function and location of outlet.
 2. Lighting controls; engraved area identification of each switch where 3 or more switches are ganged together.
- F. Blank bushed or special outlet plates shall be provided for all signal and communications systems outlets as required.

2.05 WIRE

- A. Low Voltage - (Under 600 Volt): Branch circuit wire shall be copper type THWN/THHN, 600 volt, from new fresh stock, bearing U.L. label, delivered to site in unbroken packages; minimum power size 12 AWG. All 20/1 home runs over 150 feet from panel shall be increased to next larger size. Conductors #8 or larger, shall be stranded copper, #10 AWG and smaller shall be solid copper or as shown on plans. All control wires shall be stranded.

2.06 MANHOLES AND PULLBOXES

- A. Precast manholes and pullboxes shall have an ultimate 28-day compressive strength of not less than 3000 psi.
- B. Metal frames and covers shall be made of steel. Covers shall be rated AASHTO H20
- C. Pulling irons shall be bars bent in form and cast in walls and floor.
- D. Cable racks, rack arms, and insulators shall be sufficient to accommodate cable. Wall brackets shall be channel steel. Slots for mounting cable racks shall be at 8 inch intervals. Cable rack arms shall be steel and removable. Insulators shall be dry process glazed porcelain.

2.07 WARNING TAPE

Warning tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep and no more than 1 foot above utility line. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion.

2.08 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each cable or wire located in manholes, handholes, and vaults. The cable tags shall have block letters, numbers, and symbols one-inch high on a yellow background.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUIT RACEWAYS

- A. General: Install conduits in a neat manner, concealed except as noted. Mount conduits directly to building structure with clamps or one hole straps where possible. Secure straps with cadmium plated wood screws into wood, and machine screws into metal or inserts preset in concrete. Where impractical to secure directly to structure, suspend on conduit hangers. Wherever possible, group and rack multiple conduit runs.
- B. Installation and Cleaning: Install free from dents, kinks and bruises. Red lead all threaded conduit joints before coupling. Plug ends at time of installation to prevent entry of dirt or moisture. Thoroughly clean out conduits before installing conductors. Thoroughly clean all exposed conduit exteriors.
- C. Provide tagged pullwire in all empty conduits. Pullwire shall be 1/8" stranded nylon, leave 36" free coiled each end.
- D. Plastic conduit shall be installed in accordance with manufacturer's recommendations and accepted trade practice. Plastic conduit shall be encased in 3" concrete envelope. Where plastic conduit rises above ground in exposed locations the riser bend and riser shall be of rigid metal conduit installed according to rigid metal portion of this specification item.
- E. All plastic, flexible, feeder and receptacle branch conduits shall carry a grounding bond wire with the size as shown, or where not shown, as determined by applicable codes for the ampacity of the circuit being carried.
- F. Protective Coating: All metallic conduits installed in contact with earth or in concrete on contact with earth shall be coated with a minimum 40 mil P.V.C. coating on all conduit lengths and fittings. The coating shall correspond to ATSM D638-68, D1706, D140-64, and D746-64T specifications and Federal test standard 141, method 615z. Coating shall be continuous without flaws showing exposed metal. Coating shall extend to the device conduit is terminated to in exposed locations and 12" above grade in unexposed locations.
- G. Conduits which stub-up through floor shall be installed so that none of the curved portions of the elbow is exposed. Conduit bends and risers terminating below-grade runs shall be 40 mil PVC coated galvanized rigid steel.
- H. Conduit Routing: Route exposed conduits parallel or perpendicular to walls or floors. Install conduits in masonry walls at time of wall construction. NO conduits will run under

heavy equipment, footing or other structural elements. Where runs must cross footings, install in sleeves per structural details.

- I. Conduit Runs in Ceiling Areas: Conduits run above accessible ceiling shall be routed parallel or perpendicular to ceiling system and structural members. All conduit runs shall be coordinated to avoid conflicts with mechanical and structural systems, lighting fixtures and ceiling support system. Conduits shall be installed as close to the above structure as possible to avoid conflict with removal of ceiling panels.
- J. Conduits Penetrating Membranes: Where conduits penetrate wall or slab membrane moisture barriers, penetration shall be sealed in accordance with the requirements of applicable sections of these Specifications for "Thermal and Moisture Protection".
- K. Conduits Penetrating Roof: Provide flashing and counter flashing making watertight joints where conduits pass through roof or waterproofing membranes, in accordance with existing roofing manufacturer's warranty requirements.
- L. Escutcheons: Conduits penetrating wall, floors, or ceiling in exposed locations shall be installed with appropriate escutcheon plates.
- M. Separations: Coordinate with all other crafts to allow minimum of 12" running and 6 inches crossing clearance at flues, hot water pipes, steam pipes, and heat sources. Keep electrical conduits free from contact with all other piping runs of other systems or of dissimilar metals.
- N. Conduits Crossing Building Joints: Conduits shall not be run in concrete slab or wall construction where passing through an earthquake or expansion joint. At such condition, conduit shall be run exposed or in furred ceiling space with 24" length of flexible conduit crossing joints.
- O. Conduits Penetrating Floors and Walls: Provide grouting around raceways where penetrating floor slabs, concrete or masonry walls. At fire separation walls or floors, use Engineer approved expanding type putty, Nelson Flameseal or equal, to maintain the fire rating of the surface penetrated.
- P. Conduit Support: Support of conduit and tubing in steel stud walls shall be by #18 gauge steel wire, secured to steel bars or straps attached to steel studs. Conduits rising vertically between wall studs shall be tied to a horizontal cross support attached tightly to eliminate any movement.
- Q. Conduit Hangers:
 - 1. Conduit hangers spaced at 8'-0" on center maximum with one hanger adjacent to each outlet box, shall be installed wherever conduit cannot be directly attached to structure. Hangers shall be secured to wood structures with steel brackets and wood screws, to steel structures with appropriate clamps, and to concrete structures with preset imbedded inserts or machine screws with expansion shields. Present inserts are preferred to provide a secure anchorage with greatest location flexibility. Power or velocity driven type attachments will not be allowed. Complete hanger installation shall provide a safety factor of 5 based upon maximum CEC allowed conduit fill.
 - 2. Hangers for rigid conduit and EMT 2" and smaller in concealed spaces shall be galvanized perforated type strap wrapped around raceway and bolted; then fastened to structure as described above.

3. Trapeze type supports shall be used where conduits are run grouped together. such hangers shall consist of 3/8" minimum steel rods, structural steel channels, and clamps of Kindorf, Unistrut, or approved equal manufacture.

3.02 INSTALLATION OF EXTERIOR PULL BOXES AND MANHOLES

- A. Where pull boxes are used without bottoms they shall be set on six inches of 3/4" crushed rock of a volume equal to that of the pull box used.
- B. Where pre-case units are used all joints are to be tongue and groove, sealed with a suitable sealer.
- C. Where conduits enter horizontally, they shall be bushed with belled ends and terminate flush with the inside of window. All cracks and openings shall be grouted smooth.
- D. Where conduits enter, other than from horizontal runs, they shall be properly bushed and extended a minimum 1/2" from inside of wall or bottom into pull box. They shall be at no more than 45 degrees rise from the horizontal runs.
- E. All conduits entering pull boxes and manholes shall be sealed watertight with suitable duct sealing compound.
- F. Precast manholes shall be set on 12 inches of level, 90 percent compacted granular fill, 3/4-inch to 1-inch size, extending 12 inches beyond all sides. Granular fill shall be compacted by a minimum of four passes with a plate vibrator. Provide 3/4-inch by 10-foot driven copper ground rod and #2 copper ground wire in each manhole.

3.03 INSTALLATION OF JUNCTION BOXES AND INTERIOR PULL BOXES

Locate pull boxes and junction boxes above removable ceilings or in electrical rooms, utility rooms, or storage areas. No junction box will be installed in an inaccessible area.

3.04 INSTALLATION OF OUTLET AND SWITCH BOXES

- A. Mounting: Mount outlet boxes flush in areas other than mechanical rooms, electrical rooms, and above removable ceilings. Boxes shall be set true and flush with all necessary and correct adapters and/or plaster rings. All boxes set deeper than code allowable shall be corrected by use of factory made extension rings such as Raco #976 or equal.
- B. Device Locations: Locations of devices on plans are approximate only. Contractor shall study the architectural and structure plans and locate the outlets so that his work is coordinated with the work of others and the fixtures and devices present a pleasing and symmetrical appearance when installed. The location of outlets centered on any architectural feature shall be exact. Outlet locations may be moved a maximum of 10' from the location shown on the drawings before roughing-in without cost to Owner. Switches in relation to door swings and cabinets must be coordinated with architectural drawings. This Contractor shall coordinate with Mechanical Contractor and security and fire alarm Contractor regarding thermostat and security outlets and other equipment locations.
- C. Device Height: The following dimensions for locating wall outlets represent the distance from the finished floor to the center of the outlet, unless noted otherwise.

Outlet	Inches
Data/ Computer	15
Convenience receptacle	15
Lighting switch	48

Adjust outlet mounting height to agree with required location for equipment served.

- D. Boxes located in stud walls shall be mounted as follows:
1. Blocking material shall be installed behind all boxes with conduit entrances on one side only or on opposite sides. Outlet box shall be securely attached to both the adjacent stud and the blocking material. Blocking material shall be same as wall studs and shall be attached to two adjacent studs.
 2. Rear blocking may be omitted for boxes with conduit entrances on two adjacent sides if conduits are secured within 8" of box to adjacent wall stud or to a horizontal support between studs. Box shall be securely attached to adjacent stud. Support material shall be same as wall studs or a piece of tubing secured between studs.
- E. Boxes in counterbacks or casework shall be installed in accordance with architectural details. Where not indicated in details, the Architect shall be consulted prior to installation.
- F. Boxes above accessible suspended ceilings shall be mounted to horizontal trapeze hangers, secured to rod attached to structure above, or attached to ceiling system suspension wire with "Caddy" clips. Conduit and boxes shall be located a minimum of 12" above ceiling where suspended depth permits. conduit and boxes shall not be installed prior to ceiling unless system is attached or braced to structure as to prevent horizontal movement of conduit.
- G. Boxes Located in Masonry Walls: Coordinate cutting of masonry walls to achieve neat openings for boxes. Use rotary cutting equipment to cut masonry work for installation. Where furring occurs, install extension rings to bring box flush to furred surface. Where masonry is the finished surface, locate boxes uniformly for each height at either the top of bottom of a block course and install so that devices plate will fit tight to block wall without extending over mortar joints.
- H. Outlets in acoustical tile ceilings shall be located either centered on the joint between tiles, or in the center of a tile. All such outlet locations shall be carefully planned and verified with Architect.
- I. Exterior Wall Outlets: Conduits shall enter boxes or exterior wall mounted devices at the sides or top only. No conduit shall enter the bottom of such boxes.
- J. Common Boxes and Alignment: Devices shown adjacent to each other at the same mounting shall be gang installed under a common plate, except for outlets of different voltages such as telephone and duplex receptacles. Outlets mounted one over the other, or side by side, shall be in exact alignment, centered on one another.
- K. Box Separation: Boxes and conduit shall be installed in a manner which minimizes sound transmission between rooms. Boxes mounted in a common wall shall be off-set horizontally a minimum of 12 inches and mounted in different stud spaces wherever possible. Boxes in fire rated construction shall be installed per CBC. No boxes shall be mounted back to back. No through boxes shall be used. Off-set boxes shall be

connected with flexible conduit not to exceed 18" in length.

- L. Sealing: All unused holes or openings in boxes shall be slugged or sealed by an acceptable means.

3.05 INSTALLATION OF WIRING DEVICES

- A. Devices shall be securely fastened to outlet box with face flush with plate.
- B. Mount receptacles vertically in appropriate boxes.

3.06 INSTALLATION OF WALL PLATES

Install coverplates on wiring devices. Plates shall be set plumb and flush with finish wall surface. Plates located adjacent to one another shall be exactly the same height.

3.07 INSTALLATION OF FLOOR BOXES

- A. Confirm exact placement with related work before installing. Install so that box will set flush with concrete floor.
- B. Securely anchor fitting to floor box. Install finish.

3.08 INSTALLATION OF WIRE

- A. Scope: Provide all wiring for complete electrical work, installed in code conforming raceway. Branch circuit wiring shall be #12 AWG minimum, unless noted otherwise.
- B. Home Runs: Branch circuit conductors shall be home run to panelboards or motor control centers in groupings shown on the drawings. Combining branch circuit home run conductors in single conduits other than that shown shall not be permitted.
- C. Color coding shall be strictly adhered to and shall be as follows:
 - 1. Color coding shall be:

120/208 Volt	277/480 Volt
A Phase - Black	A Phase - Brown
B Phase - Red	B Phase - Orange
C Phase - Blue	C Phase - Yellow
Neutral - White	Neutral - Grey
Ground - Green	
Travelers - Pink	
 - 2. Color coding utilized shall be noted on electrical "as constructed" drawings and shop drawings.
 - 3. The wires shall be of solid colors in size #6 and smaller. In sizes #4 and larger the wires shall be black and 3" width of the appropriate color tape shall be applied around the wire at 12" intervals starting 2" from the termination of the end of the wire.
 - 4. The color coding for control circuit wires will be as noted on the plans or as agreed upon with the Architect or Electrical Engineer and will be of a color other

than that designated for the phase wires. Where control wires are installed and various colors are used, they shall be noted on the "as constructed" drawings and shop drawings turned in at the completion of the job.

- D. Pulling: Use approved wire pulling lubricant for pulling #4 AWG and larger wire. Oil or grease is prohibited as a conductor pulling lubricant. All conductors #8 and smaller shall only be pulled by hand. Pulling lubricant for conductors over 600 V will be approved by the conductor manufacturer and the Architect or Electrical Engineer.
- E. Splices: Join the conductors securely, both mechanically and electrically using crimp, compression, or pressure type connectors, except that screw-on type connectors shall not be used for wires larger than #10 AWG. The splice area shall be taped to provide equal or greater insulation than the original. Tape run-back over the original insulation shall extend 3 to 5 overall diameters of the insulated wire.

No splices in conductors over 600 V or feeders over #6 AWG is permitted.
- F. Splice only in accessible junction or outlet boxes.
- G. Wiring in panelboards, switchboards, and cabinets shall be neatly installed. Wiring shall be grouped, laced or clipped, and fanned out to wiring terminals.
- H. Identification and Markings: In addition to all other requirements for identification and marking of wires, panelboards, and junction boxes, the following shall be strictly adhered to:
 - 1. The identification of individual wires terminating in either junction boxes, circuit breakers, terminal strips, or on control devices shall be done by means of appropriate tape marker.
 - 2. Where subdistribution wires terminate they shall be marked with the point of origination or point of destination, phase, and voltage to ground. This will include all subdistribution circuits originating from 480/277 volt or 208/120 volt distribution panels serving lighting circuits, receptacle circuits, small power equipment, and small mechanical equipment.
 - 3. Thus each end of a particular feeder or subdistribution class circuit shall be marked as to its phase and point of origination or destination and either voltage line to line in distribution class circuits or voltage to ground in subdistribution class circuits.
 - 4. All control circuits will be marked at each control panel as to their function and where they terminate.
Where control wires terminate into relays or enclosures or terminal cans remote from the main point of control, the wires will be marked as to their function and where they originate.
 - 5. All associated wiring integral within a control cabinet may be marked with the printed circular wire wrapping at each end.
 - 6. Where wires are pulled through or looped through a junction box, they shall be marked as to the point of origin and the point of destination. All markings in above ground junction boxes will be via linen tags with indelible ink and all markings on junction boxes or pull boxes below ground level will be by means of 1/4" plastic tape with embossed letters. This plastic tag will circle the wire and both ends stapled together.

- I. All junction boxes in attic spaces terminating or serving as gathering points for 208 volt circuits will have the cover painted blue.
- J. Testing: All wires under 600 volt potential shall be tested with a 600 volt megohm prior to energization and the readings shall be recorded and handed in with the record drawings at the completion of the project. The tests shall be conducted from phase to phase and from each phase to ground.

3.09 INSTALLATION OF MECHANICAL AND OWNER'S EQUIPMENT WIRING

- A. Furnish all power supplies, variable frequency drives, and motor starter for Mechanical, Plumbing, and Water System (Life Support Systems) Division equipment as shown on the mechanical plans.
- B. Make all connections of power to all mechanical, plumbing, life support systems, and Owner's equipment along with installation of required disconnection means. This Contractor shall make all connections to other miscellaneous equipment which required line or low voltage power. Verify accessibility of all outlets and re-adjust outlets if necessary to meet the Code. Verify sizes and current characteristics of all equipment before installation of wiring and adjust wiring properly as required.
- C. Supply all electrical junction boxes for mechanical equipment.
- D. After all wiring to each unit is complete, Electrical Contractor shall cooperate with Mechanical or Equipment Contractors in testing equipment for proper operation and shall correct wiring as required for proper operation.

3.10 FIELD TESTING

As an exception to requirements that may be stated elsewhere in the contract, notify the Engineer [5] working days prior to each test.

A. Distribution Conductors 600 Volt Class

Perform 600 volt cable tests to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance; minimum resistance shall be 250,000 ohms.

B. Medium Voltage Cables

After installation, and before placing in service, perform a dc High Potential Test on cables rated above 600 volts. Perform medium voltage cable tests after installation in accordance with the requirements of the appropriate "Voltage Tests After Installation" paragraphs in the particular IPCEA specification for the cable involved. Adhere to precautions and limits as specified in the applicable standards. Current sensing circuits in test equipment shall measure only the leakage current associated with the cable under test, and shall not include internal leakage current of the test equipment.

- 1. Record temperature and relative humidity. Do not perform tests unless weather is clear and relative humidity is below 70 percent.
- 2. Test each conductor individually with other conductors grounded. Shields shall be grounded.

3. Terminations shall be properly corona suppressed by guard ring, field reduction sphere, or other suitable methods.
4. Perform insulation resistance and continuity test prior to hi-pot test.
5. Apply a dc hi-pot in at least five equal increments until maximum test voltage is reached. Record a dc leakage current at each step after a constant stabilization time consistent with system charging current decay. One hundred percent voltage shall be reached in a maximum of 60 seconds.
6. Separable insulated connectors shall be plugged into insulated bushings.
7. Raise the test conductor to a maximum test voltage and hold for a total of 15 minutes. Readings of leakage current shall be recorded each minute.
8. Reduce the conductor test potential to zero and apply the grounds for at least 10 minutes.
9. The dc test voltage shall be 53 KV for new feeders and 22 KV for existing feeders, disconnected.
10. Furnish the Engineer with three copies of test results.
11. Medium voltage high potential testing shall be performed by an independent testing laboratory and coordinated by the contractor. **High potential testing shall be witnessed by the City of Fresno Electrical Inspector.**

3.11 CONNECTIONS TO NEW MANHOLES

Construct concrete-encased duct lines connecting to underground structures to have a flared section adjacent to the manhole to provide shear strength. Construct underground structures to provide for keying the concrete encasement of the duct line into the wall of the structure. Use vibrators when this portion of the encasement is poured to ensure a seal between the encasement and the wall of the structure.

3.12 CONNECTIONS TO EXISTING MANHOLES

For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

SECTION 264000

DISTRIBUTION AND GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 - Specification sections, apply to work of this section.
- B. Section 260000 - General Electrical, and Section 260500 - Basic Materials and Methods sections apply to work specified in this section.

1.02 SCOPE

- A. Work included: Furnishing and installation of a complete electrical distribution and grounding system. Conditions of this section apply to all other 264000 series sections included.
- B. Related Work: Refer to other sections, particularly those listed below, so as to properly coordinate work specified herein with that specified elsewhere to produce a finished, workmanlike, fully functioning installation.

All other Electrical Sections: Division 26

1.03 QUALITY ASSURANCE

Codes and Regulations, Reference Standards: See Section 26000.

1.04 NAMEPLATES

Laminated phenolic plastic, color coded black for equipment, with white letters. Provide for identification of each transformer, panelboard and motor control center, secure to face with two (2) chrome plated screws each. A schedule of nameplates shall be included with the shop drawings for approval.

1.05 SUBMITTAL

- A. Product Data: Submit manufacturer's data on service entrance equipment, switchboards, motor control centers and/or individual starters, transformers, panelboards, disconnect switches and grounding components.
- B. Trip Curves: When requested, submit trip timing curves for all circuit interrupting devices.
- C. Nameplate Schedule: Submit nameplate schedule for approval.

1.06 COMPONENT COORDINATION

In order to maintain close control and coordinate the various components of the distribution systems, the number of manufacturers shall be kept to a minimum. Equipment manufacturer shall be General Electric, Westinghouse, Siemens, or Square D. It shall be the manufacturer's responsibility though the Electrical Contractor to coordinate all components of the system in order to ensure systems that will provide maximum protection of equipment and reliable safe operation.

1.07 FEEDER CONNECTIONS

Provide cast, saddle type bolted lugs or hydraulically set compression lugs for all bus connections. Manufacturer shall be Thomas and Betts, Burndy, O.Z. or approved equal. Lugs in which the set of screw embeds directly into feeder conductor shall not be used.

1.08 MISCELLANEOUS

- A. Equipment Bases: Provide appropriately sized concrete housekeeping bases for all floor-mounted equipment.
- B. Hoisting Lifting Lugs: Provide on all heavy equipment as required to ensure safe hoisting.
- C. Space for Future Protective Device: Provide as indicated on drawings; shall be completely equipped for the future addition of a circuit breaker or fused switch, including all connections.

PART 2 - PRODUCTS

2.01 PANELBOARDS

- A. Panelboards shall be Air Circuit Breaker bolted type, with voltage, phase, and breakers as specified in panelboard schedules. Panelboards shall be installed flush or surface or specified, at locations as indicated on plans. Panelboards shall be installed in code gauge rust proof steel cabinets with flush door having flush locks all keyed alike and with trim cut square and true.
 - 1. Panelboards: General Electric
- B. All panelboards and breakers shall meet the requirements of the indicated available symmetrical short circuit current or have a minimum bus bracing to meet figure shown.
- C. All interiors shall be completely factory assembled. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machining, drilling or tapping.
- D. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. A nameplate shall be provided listing panel type and ratings.
- E. Unless otherwise noted, full size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug or each outgoing feeder requiring a neutral connection. A ground bus will be included in all panels.
- F. Boxes shall be at least 20 inches wide made from galvanized steel. Provided minimum gutter space in accordance with California Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
- G. Door hinges shall be concealed. All locks shall be flush, stainless steel, cylinder tumbler type locks with catches and spring loaded door pulls, keyed alike and directory frame and

card having a transparent cover shall be furnished with each door.

- H. All exterior and interior steel surfaces of the trim shall be properly cleaned, primed with a rust inhibiting phosphatized coating and finish with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim clamps shall not be accessible when the panel door is closed and locked.
- I. All main bus bars shall be copper sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above an ambient of 40 degrees C maximum.
- J. Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multipole breakers. (Trip indication shall be clearly shown by the breaker handle taking position between ON and OFF when the breaker is tripped). Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" and carry the SWD marking. UL Class A (5 milliampere sensitivity) ground fault circuit protection shall be provided on 120V ac branch circuits as specified on the plans or panel board schedule. This protection shall be an integral part of the branch circuit breaker which also provided overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional slide pole circuit breaker. Connections to the bus shall be bolt on.

2.02 DISCONNECTS

- A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.
- B. Disconnect switches shall be suitable for area where they are installed, i.e., weatherproof, and shall be rated heavy duty. Use only 600 volt class with proper number of poles. Switches shall be fused unless indicated on plans. Fuses shall be of type specified on plans.
- C. When the disconnect is not clearly visible from the control location, provide it with an operating handle which is lockable in the open position.

2.03 GROUNDING

- A. Clamps, bonds, etc. suitable and as necessary to provide continuous ground system.
- B. All grounding conductors shall be copper, sizes not less than that required under CEC requirements.

2.04 SWITCHBOARDS

- A. Manufacturer's: Subject to compliance with requirements, provide switchboards of one of the following:

General Electric Company

- B. General: Except as otherwise indicated, provide switchboards of types, sizes, characteristics, and ratings indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for complete installation. Service entrance switchboards shall comply with serving utility requirements.
- C. AC Dead-Front Distribution Switchboards: Provide factory assembled, dead-front, metal enclosed, self-supporting secondary power switchboards, of types, sizes and electrical ratings and characteristics indicated; consisting of panel (vertical) units, and containing circuit breakers of quantities, ratings and types indicated. Provide copper or tin plated aluminum main bus and connections to switching devices of sufficient capacity to limit rated continuous operating temperature rise to 54 degrees F, and 90 degrees F for circuit breaker branches; with main bus and tap connections silver-surfaced and tightly bolted for maximum conductivity. Brace bus for short circuit stresses up to maximum interrupting capacity. Prime and paint switchboard with manufacturer's finish and color. Construct units for outdoor, NEMA Type 3R.
- D. Enclosures: Construct dead-front switchboards, suitable for floor mounting, with front cable/wire and conduit accessibility as indicated. Provide welded steel channel framework, hinge wireway front covers to permit ready access to branch circuit breaker load slide terminals. Coat enclosures with manufacturer's standard corrosive resistant finish.
- E. Bussing: Provide switchboard with sufficient cross-sectional area to fulfill U.L. Standard 891 pertaining to temperature rise.

2.05 DRY TYPE TRANSFORMERS

- A. Transformers shall be compartment type, self-cooled, tamper resistant and weather resistant for mounting on a pad and shall comply with the latest applicable standards. The coils shall be wound with copper conductors.
- C. Transformers shall be K4 rated and have a maximum temperature rise of 80EC above a 40EC ambient.
- D. Primary taps shall be full capacity, with a minimum of two 2 1/2% above and below rated voltage.
- E. KVA sizes and voltages shall be as shown on the drawings.

2.06 MOTOR STARTERS

- A. Manual motor starters to be quick-make, quick break, with overload protection. General Electric cr 101 for 120/240 volt 1 hp or less.
- B. Magnetic motor starters shall be full voltage non-reversing unless indicated with control power transformer (120 volt coil) and with overload relay protection. Reduced voltage type starters shall have starting timing relays and multi-tap autotransformers. Combination type shall have integral fused switch, motor circuit protector, or circuit breaker as indicated. Provide Hand-Off-Auto selector switches, pushbuttons, pilot lights, control circuit disconnect, elapsed time meters, interlocks, and other control devices as required or indicated. Provide spare 2 normally open and 2 normally closed auxiliary contacts.
- C. Motor control centers shall be floor standing, NEMA I enclosures, and with Class 1, Type

B wiring.

PART 3 - EXECUTION

3.01 INSTALLATION OF SWITCHGEAR AND SWITCHBOARDS

- A. Install switchgear and switchboards as indicated, in accordance with manufacturer's written instruction, and with recognized industry practices to ensure that switchboards comply with requirements of NEMA and CEC standards, and applicable portions of NECA's "Standard of Installation".
- B. Prior to energization of circuitry, check all accessible connections to manufacturer's torque specifications. Subsequent to wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.

3.02 INSTALLATION OF PANELBOARDS

- A. Provide mounting brackets, busbar drilling, and filler pieces for unused spaces.
- B. Branch circuits shall be connected as shown in line diagrams and/or panelboard schedules, with wires neatly tie wrapped in panel.
- C. All distribution panelboards shall have all sub feeders and main breakers marked with 1" x 3" plastic name tags secured with two self tapping screws.
- D. All panelboards shall be provided with a 2" x 3-1/2" plastic name tag on the front of the panel door or on the trim, indicating panel designation and distribution panel and circuit feeding above panel, secured with two self tapping screws.
- E. Branch circuit panelboards shall have a plastic covered circuit directory card on the inside of each door with all circuit destinations neatly typed.
- F. Contractor shall check and tighten all factory made wire or lug connections. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.
- G. Install four (4) spare 3/4" conduits from all panelboards to accessible ceiling space.

3.03 INSTALLATION OF DISCONNECTS

Install disconnects for all equipment and motors of the size required and as recommended by manufacturer.

3.04 INSTALLATION OF GROUNDING

- A. Scope: Provide grounding system complying with the codes and ordinances specified. Grounding system shall provide continuity through the entire electrical system.
 - 1. Panelboard ground buses.
 - 2. PVC conduit or other raceways.
 - 3. All motors.

4. All lighting fixtures.
 5. Grounding terminals of all receptacles.
 6. Miscellaneous grounds required by code.
- B. Equipment and raceway bonding procedures shall be rigidly maintained and meet all jurisdictional requirements of codes and regulations.
- C. Good, electrically continuous, metal to metal contacts shall be made wherever possible at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduit shall be bonded round the boxes with a 6 BS gauge, rubber covered, double braided wire with ground clamps.
- D. A separate grounding conductor shall be run in all conduit runs from distribution, lighting, and power, etc. panelboards, motor control outlets, etc., back to their respective service or distribution panelboards.
- E. Flexible Conduit Grounding: Provide a separate grounding conductor in all flexible conduit runs to include watertight flexible conduit with integral grounding straps. Install ground conductors inside conduit with ungrounded conductors. Extend from nearest panel to device being connected.
- F. Receptacle Circuits: Provide a separate grounding conductor in all receptacle circuit conduit runs, back to serving panelboard.
- G. Ground rings and fence grounding for medium voltage switchgear: Provide ground ring around switchgear with eight 10' X 3/4" copper ground rods and one within switchgear footprint. Provide #4/0 copper grounding conductors 24" buried and bonded to buried ground rods with exothermic welds. Bond each sections of the 12 KV switchgear. Fence shall be grounded with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 12 inches below grade. Attach a No.4 AWG copper conductor, by fusion weld process, to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 inches of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section shall be bonded to its gatepost by a 1/8 - inch by 1 - inch flexible braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.
- H. Manhole grounds: Provide one 10' X 3/4" copper ground rod in all 12KV manholes and bond all cable shields.

3.05 INSTALLATION OF MOTOR STARTERS

- A. In finished areas, mount motor protection switches flush and install suitable coverplates.
- B. Install heaters correlated with full load current of motors provided.
- C. Set overload devices to suit motor provided.

END OF SECTION

SECTION 265000

LIGHTING ANF FIXTURES

PART 1 - GENERAL

1.01 SCOPE:

- A. Provide lighting fixtures of sizes, types and rating as indicated; complete with, but not necessarily limited to, housings, LED lamps/arrays, reflectors, lenses, drivers, wiring, and mounting hardware.
- B. Contractor shall be responsible for fixture counts.

1.02 DESIGNATION:

- A. Unless otherwise shown on the plans, fixture type designation for an individual fixture shall be typical for similarly indicated fixtures within the entire room or defined area.
- B. Unless otherwise shown on the plans, fixtures mounted in a continuous row shall be of the same type as any individual designated fixture within the row.
- C. In the event a fixture is un-designated on plans, it shall be of the same type as fixtures of similar function within rooms or areas.

1.03 COORDINATION:

- A. Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Architect or Electrical Engineer, and defer ordering until clarified.
- B. Supply plaster frames, trim rings, and back boxes to other trades.
- C. Coordinate with Division Mechanical to avoid conflicts between luminaire supports, fittings & mechanical equipment.
- D. All fixtures shall be coordinated with the architectural reflected ceiling plan. If any discrepancies occur, the Architect or Electrical Engineer must be notified in writing before installation is started.

1.04 SUBMITTAL:

Make product submittal per Section 260000.

- A. Product Data shall include complete list of fixtures along with catalog cuts or detailed drawings of each.
- B. Shop Drawings: Provide fixture construction details for fixtures going into 1' x 1' rectangular or gypsum board ceilings, and custom fabricated fixtures.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

The fixtures described in the light fixture schedule on the drawings are to be used as a standard of quality to be maintained. Substitute items of same function and performance are acceptable in conformance with Section 260000.

2.02 FIXTURES: General

- A. Provide fixtures complete with all component parts to make a complete installation. Fixtures shall have a suitable interior means of grounding the enclosure.
- B. All fixtures shall bear the U.L. label and shall be suitable for installation location.
- C. All attaching devices for recessed or surface mounted fixtures mounted in the ceiling shall be of formed or rolled steel and of sufficient strength to prevent movement of fixture after installation.
- D. The Architect or Electrical Engineer shall have the right to reject any fixture damaged due to improper packaging. Any fixture with broken or bent metal, broken lenses, or an appearance deemed not to be normal, may also be rejected by the Architect or Electrical Engineer at the expense of the Contractor.
- E. Provide gasketing, stops, and barriers to form light traps and prevent light leaks.
- F. Trademarks or Monograms: There shall be no visible trademarks or monograms on the lighting fixtures.

2.03 LED DRIVERS:

- A. Drivers shall be high power factor, constant current type.
- B. Drivers shall be equipped with 0-10V dimming, unless specifically noted otherwise.

2.04 EXTERIOR FIXTURES:

- A. Metal parts of exterior fixtures exposed to weather conditions shall be constructed of cast or spun aluminum, cast bronze, stainless steel or other nonferrous metals available to withstand exposure.
- B. Steel fixtures installed in damp or wet locations shall have zinc-chromate or equal primer.
- C. Provide gaskets on all trims and housing.

2.05 WET LOCATIONS:

All lighting fixtures installed in wet or damp locations shall have U.L. approved "wet" or "damp" location labels visible in interior of fixtures.

PART 3 - EXECUTION

3.01 INSTALLATION OF LIGHTING FIXTURES:

- A. Fixture installation shall conform to all applicable standards for installation, mounting, wiring, and quality.
- B. All fixtures shall be grounded and bonded in accordance with applicable codes. Where fixtures are installed in rows, a bonding screw shall be used to maintain bonding integrity from fixture to fixture.
- C. All fixtures, lenses, and other trim shall be aligned, cleaned, free of paint and blemishes before final acceptance.
- D. Fixtures weighing more than two pounds shall be supported by means other than the outlet box. All outlet boxes shall be able to support a minimum of eight pounds.
- E. For fixtures weighing more than two pounds, support shall be provided at all four corners, plus the outlet box. Each support shall be able to carry a minimum of four times its intended load.
- F. No support or insert, except pendant canopies, shall be visible from the floor.
- G. Where fixtures are pendant suspended, the use of ball aligner canopies, stem, and other required mounting devices shall be required for installation.
- H. When fixtures are stem mounted, the variation in distance from the finished floor shall vary no more than 1/2" from the heights as specified on the plans.
- I. Mounting Heights of Pendant-Mounted Fixtures shown on plans of in specifications shall be to the bottom of the fixture. Mounting heights of the wall-mounted fixtures shall be to the center of the outlet box unless otherwise noted.
- J. Surface-Mounted Fixtures: The Electrical Contractor shall provide surface-mounted incandescent or fluorescent fixtures with UL approval for direct mounting on the various ceilings unless specified otherwise. Spacers will not be approved.
- K. Fixtures in Conflict with Ducts and Piping: electrical Contractor shall coordinate the location of the incandescent and fluorescent fixtures to the available space left between the various ducts and piping. The mounting heights of the adjacent mechanical equipment and any adverse situation shall be as directed by the Architect or Electrical Engineer.
- L. Spacing of Stem Hangers of commercial and Industrial Fixtures: Mount individually or in continuous rows to be approximately 4' 0" o.c. or 8' 0" o.c., as recommended by the individual manufacturers specified.
- M. Installation of recessed fixtures in accessible-type suspended ceilings shall be such that the fixtures will exactly suit the type of ceilings used without altering the fixture or the ceiling. Each fixture shall be wired with a piece of flexible conduit sufficiently long to remove fixture enclosure from ceiling without disconnecting unit. Fixture manufacturer shall prepare drawings or catalog sheets in which all details of fixture installation are carefully analyzed. Contractor to submit these shop drawings for approval. If clearance above "T" bar system is too restricted in "tip-in" fixture, the Electrical Contractor shall coordinate with acoustic ceiling installer by leaving one cross "T" off until the cross "T" shall be secured into its proper place.
- N. All fixtures shall be supported from the building structural members or from bridging attached to the structural members. Provide all necessary blocking and hardware so that fixtures hang true, square, plumb, and in proper alignment. Recessed fluorescent

fixtures in T-bar ceilings shall have minimum of two #12 steel hanger wires from each 4-foot fixture, one at either end.

- O. All LED drivers shall operate within NEMA sound ratings. Noisy or otherwise defective drivers shall be replaced.
- P. All lamps shall be operating and all fixtures shall be clean at time of final inspection.
- Q. Recessed Fixtures shall have their support brackets screwed into ceiling channels.

3.02 FIELD QUALITY CONTROL:

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. The Contractor shall replace at his expense all noisy fixtures, broken or cracked lenses or other defects. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.
- B. At the time of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Electrical Engineer.

3.03 ADJUSTMENT AND CLEANING:

- A. Clean interior lighting fixtures of dirt and debris.
- B. Protect installed fixtures from damage during remainder of construction period.

END OF SECTION

SECTION 272000

DATA COMMUNICATIONS

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 26
- B. All LAN Data system equipment and cabling shall be approved by the Owner prior to purchase and prior to installation. The following specifications are provided to establish a standard of quality. Actual numbers and manufactures may vary. Verify with Owner.

1.02 REFERENCES

- A. American National Standards Institute / Telecommunications Industry Association / Electrical Industries Association
 - 1. ANSI/TIA/EIA-568-B.1 and addenda
"Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements"
 - 2. ANSI/TIA/EIA-568-B.2 and addenda
"Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair"
 - 3. ANSI/TIA/EIA-568-B.3 and addenda
"Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling and Components Standard"
 - 4. ANSI/TIA/EIA-569-B and addenda
" Commercial Building Standard for Telecommunications Pathways and Spaces"
 - 5. ANSI/TIA/EIA-606-A and addenda
" Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
 - 6. ANSI-J-STD-607-A and addenda
" Commercial Building Grounding and Bonding Requirements for Telecommunications"
 - 7. ANSI/TIA/EIA-526-7
"Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"
 - 8. ANSI/TIA/EIA-526-14A
"Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"
- B. International Electrotechnical Commission
 - 1. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments
"Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling"
- C. International Organization for Standards
 - 1. ISO/IEC 11801:2002 Ed2.0 and amendments
" Information technology - Generic cabling for customer premises"
- D. European Committee for Electrotechnical Standardization
 - 1. CENELEC EN 50173:2000 and amendments
" Information Technology - Generic cabling systems"

1.03 SCOPE OF WORK

- A. Furnish all labor, programming, equipment, and materials for, and comply with the performance requirements of the Data/Communications System indicated in the drawings and specified herein.

1.04 SYSTEM DESCRIPTION

- A. A complete local area network to include outlets, plates, racks, optical fiber cable, copper cable distribution, cable management, etc. as required for the installation of a Local Area Network (LAN).

1.05 QUALITY ASSURANCE

- A. Required Contractor Training

The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:

1. Provide references of the type of installation provided in this specification.
2. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus OTDR.
3. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
4. Contractor must be registered with BICSI and have at least one RCDD on staff;

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Ortronics/Legrand
123 Eugene O'Neill Drive, New London, CT 06320
Phone (800) 934-5432. Website: www.ortronics.com
- B. Berk-Tek
132 White Oak Road, New Holland, PA 17557
Phone (800) BERKTEK. Website: www.berktek.com
- C. American Power Conversion Corp
123 Fairgrounds Road, West Kingston, RI 02892
Phone (877) 272-2722. Website: www.apc.com
- D. Chatsworth Products, Inc.
31425 Agoura Road, Westlake Village, CA 91361
Phone (818) 735-6100. Website: www.chatsworth.com

2.02 BALANCED TWISTED-PAIR PRODUCTS

- A. In addition to meeting the category 6 specifications outlined in ANSI/TIA/EIA-568-B.2-1, the requirements of this section must also be met for the specified products.
- B. Outlets: Ortronics NetClear GT2 or equal
- C. Patch cords: Ortronics Clarity 6, Blue, 4-Pair or equal
- D. Category 6 Patch panels: Ortronics NetClear GT2 or equal

- E. Cable: Berk-Tek LANmark-1000 Category 6 Cable or equal

2.03 OPTICAL FIBER PRODUCTS

- A. In addition to meeting the specifications outlined in ANSI/TIA/EIA-568-B.3 and ISO/IEC 11801:2000 Ed2.0, the requirements of this section must also be met for the specified products.
- B. Outlets / Adapters / Connectors: Ortronics NetClear MM10 or equal
- C. Patch Cords: Ortronics 50/125µm laser optimized multimode duplex fiber or equal
- D. Patch Panels: Ortronics Low Profile, Rack Mount Fiber Cabinet or equal
- E. Cable: Berk-Tek Gigalite-10 multi-mode optical fiber cable
 - 1. Outdoor: Adventum loose tube-dry fiber
 - 2. Indoor: Horizontal Interconnect tight buffer fiber

2.04 MAIN DISTRIBUTION FRAME (MDF): NETWORK OPERATIONS CENTER

- A. Rack System: APC
 - 1. (2) #AR3100 SX 42U 600mmWx1070mmD
 - 2. (2) #AP9335TH Temperature & Humidity Sensor
 - 3. (1) #NBRK0451 NetBotz Rack Monitor 450 with 120V Power Supply
 - 4. Vertical & Horizontal Cable Managers
 - 5. Bolt-down kits
 - 6. Power distribution and cordsets
 - 7. Seismic bracing
 - 8. In-row cooling assemblies for use with cooling system
- B. Cooling System: APC

In-Row Direct Expansion RD, Air Cooled
Rack air containment assemblies
Audible noise at 1 meter: 0.00 dBA
- C. UPS: APC #ISX20KF
Multi-function LCD status and control console
 - 1. Output:
 - a. Configured Power: 20kW/20kVA
 - b. Nominal Output Voltage: 120V, 208V, 208V 3Φ
 - c. Bypass: Built-in maintenance bypass & static bypass
 - d. Output Frequency (sync to mains): 60Hz - programmable ±0.5 / 1 / 2 / 4 / 6 / 8%
 - e. Output Frequency (not synced): 60Hz ±0.1% for 60Hz nominal
 - f. Crest Factor: 2.5:1
 - g. Waveform Type: Sine
 - h. Output Connections: (9) NEMA L21-20
 - 2. Input:
 - a. Nominal Input Voltage: 208V
 - b. Input Frequency: 50/60Hz ±3Hz (auto-sensing)
 - c. Input Connection: Hardwire
 - d. Input Voltage Range: 177-240V

e. Power Factor at Full Load: 0.99

D. Include Factory Startup, Assembly Service, Software Support, Configuration, etc. for APC equipment.

2.05 MAIN DISTRIBUTION FRAME (MDF): EDUCATIONAL ADMINISTRATION BUILDING

- A. Rack System: Chatsworth Adjustable Rail QuadraRack
Provide (2) four-post racks. The rack system shall have these minimum features:
1. #12-24 threaded rails for support of 19" wide equipment.
 2. 45 RMU in each rack.
 3. 1000kg load capacity.
 4. 19" EIA-310-D compliant and UL Listed 60950.
 5. Welded front and rear frame, bolted assembly.
 6. Epoxy-polyester hybrid powder coat paint, black color.
 7. Vertical and horizontal cable management.
 8. Power distribution system.
 9. Seismic bracing.
- B. UPS:
1. American Power Conversion Corp. (APC)
 2. Rack-mounted uninterruptable power supply.
 3. Provide 30 minute battery runtime for all rack-mounted equipment to include, data & VoIP switches, servers, surveillance DVR, etc. Coordinate with other specification sections and District IT personnel to determine minimum power rating and battery capacity.

2.06 INTERMEDIATE DISTRIBUTION FRAME (IDF): SHOPS

- A. Wall Mounted Cabinet: Chatsworth CUBE-iT
When wall mounted cabinets are deployed, the solution shall have these minimum features:
1. Swing-out cabinet body to allow access to the rear of the installed equipment.
 2. Rear panel to be pre-punched with knockouts for 1/2", 3/4", 2-1/2", and 3" conduit.
 3. Interior cable tie points and attachment points for accessory rack-mount brackets.
 4. Cabinet body to include one pair of adjustable length 19" EIA threaded equipment mounting rails.
 5. Cabinet body to be vented and include accessory fans and filters.
 6. Front door to have rounded edges and include tinted window.
 7. Front door and rear panel to be equipped with key locks.
 8. Include additional factory accessories as required for installation.
- B. UPS:
1. American Power Conversion Corp. (APC)
 2. Rack-mounted uninterruptable power supply.
 3. Provide 30 minute battery runtime for all rack-mounted equipment to include, data & VoIP switches, servers, surveillance DVR, etc. Coordinate with other specification sections and District IT personnel to determine minimum power rating and battery capacity.

2.07 SWITCHES

- A. HP ProCurve(verify)
 - 1. 10/100/1000 Power-over-Ethernet (PoE) rack mount switches.
 - 2. Provide adequate quantity of switches to accommodate all data outlets shown on plans.
 - 3. Switches shall have at least two ports that accept mini-GBIC's.
 - 4. Provide mini-GBIC's as required for Interbuilding connection with NOC.

PART 3 - EXECUTION

3.01 SYSTEM DESIGN REQUIREMENTS

A. Horizontal Cabling

The Horizontal Subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the telecommunications room. It consists of the telecommunications outlet/connector, the horizontal cables, optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Horizontal Subsystem.

B. Backbone Cabling

Cables allowed for use in the backbone include: 50/125 μ m multimode optical fiber cables. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.

1. Interbuilding Cabling

When a distribution system encompasses more than one building, the components that provide the link between buildings constitute the Interbuilding Backbone Subsystem. This subsystem includes the backbone transmission media, associated connecting hardware terminating this media, and electrical protection devices to mitigate harmful voltages when the media is exposed to lightning and/or high voltage power surges that pass through the building cable. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building.

3.02 SITE SURVEY

- A. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

3.03 PHYSICAL INSTALLATION

A. Cable Pathways

- 1. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
- 2. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations.
- 3. Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.

4. The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
5. Pathways shall not be located in elevator shafts.

B. Interbuilding Cable Routing

1. Install an interbuilding connection from the MDF at this building to the MDF at the District Operations Building with 12 MM / 6 SM fiber optic cable. The connection shall be made via underground conduits.
2. Unless otherwise recommended by the manufacturer, all fiber cables will be run in innerduct.
3. Fibers will be terminated in the telecommunications rooms using SC, ST, MT-RJ or LC connectors in wall mounted interconnect centers or rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
4. In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill factor of 40%.
5. All underground systems shall be designed to prevent water runoff from entering the building.
6. The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each satellite building telecommunications room. All Interbuilding cables shall be installed to the applicable codes and regulations.
7. Backbone pathways shall be installed such that the minimum bend radius and pulling tension of backbone cables is kept within cable manufacturer specifications both during and after installation.
8. Lay detectable warning tape in all underground pathways.
 - a. Warning tape shall be a minimum of 6" wide, orange in color, and shall have a non-degradable imprint as follows: "Caution Fiber Optic Cable Buried Below".
 - b. The warning tape shall be detectable.

C. Horizontal Cable Routing

1. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.
2. The combined length of jumpers, or patch cords and equipment cables in the telecommunications room and the work area should not exceed 10m (33 ft) unless used in conjunction with a multi-user telecommunications outlet.
3. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
4. In open ceiling cabling, cable supports shall be provided by means that is structurally independent of the suspended ceiling, its framework, or supports. These supports shall be spaced no more than 1.5 m (5 ft) apart.
5. Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is less than 3kVA, shall be installed with a minimum clearance of 50 mm (2 in).
6. 4-pair balanced twisted-pair cables shall be run using a star topology from the telecommunications room serving that area to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
7. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.

8. Each run of balanced twisted-pair cable between horizontal portion of the cross-connect in the telecommunication closet and the information outlet shall not contain splices.
9. In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.
10. Continuous conduit runs installed by the contractor should not exceed 30.5 m (100 ft) or contain more than two (2) 90 degree bends without utilizing appropriately sized pull boxes.
11. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.
12. The number of horizontal cables placed in a cable support or pathway shall be limited to a number of cables that will not cause a geometric shape of the cables.
13. Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill is limited to 60% fill for move and changes.
14. Horizontal distribution cables shall not be exposed in the work area or other locations with public access.

D. Cable Administration

1. Identify cables at each end with a permanent self-laminating adhesive label.
2. All labels must be mechanically printed, and not written by hand. This requirement is intended to improve legibility and to upgrade the professional appearance of the installation.
3. The administrative schema shall be the 'Origination' and 'Destination' method for all cables.
4. It shall conform to the TIA/EIA 606-A Administration Standard for Commercial Telecommunications Infrastructure guidelines.
5. Identify each patch panel, workstation connector port, and copper patch panel port with a self-adhesive, machine printed label.
6. Each workstation connector port and patch panel port shall be identified with a unique cable identifier consisting of the building number with room number, station number, and then connector position (e.g. A.101:01:D1).
7. The station numbering plan is orientated to the building floor plans. Beginning from the room entrance in a clockwise manner, identify the first station as 01, then continue around the room, reserving the floor outlets, if any, as the last stations.
8. All fiber storage rings shall be clearly identified with a Fiber Optic Cable Marker label. The label shall display the Telecom Room Cross-connect number (e.g. TR-B1.1), as well as the fiber type and strand count.

E. Work Area Termination

1. All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.
2. The telecommunications outlet/connector shall be securely mounted at planned locations.
3. The height of the telecommunications faceplates shall be to applicable codes and regulations.

F. Pulling Tension

1. The maximum cable pulling tensions shall not exceed manufacturer's specifications.

G. Bend Radius

1. The maximum cable bend radii shall not exceed manufacturer's specifications.
2. In spaces with balanced twisted-pair cable terminations, the maximum bend radius for 4-pair cable shall not exceed four times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.
3. During the actual installation, bend radius on 4-pair cable shall not exceed eight times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

H. Slack

1. In the work area, a minimum of 300 mm (12 in) should be left for balanced twisted-pair cables, while 1 m (3 ft) be left for fiber cables.
2. In telecommunications rooms a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.

I. Cable Tie Wraps

1. Tie wraps shall be used at appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
2. Hook and loop cable managers should be used in the closet where reconfiguration of cables and terminations may be frequent.

J. Grounding

1. All grounding / earthing and bonding shall be done to applicable codes and regulations.

K. Pull Ropes

1. Install a pull rope in with all cable pulls and in spare conduit.
2. Pull ropes shall be 1/2" flat tape with a minimum tensile strength of 1200 lbs.
3. Ropes shall be pre-lubricated woven polyester or aramid fiber tape made from low friction, high abrasion resistant yams providing a low coefficient of friction. Tape shall be printed with sequential footage markings for accurate measurement.

3.04 TESTING

A. Testing of all newly installed cable channels shall be performed prior to system cutover.

B. Copper Testing

1. All category 6 field-testing shall be performed with an approved level III balanced twisted-pair field test device.
2. All installed category 6 channels shall perform equal to or better than the minimum requirements as specified by the table below:

Parameter	Performance @ 100MHz	Performance @ 200MHz	Performance @ 250MHz
Insertion Loss	20.3 dB	29.7 dB	33.7 dB
NEXT Loss	42.1 dB	37.5 dB	36.1 dB

PS NEXT Loss	40.6 dB	36.1 dB	34.6 dB
ACR	21.8 dB	7.8 dB	2.4 dB
PS ACR	20.3 dB	6.4 dB	0.9 dB
ACR-F	23.9 dB	17.9 dB	15.9 dB
PS ACR-F	20.9 dB	14.9 dB	12.9 dB
Return Loss	14.0 dB	11.0 dB	10.0 dB
Propagation Delay	528 ns	527 ns	526 ns
Delay Skew	40 ns	40 ns	40 ns

3. Category 6 balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

C. Fiber Optic Testing

1. Horizontal Fiber Testing

- a. Fiber horizontal cables shall be 100% tested for insertion loss and length.
- b. Insertion loss shall be tested at 850 nm or 1300 nm for 50/125µm multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
- c. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.

2. Backbone Fiber Testing

- a. Fiber horizontal cables shall be 100% tested for insertion loss and length.
- b. Insertion loss shall be tested at 850 nm and 1300 nm for 50/125µm multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
- c. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.

D. Test Equipment Criteria

1. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
2. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters
3. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

3.05 ADMINISTRATION & DOCUMENTATION

A. Drawings

1. As-built drawings shall be supplied by the contractor showing the locations of and identifiers for all:
 - a. Horizontal cable routing and terminations
 - b. Telecommunications outlets/connectors
 - c. Backbone cable routing and terminations
- B. Records and reports
1. All records shall be created by the installation contractor and turned over at the completion of work. The format shall be computer based and both soft copies and hard copies shall be part of the As-built package. The minimum requirements include:
 - a. Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
 - b. Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
 - c. Test documentation on all cable types shall be included as part of the As-built package.
 2. All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:
 - a. Cable Reports
 - b. Cross-connect Reports
 - c. Connecting Hardware Reports

3.06 WARRANTY

- A. Either a basic link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 250 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.
- B. System Warranty

A twenty (25) year warranty available for the category 6 structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof. Additional features of the warranty shall include:

1. Margin over category 6 channel specifications on all parameters across the entire frequency range of 1-250MHz as noted below:

Parameter	Guaranteed Margin 1-250MHz
Insertion Loss	0.1 dB
NEXT Loss	0.9 dB
PS NEXT Loss	1.9 dB
ACR	1.1 dB
PS ACR	2.1 dB
ACR-F	0.6 dB
PS ACR-F	0.6 dB

Return Loss	0.5 dB
Propagation Delay	20 ns
Delay Skew	10 ns

2. Performance claims based on worst case testing and channel configurations

C. Product Warranty

The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its products. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.

END OF SECTION

SECTION 31 1000 SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and protection of vegetation.
- B. Removal of existing debris.
- C. Salvage of trees removed for deadfall pieces in exhibits.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- D. Section 31 22 00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- E. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.
- F. Section 32 93 00 - Plants: Relocation of existing trees, shrubs, and other plants.

1.03 SUBMITTALS

- A. See Section 01 3100 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Vegetation removal limits.
 - 2. Areas for temporary construction and field offices.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 31 22 00 - Grading

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Comply with other requirements specified in Section 01 70 00.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 VEGETATION

- A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by

building structure, paving, playing fields, lawns, and planting beds. Coordinate with Owner and Architect for salvage of trees to be used in exhibits

- B. Do not remove or damage vegetation beyond the limits indicated on drawings.
 - 1. 40 feet outside the building perimeter.
 - 2. 5 feet each side of surface walkways, patios, surface parking, and utility lines less than 12 inches in diameter.
 - 3. 5 feet each side of roadway curbs and main utility trenches.
 - 4. 25 feet outside perimeter of pervious paving areas that must not be compacted by construction traffic.
- C. Install substantial, highly visible fences at least 6 feet high to prevent inadvertent damage to vegetation to remain:
 - 1. At vegetation removal limits.
- D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.
- E. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
 - 1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
 - 2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
 - 3. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
- F. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.03 DEBRIS

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 31 1400
SOIL MATERIALS**

PART 1: GENERAL

1.01 SECTION INCLUDES:

- A. Excavated materials and imported materials.

1.02 RELATED SECTIONS:

- A. Section 31 2000 – Earthwork: Excavation, Filling, and Grading.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

1.03 SUBMITTALS:

- A. Samples: Submit, in air-tight containers, 10 lb. sample of Type B and C fill to the Inspector.
- B. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.

PART 2: PRODUCTS

2.01 SOIL MATERIALS:

- A. Soil Type A: Excavated and reused material, graded, free of roots, lumps greater than one inch, rocks larger than ½ inch, debris, weeds, and foreign matter.
- B. Soil Type B: Imported topsoil, friable loam; reasonably free of roots, rocks larger than ½ inch, debris, weeds, and foreign matter.
- C. Soil Type C: Imported borrow, suitable for purpose intended, free of vegetable matter and other unsatisfactory material, with minimum R value of 10 and required as follows:

IMPORTED FILL

Maximum Plasticity Index	less than 6
Maximum Particle Size (inches)	3"
Percent Passing 3 inch sieve	100
Percent Passing #4 sieve	85-100
Percentage Passing #200 sieve	0-15
Minimum "R" Value (pavement area)	min 50
Maximum Water Soluble Sulfate (SO ₄) in Soil	0.05% by weight
Expansion Index	less than 5

2.02 SOURCE QUALITY CONTROL:

- A. Inspection of imported soil will be performed as per Section 01 40 00.

PART 3: EXECUTION

3.01 STOCKPILING:

- A. Stockpile imported material on site at location designated by project Inspector.

3.02 STOCKPILE CLEANUP:

- A. Remove stockpile, grade site surface to prevent freestanding surface water.

END OF SECTION

SECTION 31 20 00
EARTHWORK-EXCAVATION, FILLING & GRADING

PART 1: GENERAL

1.01 SECTION INCLUDED:

- A. Over-excavating soil for building and improvement areas.
- B. Excavating soil and other materials for surface improvements.
- C. Compaction of existing ground.
- D. Placement of fill (if necessary)
- E. Preparation of subgrade for other improvements.
- F. Grading of soil.

1.02 RELATED SECTIONS:

- A. Contract General Conditions
- B. Section 31 11 00 – Clearing of Work for Site Improvements
- C. Section 31 14 00 – Soil Materials
- D. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

1.03 REFERENCES:

- A. ASTM D 1557.

1.04 COORDINATION:

- A. Coordinate work with Owner personnel.
- B. Verify that the location of existing utilities has been indicated at work site by utility authorities and Owner personnel.

1.05 EXISTING UTILITIES:

- A. The Engineer has indicated on the plans the location of all known existing utility facilities within the work area. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals have been shown where information was available. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- C. Contractor shall verify all utilities within the work area, including using hand method. Contractor shall protect all existing utilities not designated to be removed.
- D. Maintain all existing utility mains and service lines in constant service during construction of the work.

1.06 PROJECT RECORD DOCUMENTS:

- A. Accurately record actual locations of utilities encountered, provide as-built information.

PART 2: PRODUCTS

2.01 MATERIALS:

- A. Fill in Turf or Other Planting Areas: Type A per Section 31 14 00.
- B. Fill in Non-planting Areas: Type B or C per Section 31 14 00.

PART 3: EXECUTION

3.01 EXAMINATION:

- A. Verify site conditions.

3.02 PREPARATION:

- A. Identify required elevation.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect any existing improvement not authorized for removal.
- D. Areas with existing improvements, to be removed, should be excavated to a minimum depth of 12 inches below existing improvements to be removed and the exposed surfaces shall be scarified to a depth of 8 inches, moisture conditioned and compacted as engineering fill.
- E. Within the area of the planned buildings, retaining wall and other structures, over-excavation must extend to a depth of 2 feet below the existing grade elevation, or 2 feet below the footings, whichever is deeper. The over-excavation must extend at least 5 feet laterally outside of the building areas where accessible.
- F. Within the area of the planned pavement, over-excavation must extend to a minimum depth of 12 inches below the existing surface or 18 inches below the pavement surface soil, whichever is greater. The over-excavation must extend 3 feet beyond the improvement area.
- G. Within the area of planned slabs and walking areas, over-excavation must extend to a depth of 12 inches below the existing grade elevation or 1 foot below the planned surface, whichever is deeper. The over-excavation area must extend at least 3 feet beyond the improvements.
- H. Following the over-excavation of the pavement and building areas, the exposed ground surface must be reviewed by the Geotechnical Engineer to evaluate if loose or soft zones are present that will require additional over-excavation.

3.03 EXCAVATION:

- A. All areas receiving fill materials shall be scarified 12 inch in depth, moisture conditioned and compacted as engineering fill.
- B. Excavate soil to finish subgrade of improvements or to finish surface grade where no improvements are to be placed thereon.

- C. Conform excavation to the grades and cross-sections shown on the plans.
- D. When excavating through tree roots, perform work by hand and cut the roots, where authorized, with a saw.
- E. Remove and stockpile excess soil not to be use as fill in the Work at the location designated by the School District, all at no additional costs to the Owner.

3.04 FILLING:

- A. Clear all debris, vegetable matter and any other material from areas to receive fill, per Section 31 11 00
- B. Compact existing ground to required relative compaction prior to placement of fill.
- C. Place and compact soil to finish subgrade of improvements or to finish surface grade where no improvements are to be placed thereon.
- D. Conform fill to grades and cross-section shown on the plans.
- E. Any fill layers shall not exceed 0.67 foot in un-compacted thickness.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Compact fill materials per Section 31 20 00/3-05.
- H. Provide imported soil materials conforming to Soil Type B per 31 14 00, as needed to attain finished grades of Work outside the limits of non-vegetative surface improvements.
- I. Provide imported soil materials conforming to Soil Type C per 31 14 00, as needed to attain finished subgrade of Work within the limits of non-vegetative surface improvements.
- J. When encountering soft spots (and/or pumping soil), Contractor shall over-excavate the existing soil to a minimum of three feet and allow the soil to air dry for 3 days and recompact. No extra time or additional cost is allowed.

3.05 COMPACTING:

- A. Maintain optimum moisture content of materials to attain required compaction density.
- B. Compact in layers not exceeding 0.67 foot in un-compacted thickness.
- C. Obtain minimum 95% relative compaction of soil in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements.
- D. Obtain minimum 85% relative compaction of soil in areas to receive replacement sod, other replacement vegetation, or bare ground.

3.06 PREPARATION FOR SUBGRADE FOR SURFACE IMPROVEMENTS: (such as concrete, asphalt-concrete, aggregate base, and other non-vegetative surface)

- A. Blade or disk the soil to a depth of 8 inches, and remove and dispose of (off the project site) all unsuitable material over 2.5 inches in size.
- B. Thoroughly mix, water, roll, and compact to a relative compaction of no less than 95%.
- C. Prior to commencing construction of surface improvements make sure no soft or spongy areas require repair.

- D. Repair at no additional cost to the owner, any soft, spongy, or otherwise unstable areas encountered in the subgrade, by removing the material and replacing it with acceptable materials.
- E. Conform finished subgrade, grades shown on the plans.

3.07 FINE GRADING:

- A. Fine grade all finished surfaces to grades shown on the plans.
- B. Rake and smooth all finished surfaces not to receive surface improvements.

3.08 TOLERANCES:

- A. Plus or minus 0.05 foot from planned elevation.

3.09 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed as per Section 01 40 00.
- B. Compaction testing will be performed in accordance with ASTM D 1557.
- C. If tests indicate work does not meet specified requirements, re-compact, or remove and replace, and retest.

END OF SECTION

**SECTION 31 23 00
TRENCH EXCAVATION BACKFILL**

GENERAL

1.01 SECTION INCLUDED:

- A. Excavating trenches, holes, and pits for constructing the work.
- B. Backfilling and compaction pipeline or underground structure from bedding to subgrade or finish grade elevations.

1.02 RELATED SECTIONS:

- A. Division 00 – Contract General Conditions.
- B. Section 01 40 00 – Quality Control.
- C. Section 01 50 00 – Temporary Facilities.
- D. Section 31 11 00 - Clearing of Work Site for Site Improvements.
- E. Section 31 14 00 – Soil Materials.
- F. Section 31 20 00 – Earthwork: Excavation, Filling, and Grading.
- G. Section 33 40 00 – Storm Drainage Improvements.
- H. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

1.03 REFERENCES

- A. ASTM D 1557.

1.04 COORDINATION:

- A. Coordinate work with Owner personnel.
- B. Verify that the location of existing utilities have been indicated at work site by Owner personnel.

1.05 EXISTING UTILITIES:

- A. The Engineer has indicated on the plans the location of all known existing utility facilities within the work area. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals have been shown where information was available. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- C. Contractor shall verify all utilities within the work area, including using hand method. Contractor shall protect all existing utilities not designated to be removed.
- D. Maintain all existing utility mains and service lines in constant service during construction of the work.

PART 2: PRODUCTS

2.01 FILL MATERIALS:

- A. Backfill with native, suitable materials.

PART 3: EXECUTION

3.01 REPARATION:

- A. Protect all improvements not authorized for removal.
- B. Maintain and protect above and below grade utilities to remain.
- C. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.02 EXCAVATION:

- A. Excavate soil required to locate existing utilities and install the work, use hand method as necessary in congested area.
- B. Employ equipment and methods appropriate to the work site.
- C. Cut trenches just wide enough to enable installation and proper backfill and do not interfere with 45 degree bearing splay of foundations. When excavating through tree roots, cut roots by hand.
- D. Excavate trenches to provide the minimum cover required.
- E. Excavate trenches, pits, or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings.
- F. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure.
- G. Stockpile excavated material to be returned to trench adjacent thereto in location, which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove unsuitable or excess materials not being used, from site and legally dispose of material.

3.03 BACKFILLING:

- A. Backfill from bottom of the trench to pipe grade with Type B and C soil.
- B. After installation of pipes and appurtenances then backfill of pipe with bedding material.
- C. Backfill trenches above pipe bedding material and to within 6 inches of finish subgrade with Type A, B, & C soils. Compact all soil backfill not exceeding 8 inches in uncompacted thickness. Maintain optimum moisture content of fill materials.
- D. Backfill final 6 inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type B or C soils.

- E. Backfill final 6 inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil with Type A soil.
- F. Obtain 85 percent relative compaction of backfill from bottom of backfill to a level of 2 feet below finish subgrade, and obtain minimum of 95 percent relative compaction of backfill in top 2 feet below finish subgrade, in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement.
- G. Obtain minimum of 85 percent relative compaction of backfill in areas to receive sod, other vegetation, or bare soil.

3.04 TOLERANCES:

- A. Top surface of Backfilling Under Paved or Concrete Areas: Plus or minus 0.05 feet from required elevations.
- B. Top Surface of General Backfilling: As required surface to match adjacent improvements or ground.

3.05 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00.
- B. Compaction testing will be performed in accordance with ASTM D 1557.
- C. If tests indicate work does not meet specified requirements, recompact, and retest.

3.06 PROGRESS AND PROSECUTION:

- A. Backfill any excavation opened in any day on that same day.

END OF SECTION

**SECTION 31 31 00
SOIL STERILIZATION**

PART 1: GENERAL

1-01 SECTION INCLUDES:

- A. Furnishing and installing soil sterilant under all new asphaltic-concrete pavement.

1-02 RELATED SECTIONS:

- A. Section 31 2000 – Earthwork.
- B. Section 32 1123– Aggregate Base Course.
- C. Section 32 1216 – Asphalt Concrete Paving.
- D. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications sections, apply to the work of this section.

1-03 STANDARDS:

- A. In accordance with the following:
 - CCR-T21 California Code of Regulations, Title 21 Public Works.
 - CBC California Building Code, California Code of Regulations, Title 24, Part 2, CCR-T24.
 - USDA United States Department of Agriculture.
 - EPA Environmental Protection Agency.

All applicable Environmental Regulations and Standards.

1-04 QUALITY ASSURANCE:

- A. Provide licensed operator to apply soil sterilant.
- B. All products shall comply with the current EPA laws at the time of application.

1-05 SUBMITTALS:

- A. Certificates of application.
- B. Certificates of compliance for material use.

PART 2: PRODUCTS

2-01 MATERIALS:

- A. Soil Sterilant: Treflan, weed and grass preventer, or approved equal.

PART 3: EXECUTION

3-01 EXAMINATION:

- A. Verify that the site is ready for application.

3-02 PREPARATION:

- A. Identify installation locations.
- B. Employ equipment and methods appropriate to the work site.

3-03 APPLICATION:

- A. Thoroughly water soak surface to be treated. Avoid excessive water runoff.
- B. Apply sterilant solution over surface to be paved prior to application of asphalt-concrete.
- C. Apply in spray form, at rate as allowable by State of California.

3-04 FIELD QUALITY CONTROL:

- A. Field inspection will be performed per Section 01 40 00.

END OF SECTION

SECTION 32 01 93
TREE & PLANTING PROTECTION

REISSUED SECTION - REVIEW FOR UNMARKED CHANGES

PART 1 - GENERAL

4.01 SUMMARY

- A. The work includes labor, equipment, and materials necessary for existing tree & plant protection, tree trimming and protection of the Critical Root Zone (CRZ).
- B. Contractor shall contact the zoo's arborist to perform any pruning tree or repair work recommended. If damage occurs due to construction operations, the arborist shall make repairs promptly to prevent progressive deterioration of damaged trees. Any pruning, cabling, root treatment and tying back of limbs will be per recommendation and approval by the arborist.
- C. Trees, shrubs, and other understory plants within the critical root zone that are not designated for removal shall be protected during clearing, tree removal and construction operations. Protect the root system, trunk, limbs and crown from breakage, scarring and prevent soil compaction or chemical contamination. Contractor shall prevent any contamination of the soil within the Critical Root Zone by construction materials, debris, silt, fuel, oils, concrete or any other chemical substance. Contractor shall notify the Architect of any such spills, compaction or other disturbance within the critical root zone and take immediate corrective action using methods approved by the Zoo.
- D. The contractor shall provide tree protection signage that must remain posted at designated trees inside the construction zone for the duration of the project.
- E. Related Work Specified Elsewhere:
 - 1. Section 02 4100 - Demolition
 - 2. Section 31 1100 - Clearing and Grubbing
 - 3. Section 31 2000 - Earthwork
 - 4. Section 32 9300 - Plants

4.02 QUALITY ASSURANCE

- A. The applicable provisions of the following standard publications shall apply throughout this section:
 - 1. American National Standard for Tree Care Operations - Tree, shrub, and other woody plant maintenance - standard practices, - ANSI 300 - 1995, published by American National Standards Institute, 1995.
 - 2. American National Standard for Tree Care Operations - Tree and shrub transplant standard practices

3. American National Standard for Tree Care Operations - Pruning, trimming, repairing, maintaining, and removing trees, and cutting brush - safety requirements ANSI Z133.1 - 1994, - published by American National Standards Institute, 1994.
4. Arrange a pre-construction meeting to review schedule, specifications, and tree protection operations.

4.03 SUBMITTALS

- A. Name of certified arborist for the project including certificate number and stamp.
- B. Product Data: Submit product literature with name of product manufacturer's name and compliance with specifications.
 1. Pesticides (herbicides, insecticides and fungicides, etc.)
 2. Anti-desiccant
- C. 1 lb. resealable plastic container of proposed mulch.
- D. Schedule and Work Plan: Submit detailed schedule and work plan for each part of the work.
- E. A plan of the site showing the location of protection fencing, trees to be removed

4.04 REGULATORY REQUIREMENTS

- A. Comply with rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction.

4.05 PROJECT CONDITIONS

- A. Existing Conditions
 1. Carefully examine the site before submitting a bid. Be informed of the site conditions including adjacent properties, utilities and soil conditions.
 2. Should the Contractor find any discrepancies between Drawings and physical conditions inform the Owner's representative immediately for clarification.

4.06 ENVIRONMENTAL CONDITIONS

- A. Do not perform root pruning, tree removal or tree protection work within the Critical Root Zone area at times when the soil is wet or muddy.

4.07 PRE-CONSTRUCTION COORDINATION

- A. Prior to the start of construction, the Contractor and Architect shall meet at the site and review the locations of the following:
 1. Existing trees to be protected and transplanted, trees to be removed from the site and trees to be removed and stockpiled for use in the project. The procedures and methods to be used to execute the work shall be reviewed during this meeting.
 2. Areas for stockpiling trees for permanent removal, stockpiling of trees to be removed and used as snags in animal yards, stockpiling mulch, stockpiling topsoil, concrete wash-out, stockpiling of demolition debris, storage of

construction materials, construction trailers, and other incidental contractor needs. Failure to comply with these reserved areas can result in immediate work stoppage and delays due to correction of non-compliance shall be at the contractor's expense.

4.08 TREE AND PLANT PROTECTION

- A. Operation of equipment, storage of materials, disposition of excavated material, and construction in general shall be conducted so as not to encroach into tree preservation areas. Injuries to tree trunks, branches or roots shall be the sole responsibility of the contractor. Trees and/or groups of trees and plants designated to remain shall be protected by tree protection fencing.
- B. The Contractor shall be responsible for providing any additional temporary fencing during the work as necessary to protect vegetation. Provide 6' chain link fencing or plywood boxes as required to protect trees, which are to remain free from any damage above and below grade throughout the construction period. Fencing shall extend to tree CRZ minimum. Erect and have approved by the Certified Arborist prior to commencement of demolition work
- C. Construction, when necessary and approved by the Architect, within the critical root zone shall be performed in a manner that avoids injury to the trees and their roots.
 - 1. In general, construction as designated within the critical root zone shall proceed with extreme care either by the use of hand tools or equipment that will not cause damage to the trees.
 - 2. Need for trimming of tree branches that interfere with construction shall be coordinated with the zoo' arborist. Trimming of branches and the cutting of roots shall be in accordance with accepted arboricultural practices and be performed by the Certified Arborist as designated in section 1.03.

PART 2 - PRODUCTS

5.01 TREE PROTECTION FENCING

- A. Minimum specifications – Construction style chain link fencing with concrete supports.
Panel widths to be a maximum of 8 feet.

5.02 TREE PROTECTION SIGNS

- A. Heavy-duty cardboard or metal signs 12 by 12 inches attached to 3/4 inch thick exterior grade MDO plywood (or other substrate as recommended by the sign supplier). Sign shall have a blaze orange background with black block letters, 1 inch high, with the inscription “No Construction Activity - Tree Protection Zone”.
- B. Signs shall be attached to the tree protection fence at intervals not to exceed 25 feet on center.

5.03 TREATMENT MATERIALS

- A. Pesticides: Approved before use for type and rate of application by and local, state, and federal agencies with jurisdiction.
- B. Anti-desiccant: ‘Wiltpruf as manufactured by Wiltproof Products, Inc., P.O. Box

4280, Greenwich, CT 06830, (203) 5314740, or approved substitute.

C. Chip mulch

1. Hardwood chips shall be produced by a disc style chipper, aged a minimum of six months and shall be free of non-wood material, including plastic, glass or leaves. Chips stockpiled from the tree removal operation may be used.

D. Construction Mat

1. Construction matting will consist of 3/4 inch plywood or heavy gauge steel plates with an underlayment of a minimum of six inches of wood chip mulch. The plywood or steel top layer shall only be applied where vehicle movement is anticipated and shall not be kept in place for extended periods of time.

PART 3 - EXECUTION

6.01 PREPARATION

- A. Prior to construction activity at the site, install tree protection fencing, tree protection signs and wood chip mulch as indicated in the project drawings and in accordance with the marked Critical Root Zone.
1. Signs and fencing shall not be attached to trees to be preserved.
 2. Tree protection fencing and signs shall remain intact for the length of the project. Damaged fencing or missing signs shall be repaired or replaced promptly.
 3. Fencing shall not be taken down to store equipment or materials.
- B. Do not park vehicles or equipment, store materials or stockpiled soil, dispose of building materials, chemicals, petroleum products or other detrimental substances within CRZ of protected trees. Protect plant material from flame, smoke and heat. Construction access to site shall not occur beneath drip line of plant material.
- C. Tree flagging:
1. Trees flagged for complete removal and disposal: Mark trees scheduled for complete removal and disposal with orange paint in a band completely encircling the trunk of the tree.
 2. Tree snags for animal yards: Mark trees to be saved for snags with a different color paint approved by Architect. In coordination with Architect, mark places on trees where cuts are to be made. Coordinate with Owner as to location for stockpiling of snags.
- D. Identify equipment ingress and egress pathways in the pre-construction walkthrough for inspection and approval by the Architect:
1. Equipment pathways shall avoid critical root zones, except as approved by the Architect. Any approved access within the critical root zone shall use an approved construction mat.
 2. Additional vertical clearance required for equipment access shall be reviewed and approved at the pre-construction walk-through.
 3. Equipment shall not be parked within the critical root zone.

6.02 EXISTING TREES TO REMAIN

A. General:

1. Provide 6' high chain link or 4'x4'x8' high plywood fence at tree CRZ.
2. Thoroughly water disturbed areas prior to placement of wood chip mulch.
3. Root zones shall also be protected with 12" of wood chip mulch to prevent compaction. Keep wood chip mulch 12" clear of tree trunk. Remove wood chips prior to placement of finished grades.
4. Where fencing is not possible due to obstructions, walkways, or other conflicting elements notify Architect for alternative fencing locations.
5. Restrict foot and vehicular traffic over root systems to prevent excessive compaction of soil.
6. Under no circumstances shall the Contractor remove or alter existing trees designated to remain for the convenience or ease of construction.
7. An effective silt fence of geotextile fabric supported by wood or metal fenceposts shall be maintained between sources of silt and the critical root zones.

B. Excavation Around Trees:

1. Excavate within CRZ of trees only where shown.
2. Where excavation or construction is required within CRZ, water tree thoroughly a few days before work is to begin
3. Where trenching for utilities is required within CRZ, tunnel under or around roots by hand digging. Do not cut main lateral roots or tap roots. The Contractor shall notify the Architect prior to cutting roots over 3/4" in diameter. Certified arborist shall cut roots larger than 3/4". Contractor may be allowed to prune roots with approval and direction from certified arborist. Make clean cuts.
4. Do not leave roots exposed to sun or other drying. Protect exposed roots with damp burlap or wood shavings within 1 hour of initial exposure.
5. Where excavating for new construction is required within drip line of tree, excavate by hand to minimize damage to roots and perform as follows:
 - a. Comb soil in direction of root growth to expose roots.
 - b. If main lateral roots are immediately adjacent to location of new construction cut roots three (3) inches from new construction.
 - c. Do not allow exposed roots to dry out before permanent backfill is placed.
 - d. Provide temporary cover with damp burlap or wood shavings.
 - e. Water and maintain in moist condition until covered with backfill.
6. Open trench inspections for hand dug areas
 - a. areas designated for hand digging shall require an inspection by the Architect prior to backfilling, to assess the extent of possible root loss or damage. The Architect may also require inspection in certain areas approved for excavation with mechanical equipment.
 - b. Should the contractor backfill any of these locations prior to the Architect's inspection, the Architect may require the contractor to remove the backfill material, at the contractor's expense, as necessary to complete the required inspection.

- c. The contractor shall provide the Architect with a minimum of 24 hours notice on planned excavations requiring an open trench forestry inspection.
- C. Grading and filling around trees
 - 1. Maintain existing grades within CRZ of trees unless otherwise indicated or approved by Owner. The Certified Arborist will evaluate the extent of backfilling within the tree root zone of a protected tree and make recommendations if necessary. Fill material to be per Earthwork, Planting and Soil Preparation sections.
- D. Repair and Replacement of Trees:
 - 1. Plant material protected within fencing that becomes damaged or dies shall be replaced with plant material of the same species and equal or approved size.
 - 2. Contractor to engage and pay for a certified and licensed arborist to perform tree repair work damaged by construction operations. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.
 - 3. Damaged and destroyed trees which cannot be replaced shall be paid for at the rate of \$50.00 per square inch of cross sectional area measured three (3) feet above existing grade for trees up to and including six (6) inch caliper, and at the rate of \$100.00 per square inch of cross sectional areas measured three (3) feet above existing grade for trees greater than six (6) inches caliper. This amount shall be credited to the Owner.
 - 4. Remove any damaged and destroyed trees from the site as determined by the arborist to be incapable of restoration to a normal growth pattern. Deliver to Owner. Repair the ground surface. Costs shall be borne by the Contractor.
 - 5. Replacement plants shall be in good health and approved by Owner before installation.
- E. Irrigation of Trees During Construction
 - 1. Ensure trees are irrigated during construction to maintain health of the tree.
 - 2. Water trees deeply at regular intervals and a minimum of once every two weeks during the growing season. The water should penetrate the soil to a depth of at least six inches
 - 3. Take necessary precautions to prevent over watering, excessive run-off, and erosion from occurring.
 - 4. Do not irrigate if specified irrigation requirements occur naturally through rainfall.

6.03 TREE REMOVAL

- A. Trees indicated for complete removal and disposal shall be removed in a manner that will not damage adjacent trees or cause injury to people or property.
- B. An ISA Certified Arborist shall supervise all tree removals.
 - 1. Tree removal service provider shall be experienced with tree removals in

areas of limited access.

2. No trees to be removed shall be pushed over or uprooted within 50 feet of a remaining tree's critical root zone.

C. Coordinate placement and stockpiling of removed trees with Owner.

6.04 TREE SNAGS/DEADFALLS

A. All trees tagged for preservation as snags for future use in animal yards shall be cut as directed by Architect and stockpiled in a location directed by Owner. Trees shall be cut in a manner that will not damage adjacent trees or property or cause injury to people.

1. An ISA Certified Arborist shall supervise all tree removals.
2. Tree removal service provider shall be experienced with tree removals in areas of limited access.
3. No trees to be removed shall be pushed over or uprooted within 50 feet of the critical root zone.
4. Snags shall be cut according to Architect's direction.
5. Stockpile snags in location approved by Architect.

6.05 TREE TRANSPLANTS

A. The Owner is responsible for all tree transplants prior to construction. The Contractor shall verify with the Owner

6.06 STUMP REMOVAL

- A. Location of existing and proposed underground utilities shall be identified prior to any stump removal.
- B. Stumps 12 inch diameter or greater shall be ground to a depth of 12 inches below existing grade in areas where site excavation does not occur.
- C. Wood chips, shavings, and debris from this operation shall be removed and properly disposed of or used as mulch on site if accepted by architect.
- D. Contractor shall backfill the stump holes with an approved backfill material. .
 1. Compact to 85% of the maximum dry density in areas outside of the CRZ.
 2. Compact to 80% of the maximum dry density in areas within CRZ
- E. Trees less than 12" in diameter shall be removed flush with existing grade.
- F. No stumps shall be dug or pulled within the CRZ.

6.07 TRIMMING OF EXISTING TREES

- A. Engage a qualified arborist to selectively remove branches from trees. Do not prune unless approved and directed by the Owner's representative.
- B. Cut branches with sharp pruning instruments and do no break or chop. Prune to outside edge of branch collar per ANSI pruning standards.

END OF SECTION

**SECTION 32 11 23
AGGREGATE BASE COURSE**

PART 1: GENERAL

1-01 SECTION INCLUDES:

- A. Furnishing, spreading, and compacting aggregate base course.

1-02 RELATED SECTIONS:

- A. Section 31 2000 – Earthwork: Excavation, Filling, and Grading.
- B. Section 31 3100 – Soil Sterilization.
- C. Section 32 1216– Asphalt Concrete Paving.
- D. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications sections, apply to the work of this section.

1-03 REFERENCES:

- A. SSCDOT – Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

1-04 QUALITY ASSURANCE:

- A. Furnish aggregate materials conforming with SSCDOT.
- B. Perform work in accordance with SSCDOT.

1-05 SUBMITTALS:

- A. Submit under provisions of Division 00 – Contract General Conditions.
- B. Certificates of compliance for materials.
- C. Load tags for delivered material.

1-06 COORDINATION:

- A. Coordinate with other work, including subgrade preparation and soil sterilization.

PART 2: PRODUCTS

2-01 MATERIALS:

- A. Aggregate Base: Class 2, ¾ Inch Maximum per SSCDOT.

PART 3: EXECUTION

3-01 EXAMINATION OF SUBGRADE:

- A. Verify that subgrade has been compacted to minimum of 95 percent relative compaction and is dry.

- B. Verify elevations of subgrade are correct.

3-02 INSTALLATION OF AGGREGATE BASE COURSE

- A. Furnish and install in conformance with SSCDOT Section 26, Aggregate Bases.
- B. Thickness – As shown on construction drawings.
- C. Spreading and Compacting – In accordance with SSCDOT. The relative compaction of each layer of compacted base material shall not be less than 95 percent.

3-03 TOLERANCE:

- A. Finished Surface: The surface of the finish aggregate base at any point shall not vary more than 0.03 feet above or below the specified grade at that point. No more than 50% of the finish surface shall be above or below the specific grade for aggregate base.

3-04 FIELD QUALITY CONTROL:

- A. Field inspection and testing will be performed per Section 01 40 00.

END OF SECTION

SECTION 32 12 16
ASPHALTIC CONCRETE PAVING

PART 1: GENERAL

1-01 SECTION INCLUDES:

- A. Asphaltic concrete paving.
- B. Seal Coat.

1-02 RELATED SECTIONS:

- A. Section 31 20 00 – Earthwork: Excavation, Filling, and Grading.
- B. Section 32 11 23 – Aggregate Base Course.
- C. Section 31 31 00 – Soil Sterilization.
- D. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications sections, apply to the work of this section.

1-03 REFERENCES:

- A. SSCDOT – Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

1-04 QUALITY ASSURANCE:

- A. Perform work in accordance with SSCDOT.
- B. Mixing Plant: Conform to SSCDOT.

1-05 SUBMITTALS:

- A. Certificates of compliance for materials.
- B. Load tags for delivered material.

1-06 COORDINATION:

- A. Coordinate with other work, including subgrade preparation and soil sterilization.

1-07 ENVIRONMENTAL REQUIREMENTS:

- A. Do not place asphalt-concrete when atmosphere temperature is less than 50 degrees F, or surface is wet or frozen.

PART 2: PRODUCTS

2-01 MATERIALS:

- A. Paint Binder: In accordance with SSCDOT, Asphaltic Emulsions.
- B. Asphalt – Concrete: Type B in accordance with SSCDOT, ½ inch maximum aggregate (medium). The asphaltic concrete should be compacted to an average relative 95 percent based on a 50 blow Marshall maximum density. Use asphalt binder performance grade PG 64-10. The bitumen ratio shall be no less 3 and no more than 7 pounds of asphalt per 100 pounds of dry aggregate.
- C. Seal Coat: Asphalt based seal coat shall be “Tot Coat” as manufactured by Industrial Asphalt, Irwindale, California, or approved equal.

PART 3: EXECUTION

3-01 EXAMINATION:

- A. Verify that subgrade has been compacted to required relative compaction and is dry.
- B. Verify elevations of base are correct.
- C. Verify the subgrade has been sterilized per 31 31 14.

3-02 BASE:

- A. Furnish and install aggregate base course per Section 32 11 23.

3-03 PREPARATION – PAINT BINDER:

- A. Apply paint binder to existing asphalt-concrete or concrete surfaces which will be in contact with asphalt concrete surfacing.
- B. Rate of application for all surfaces against which asphalt concrete is to be placed shall be no less than 0.02 and no more than 0.05 gallons per square yard. All vertical concrete surfaces which will be in contact with asphalt concrete surfacing and all areas now in place which will be covered with new surfacing materials and feathering operations shall be coated with a paint binder applied at the rate of 0.05 gallons per square yard.

3-04 INSTALLATION OF ASPHALTIC – CONCRETE:

- A. Install in conformance with SSCDOT, Asphalt Concrete.
- B. Thickness – As shown on construction plans: Asphaltic concrete shall be laid to the thickness designated on the Plans. The Contractor shall lay the asphaltic concrete to a depth required to insure that, after compaction, the in place compacted thickness is equal to or greater than the specified plan thickness. The maximum layer of asphalt concrete thickness shall not exceed 3 inches.
- C. Asphalt type: PG 64 – 10
- D. Compaction Equipment – In accordance with Section 39, SSCDOT.

3-05 INSTALLATION OF SEAL COAT:

- A. A minimum of 21 days waiting period is required for new pavement to receive seal coat. B.

Immediately prior to applying the sealer, the surface shall be cleaned of all loose material which might adversely affect bonding of the sealer.

- C. A prime coat of SS-1 asphalt emulsion diluted with water, to 5 parts water to 1 part asphaltic emulsion, shall be applied to all existing (not new) pavement surfaces at a rate of application of 0.05 to 0.10 gallon of diluted primer per square yard.
- D. Following the prime coat, two coats of asphalt based seal coat shall be applied. The first coat shall have added to it a silica sand mineral filler, which has passed a 50-mesh screen, at a rate of 2 to 3 pounds per 1 gallon of concentrated sealer. When the first coat is dry enough to walk on without picking the material up, a second coat shall be applied without mineral filler. If the manufacturer indicates that the product may be diluted, it may be diluted with no more than 20 percent by volume clean fresh water with the prior approval of the Engineer. The total application rate shall be a minimum of 35 to 45 gallons of undiluted product per 1,000 square feet, as directed by the Engineer. The finished surface shall be smooth and uniform in appearance. If existing depressions are such that aggregate still protrudes after the second coat of asphalt based sealer has been applied, the Contractor shall apply a third coat when so directed by the Engineer.
 - 1. Seal Coat (for new pavement) – a minimum of 20 gallons of undiluted product per 1,000 square feet, as directed by the Engineer.
- E. Protect sealed surface until it is cured.

3-06 TOLERANCES:

- A. Flatness: Maximum variation of $\frac{1}{4}$ inch measured with 10-foot straight edge.
- B. Scheduled Compacted Thickness: Within $\frac{1}{4}$ inch.

3-07 FIELD QUALITY CONTROL:

- A. Field inspection and testing will be performed by Section 01 40 00.

3-08 PROTECTION:

- A. Immediately after placement, protect pavement from mechanical injury.

END OF SECTION

**SECTION 32 1316
SITE CONCRETE PAVING**

1.01 SECTION INCLUDES

A. Concrete sidewalks.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and

Mass Concrete; American Concrete Institute International ; 1991 (Reapproved 2002).

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International ; 2010.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International ; 2000.

D. ACI 305R - Hot Weather Concreting; American Concrete Institute International ; 2010.

E. ACI 306R - Cold Weather Concreting; American Concrete Institute International ; 2010.

F. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete ; 2007.

G. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete ; 2007.

H. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement ; 2009b.

I. ASTM C33 - Standard Specification for Concrete Aggregates ; 2011.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens ; 2010.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete ; 2011.

L. ASTM C150 - Standard Specification for Portland Cement ; 2011.

M. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete ; 2010a.

N. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete ; 2007.

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete ; 2010a.

P. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete ; 2008a.

Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types) ; 2004 (Reapproved 2008).

1.04 SUBMITTALS

A. Product Data: Provide data on joint filler, admixtures, and curing compound.

B. Concrete mix designs.

C. Contractor's certification that mix designs are compatible with all additives, admixtures, surface color treatments, form release agents and curing methods.

1.05 QUALITY ASSURANCE

A. Mock-ups

1. Prior to construction, provide (1) 4-foot x 4-foot x 4-inch sample of each paving type specified on Drawings and schedule.
 2. Ensure that each mock-up contains joint types specified on project, i.e. construction, contraction, and expansion.
 3. Locate mock-ups in a conveniently accessible and protected place. Approved mock-ups will be standard for future paving installation review.
 4. Remove mock-ups from site upon completion of Work and approval by Owner's representative.
- B. Installers: Company approved by manufacturer of surfaces / textures with 3 years' experience in work of similar complexity and type.
- C. Provide all additives or admixtures from same manufacturer for compatibility.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

- A. Comply with applicable requirements of ACI 301.

2.02 FORM MATERIALS

- A. Form Materials: Conform to ACI 301.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751).
1. Thickness: 1/2 inch.
- C. Strippable cap for joint filler :
1. Superior Profiles Inc.; Voidcap 21A-VC-500 (1/2").
 2. Vinylex; Expansion board cap #941 (1/2")

2.03 REINFORCEMENT

- A. Steel Welded Wire Reinforcement: Plain type, ASTM A 185/A 185M; in flat sheets; unfinished. 6 x6 W2.1 x W2.1
- B. Dowels: ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.

2.04 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150 Normal - Type I portland type, grey color.
- C. Fine and Coarse Mix Aggregates: ASTM C33.
- D. Fly Ash: ASTM C618, Class C or F.
- E. Water: Clean, and not detrimental to concrete.
- F. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length. Comply with ASTM C 116 - Type III
1. Acceptable Products:
 - a. Fibermesh; Fibermix Stealth - 1/4" long: www.fibermesh.com
 - b. Grace Construction Products; MicroFiber: www.graceconstruction.com
- G. Shrinkage Reducing Admixtures: ASTM C 157 .
1. Acceptable Manufacturers:
 - a. Grace Constructions; Eclipse Shrinkage Reducing Admixture www.Graceconstruction.com
 - b. Not used.

H. Water Reducing Admixtures: ASTM C 494/C 494M, Type A - Water Reducing.

1. Acceptable Manufacturers:

a. Grace Constructions; WRDA: www.Graceconstruction.com

b. Master Builders, Inc; Pozzolith: www.basf-admixtures.com

c. Not used.

I. Integral Concrete Coloring Admixture - ASTM C979-82 - Standard Specifications for Pigments for Integrally Colored Concrete.

1. Acceptable Manufacturers:

a. L.M. Scofield: www.scofield.com

b. Colorfull by Admixtures, Inc.: www.Admixtures.biz

c. Davis Colors, Inc.: www.daviscolors.com Basis of Design (color numbers in schedule)

d. Basis of Design Colors for Type 1:

1) Color A - Davis Colors Omaha Tan - 5084

2) Color B - Davis Colors Adobe - 61078

3) Color C

J. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.05 ACCESSORIES

A. Calcium Chloride Retarder:

1. Conforming to ASTM D 98, in predissolved flake or pellet form. Use at imprinted paving and "washed" concrete paving .

B. Curing Compound: ASTM C 309, Type 1, Class A. Use only products acceptable to integral color manufacturers.

C. Matte finish clear sealer: Use only products acceptable to special integral color manufacturers.

D. Joint Sealant: Type Traffic as specified in Section 079005. Match color to adjacent integral colored concrete.

E. Sand: Clean builder's sand for broadcast into joint sealer to match adjacent material's texture.

F. Sealer: Basis of design – Scofield Cementone water-based modified acrylic clear sealer

1. Medium duty

2. Low gloss

3. Minimal color alteration

2.06 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

E. Concrete Properties:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3000 psi.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Water-Cement Ratio: Maximum 40 percent by weight.
4. Maximum Aggregate Size: 3/4 inch.

2.07 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted granular base is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. Crushed gravel for base course shall consist of clean, hard, durable particles conforming to Texas Department of Transportation, compacted to 95% modified Proctor test. Omit where indicated on drawings.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole, catch basin, and drain frames with oil to prevent bond with concrete pavement.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.
- D. Apply form release agents where needed.

3.05 REINFORCEMENT

- A. Place reinforcement at midheight of slabs-on-grade.
- B. Interrupt reinforcement at expansion joints.
- C. Minimum cover per IBC requirements and ACI standards.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints

occur.

D. Finish surface to slopes and elevations indicated. Cross slopes for walks maximum 2%;

walks with greater than 2% cross slope to be replaced at no additional cost to Owner.

3.08 JOINTS

A. Definitions

1. Expansion or isolation joints – through-slab joints along length of walk with filler material up to 1/2" of final surface. Fill with approved sealant after concrete cured. For concrete heat expansion, ease of repair or to separate slabs from other parts of a structure.

2. Contraction Joint - saw cut joint for concrete crack control.

3. Construction Joint - pouring layout joint for convenience of Contractor. Locate where a contraction joint would occur. Tool top to have the appearance of a contraction joint.

B. Place ½ inch wide expansion joints at 15 foot maximum intervals and to separate paving from vertical surfaces, other components and in pattern indicated.

1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.

2. Secure to resist movement by wet concrete.

3. Apply sealants and backer materials to expansion joints per manufacturer's recommendations. Sand joints immediately after, with aggregate to match adjacent paving finishes.

C. Contraction Joints:

1. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/4 into depth of slab. Do not overcut.

D. Provide keyed construction joints as required for pouring sequence.

1. Tool Joint at pedestrian and vehicular paving surface, to 1/4 depth of paving thickness.

2. Provide smooth dowel per drawings at vehicular paving areas.

3.09 GENERAL WALK PAVING TECHNIQUE

A. General walk paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

B. Place curing compound on exposed concrete surfaces immediately after finishing has

been completed. Apply in accordance with manufacturer's instructions.

3.10 JOINT SEALING

A. See Section 07 9005 for joint sealer requirements.

3.11 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

C. Cross slopes of public areas are not to exceed 2% slope.

3.12 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests.

1. Provide free access to concrete operations at project site and cooperate with appointed firm.

B. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three

concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

END OF SECTION

**SECTION 32 15 40
CRUSHED STONE SURFACING**

PART ONE - GENERAL

1.01 SUMMARY

A. Section
Includes:

1. Work in this section consists of furnishing, placing and compacting stabilized soil paving and stabilized soil paving with binder for pedestrian and other pathways as shown on the drawings.

1.02 RELATED WORK

- A. Section 03 30 00 Cast in Place Concrete: Aggregate used in this same section is the same aggregate used in Seeded finish.
- B. Section 31 10 00 Site Clearing, for removal of existing paving and layout
- C. Section 32 1123 Crushed Rock: base course where shown on drawings.
- D. Section 32 91 13 Soil Preparation: for soil components

1.03 SUBMITTALS

- A. Product Data:
 1. Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit for the Architect's approval:
 - a. Sieve analysis of aggregate materials.
 - b. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - c. Certificates of compliance with the specified standards for natural materials and manufactured items.
 - d. Materials list of items proposed to be furnished under this section.
- B. Samples:
 1. Provide samples of any materials requested by the Owner's Testing Laboratory.
 2. Submit 1/2-cubic foot sample of stabilized soil surfacing for the Architect's approval.
 3. Provide a 6 x 10 foot sample of installed stabilized soil paving in accordance with the specified requirements for the approval in writing of the Architect prior to construction of any additional stabilized soil paving. Maintain sample as a quality control measure throughout the performance of the work.

1.04 QUALITY ASSURANCE

- A. Standards:
 1. Comply with pertinent provisions of following standards, in case of conflict between referenced standards, the more stringent requirements shall govern.
 2. American Society for Testing and Materials (ASTM), latest edition.
 3. American Association of State Highway and Transportation Officials, Specifications for Materials (AASHTO), latest edition.
- B. Tests and Inspections:
 1. The Owner will provide a qualified testing laboratory to observe and test

placement of aggregate in accordance with the specifications.

2. Tests will include inspection of subgrade prior to placing aggregate, inspection and testing of materials after mixing, and compaction tests to determine compliance with specification requirements.

C. Grading Tolerance:

1. Construct grades described in this section within a tolerance of plus or minus five-hundredths (0.05) foot maximum variation in any ten-foot length from the grades shown on drawings.

D. Surface Drainage:

1. No area of the finished paving will hold water.

E. Installer Qualifications:

1. Installer to provide evidence to indicate successful experience in the installation of products in this Section or approval by manufacturer.

1.05 JOB CONDITIONS

A. General:

1. Provide protection of all natural and man-made elements in compliance with applicable provisions of current state and federal safety and health standards and acts, codes and ordinances.
2. Carefully maintain bench marks, monuments and other reference points. Replace as directed if disturbed or destroyed.

B. Protection From Water Accumulation:

1. Perform all operations in a manner which continuously allows proper disposal of surface run-off and prevents accumulation of water potentially causing soft areas impeding Work. Before leaving after each workday perform such operations as may be necessary to minimize possible damage or work slowdown caused by rain.

PART TWO - PRODUCTS

2.01 AGGREGATE BASE

- A. Provide a 3" thick base course of Class 2 Aggregate Base (CalTrans Standard Specification Section 26) compacted to 95%.
- B. Install aggregate base according to Section 321123 of these Specifications.

2.02 STABILIZED SOIL PAVING

A. Manufacturers

1. Stabilizer Solutions Paving Material, as provided by Stabilizer Solutions, Inc.; www.stabilizersolutions.com Color: Santa Fe Gold.

B. Aggregate Specifications: Crushed stone shall consist of inert materials that are hard, durable, with stone free from surface coatings and deleterious materials, or approved decomposed granite.

1. Gradation

Sieve Designation: Percentages Passing (by Weight)

3/8 inch	100
----------	-----

No. 4	90-100
No. 8	75-80
No. 16	55-65
No. 30	40-50
No. 50	25-35
No. 100	15-20
No. 200	10 to 15

2. R-value (wear resistance) minimum of 70 determined by ASTM D 2488 Methodology.
 3. Sand equivalent (proportion of sand to silt and clay) will stay at a range of 30-55 determined by ASTM D 2419 Methodology.
- C. Stabilizer binder: non-toxic organic binder in a colorless and odorless concentrated powder.

PART THREE - EXECUTION

3.01 SUBGRADE PREPARATION

- A. General:
1. Prepare subgrade in conformance with all requirements of Section 32 91 13, Soil Preparation.
 2. Blend soil stabilizer at rate-per-ton recommended by product manufacturer for the selected aggregate.

3.02 MIXING

- A. Mix soil stabilizer material with aggregate per the manufacturer's directions. Do not allow material to get wet until finally placed; do not blend in bucket or with rakes and shovels. Use proportions of stabilizer as recommended for type of aggregate.

3.03 PLACEMENT AND COMPACTION

- A. Layer Thickness:
1. Place stabilized soil surfacing at a 4" compacted depth for heavy foot and light vehicle traffic. Install in 2 each 2" lifts.
- B. Watering: after placement and leveling, apply water at manufacturer's recommended rate for full saturation of stabilized soil.
- C. Placement:
1. Compaction may be achieved using a 5-ton double-drum roller or similar equipment.
 2. Compact material, making 8-10 passes.
 3. Remist top surface if it dries before final compaction.
 4. Use plate compactor on edges and areas inaccessible to large equipment.
 5. Loose material shall not be present on final surface.
 6. Hand tamp near irrigation and planting so as to not disturb irrigation systems.

3.04 WATERING

- A. Water the final surface with a light spray following compaction. Contractor shall take care as to not disturb the final surface with spray action.

3.05 INSPECTION

- A. Inspection and Repair of Stabilized Soil Surfacing:
 - 1. Finished surface shall be smooth, uniform and solid, with no evidence of chipping or cracking. Dried, compacted surfacing shall be firm all the way through with no spongy areas. No ruts shall be present.
 - 2. Loose material shall not be present on the surface.

END OF SECTION

**SECTION 32 17 00
PAINTING AND MARKING SITE SURFACES**

PART 1: GENERAL

1-01 SECTION INCLUDES:

- A. Furnishing and installing paint to curb, and parking lot on asphalt concrete surfaces.

1-02 RELATED SECTIONS:

- A. Section 32 12 16 – Asphalt Concrete Paving.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

1-03 REFERENCES:

- A. SSCDOT – Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment and to furnishing of materials by State.

1-04 SUBMITTALS:

- A. Submit under provisions of Division 0 – Contract General Conditions.
- B. Certificates of compliance for material.

1-05 COORDINATION:

- A. Commence striping or marking of asphalt concrete no sooner than 7 days following any sealing of the asphalt concrete.

PART 2: PRODUCTS

2-01 MATERIALS:

- A. Paint: Quick drying, high visibility water soluble acrylic striping paint; Stripe Master, Wikel Mfg. Company, or similar by Sherwin – Williams, J.E. Bauer, or PPG, or approved equal.
- B. Paint shall be of color indicated on the construction plans.

PART 3: EXECUTION

3-01 EXAMINATION:

- A. Verify that site is ready for application.

3-02 PREPARATION:

- A. Identify installation locations as shown on plan.
- B. Thoroughly clean all surfaces to be painted.
- C. Employ equipment and methods appropriate to the work site.

3-03 INSTALLATION:

- A. Apply paint striping and marking as indicated on the plans..
- B. Apply paint uniformly, straight and true, with equipment designed for striping and marking applications.
- C. Apply paint striping and marking per SSCDOT, except supply paint conforming to 02861/2-01.
- D. Apply a minimum of 2 coats of paint at all striping and marking locations, including asphalt concrete surfaces.

3-04 FIELD QUALITY CONTROL:

- A. Field inspection will be performed by the Inspector.

END OF SECTION

SECTION 32 31 13: CHAIN LINK FENCING AND GATES

PART 1: GENERAL

1.01 DESCRIPTION

Work Included: Provide all labor, material and services necessary to complete installation of chain link fencing and gates as required by the drawings and specified herein, including concrete foundations.

B. Related Work Specified Elsewhere:

1. Mowstrips, see Site Concrete Section 32 16 13
2. Exit devices or lever latch, see Finish Hardware 08 71 00. (Furnish only)

1.02 INCORPORATED DOCUMENTS

In addition to the Codes and Standards listed in Section 01 10 00, the published specifications, standards and methods of the trade cited below shall apply to work of this Section.

A. Chain Link Fence Manufacturers Institute.

1.03 SUBMITTALS

Submittals shall be in accordance with SUBMITTALS Section and shall include complete shop drawings and manufacturer's product literature describing all materials.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the work of other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Architect and at no additional cost to the Owner.

PART 2: PRODUCTS

2.01 FRAMING MATERIALS

- A. Posts, gate frames, braces, rails, stretcher bars, and truss rods shall be of steel. Reinforcing wires shall be of high carbon steel. Gate hinges, post caps, barbed wire supporting arms, stretcher bar bands, and other parts shall be of steel, malleable iron, ductile iron or approved equal. All parts shall be formed accurately to dimension.
- B. All steel and iron parts shall be hot dip galvanized after fabrication, conforming to ASTM- A153. Zinc-coated surfaces shall be free from imperfectly coated spots.

- C. Pipes greater than 2" O.D. for backstops shall meet ASTM A53, Grade B, Type E or S, galvanized per Paragraph B above. Sizes/weights are specified on the Drawings.
- D. Posts, gate frames, rails, chain-link fabric, and braces shall conform to the specifications, dimensions and weights as shown on the Drawings or the Chart at Para. 2.06:
 - 1. Posts shall be of the lengths required and shall be round pipe.
 - 2. Post Braces shall be provided for each gate, corner, pull, and end post for use with fabric 5' or more in height, and shall consist of a tubular brace extending to each adjacent line post at mid-height of the fabric, and a truss consisting of a rod not less than 3/8" in nominal diameter from the line post back to the gate, corner, pull, or end post, with a turnbuckle or other equivalent provision for adjustment.
 - 3. Post Tops shall consist of ornamental tops, as required by the drawings. The top shall be provided with an opening for the through passage of the top rail. The post tops shall fit over the outside of posts and shall exclude moisture from round posts.
- E. Top Rails shall be round pipe, shall be in lengths not less than 18' and shall be fitted with couplings for connecting the lengths into a continuous run. The couplings shall be not less than 6" long, shall provide a substantial connection, and shall allow for expansion and contraction of the rail. Suitable tie clips shall be provided in sufficient number for attaching the fabric securely to the top rail at intervals not exceeding 2'. Means shall be provided for anchoring the top rail to each gate, corner, pull and end post.
- F. Stretcher Bars (galvanized in accordance with ASTM A153) shall not be less than 3/16" x 3/4" and shall be of lengths 1" less than the full height of the fabric with which they are to be used. The stretcher bars shall be arranged for attaching to the fabric by threading through the fabric, by clamps, or by other positive mechanical means. One stretcher bar shall be provided for each gate, and end post, and two for each corner and pull post.
- G. Clips or Ties shall be of adequate strength and, provided in sufficient number for attaching the fabric to all line posts at intervals not exceeding 15".
- H. Bands or Clips shall be of adequate strength and, provided in sufficient number for attaching the fabric and stretcher bars to all terminal posts at intervals not exceeding 15".
- I. Bottom Reinforcing Wires (or bottom rails where shown) shall be of coiled spring wire not less than #7 gage. Tie clips shall be provided for attaching each wire to the fabric at intervals not exceeding 2'.

2.02 FABRIC

- A. Fabric shall be 1" mesh, 9 gage, steel, knuckled salvage top and bottom. Fabric shall be hot dipped galvanized before weaving, with a minimum coating weight of 1.2 ounces per square foot, conforming to ASTM A 392, Class I, after which shall be coated with a black vinyl coating. Fabric shall be furnished with knuckling at all selvages. The knuckled selvaqe shall be used along all corners and edges.
- B. Hook Bolts: Provide 3/8" diameter galvanized bolts, designed to be cast into concrete mow strip at bottom of fence and to hook over bottom reinforcing wire and fabric. Provide at center of each fencing panel.
- C. Fabric shall be fastened to top mail (and bottom rail where shown) with clips or ties not exceeding 15".

2.03 GATES

- A. Gates shall be swing or sliding as required by the drawings, complete with latches, stops, hatchbacks, keepers, hinges, or rollers and roller tracks and secure latching-in system with padlock provision, and all other hardware as required and shown on the Drawings. Gates on accessible path of travel (indicated on the Drawings) shall comply with all accessibility requirements of ADA and CBC for doors, and contain provisions for an exit device or accessible lever type hardware per the applicable Hardware Group.
1. Frames shall be constructed of round pipe constructed in a manner to provide a rigid frame with ample strength to prevent sag and twist.
 2. Fabric shall be the same type as used in the adjacent fence construction. The fabric shall be attached securely to the gate frame at intervals not exceeding 15".
 3. Hinges shall be a heavy pattern, of adequate strength for gate, and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person.
 4. Latches, Stops and Keepers shall be provided for all gates. Latches shall have the plunger-bar and arranged to engage the gate stop, except that for single gates for openings less than 10' wide a forked latch may be provided. Latches shall have provisions for locking. Stops shall consist of a device arranged to be set in concrete and to engage the plunger of the bar latch, except that for single gates for openings less than 10' wide other approved types of stops may be provided. Keepers shall consist of a mechanical device for securing and locking the free end of the gate when in the open position.
 5. Single-leaf gate, as scheduled and shown on the Drawings, either (1) handicap accessible from inside or outside (with lever latch and bottom kickplate), (2) handicap accessible exit gate, with panic inside and pull on the outside, bottom kickplate, and security screen inside as shown, or (3) neither accessible nor an official "exit".
 - a. General. All single-leaf gates shall have a locking latch, stop plates and keeper (consisting of a mechanical device for locking the free end of the gate in the "open" position). Locking latch shall be either a padlock or a keyed lock as further described or shown.
 - b. Provide a kickplate for accessible gates to be installed securely as detailed, with gate frame all around, using 16 ga. stainless steel: Frame shall be approx. 2" clear above grade.
 - c. If Drawings require a latch for accessibility (not an exit device), offset the frame around the latch (maintaining gate strength), providing a "sandwich" of 16 ga. stainless steel plates to receive the latch device, and provide 13 ga. steel box receive the bolt, as detailed.
 - d. If the Drawings show an "exit" gate and require an exit device, provide a pair of horizontal frame members with a stainless steel plate each side, the interior face to receive the exit device and keyed lock on the exterior, and the strike as required (sim. to c. above). Provide security screening as shown on details, using stainless steel perforated sheet, 18 ga., # 4 finish, 3/16" round holes at 1/4" on-center stagger (equal to McNichols Co.), fastened with #6 S.S. STS screws at 5"o.c. to supports or as detailed.
 6. Double Gates: Latches, Stops and Keepers shall be provided for all paired gates for vehicular access or maintenance use. Latches shall have the plunger-bar and arranged to engage the gate stop, except that for single gates for openings less than 10' wide a forked latch may be provided. Latches shall have provisions for locking. Stops shall consist of a device arranged to be set in concrete and to engage the plunger of the bar latch, except that for a single leafs for openings less than 10' wide other approved types of stops may be provided. Keepers shall consist of a mechanical device for securing the free end of the gate when in the fully open position.
 7. Make provision for and furnish and install lock boxes where shown on the Drawings. Provide "Knox-Box", Series 3200 with hinged door, heavy-duty high-security key box that stores keys,

recessed mounted; purchase and apply local Fire Department standard padlock and key, placing key in the above key box.

8. Hardware Section shall provide exit devices or lever latches, this Specification 32 31 13 shall be responsible for installing them.
9. Gates in path of Exit discharge or as shown on the Drawings shall have panic hardware, with all preparation of gate and posts to receive such.

2.04 FABRICATION

- A. All welding shall conform to the requirements of the California Building Code, CBC, Chapter 22A.
 1. Where the galvanized surface has been burned by welding, all surfaces of the welded connections shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed. The damaged area and weld shall then be painted in accordance with the following:
 - a. All galvanized, welded, or damaged surfaces that are to be painted shall first be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.
 - b. After washing, all areas shall be roughened by abrasive blasting using an abrasive that is no larger than 30 mesh. Galvanizing shall not be removed by this operation.
 - c. After preparation, all galvanized surfaces that are to be painted shall be covered with one application of Zinc Dust-Zinc Oxide Primer. Federal Specification TT-P-641, Type II. The Zinc Dust-Zinc Oxide paint shall be applied by spraying to produce a complete covering of the galvanized surface.
 - d. After the application of the Zinc Dust-Zinc Oxide paint, one application of Pre-Treatment, Vinyl Wash Primer, Section 91-2.07 of the State Standard Specifications, shall be applied to such surfaces. The Vinyl Wash Primer shall be applied by spraying to produce a uniform wet film on the surface.
 - e. Such surfaces shall then be covered with two separate applications of White Tint Base Vinyl Finish Coat, Section 91- 2.22 of the State Standard Specifications, sufficient to completely cover the preceding color. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the second application. After drying for 24 hours, one application of Aluminum Paint, Finish Coat, Section 91- 2.08 of the State Standard Specifications, shall be painted on the welded area.

2.05 CONCRETE

- A. Mowstrips. See requirements of SITE CONCRETE Section 03 30 01 or details on Drawings for quality standards.
- B. Post Foundations. See requirements of Cast-in-Place Concrete, Section 03 30 01.

PART 3: EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspection:
 1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 2. Verify that chain link fencing and gates may be installed in strict accordance with the original design and the approved Shop Drawings.
- B. Discrepancies:
 1. In the event of discrepancy, immediately notify the Architect.

2. Do not proceed with installation in areas having discrepancies until all such conditions have been fully corrected.

3.02 FENCE INSTALLATION

- A. General: Install all chain link fencing and gates in strict accordance with the original design and the approved Shop Drawings, and in accordance with the manufacturer's published recommendations.
- B. All posts shall be set in concrete footings as shown on the Drawings to within 3 inches of bottom.
- C. All vertical line and end posts shall be braced to the nearest adjacent vertical post with galvanized horizontal braces as shown on the Drawings.
- D. Perimeter fencing chain link fabric shall be fastened to the outside of the fence. Fabric on the fence shall be fastened to the fence. All fabric shall be stretched and securely fastened to the posts, as follows: The fabric shall be fastened to end, corner and gate posts with 1/4 inch by 3/4 inch stretcher bars and not less than 1/8 inch by 3/4 inch stretcher bar bands space at one foot intervals for whatever widths of fabric are supplied. The fabric shall be fastened to line posts with tie wires or post clips. Tie wires shall be at least 9 gauge (0.148" diameter) steel. Post clips shall be given at least one complete turn. Hop rings shall be closed with ends overlapping. The distance from the selvage to the braces or top rails shall be 2 inch maximum and shall be fastened to the brace or rail by wire fasteners spaced at approximately 14 inches with a minimum of 8 fasteners per each 10 foot horizontal span.

* * * * *

SECTION 32 32 46
NATURAL STONES INSTALLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Natural boulders for placement along the visitor path and in landscape, as indicated on the drawings.
- B. Natural boulders for embedment in shotcrete in and around the exhibit areas, as indicated on the drawings.
- C. Rock mulch.
- D. Rubble
barrier

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete
- B. Section 03 37 10 - Shotcrete
- C. Section 31 20 00 - Earthwork
- D. Section 32 15 40 - Crushed Stone Surfacing

1.03 SUBMITTALS

- A. Provide available colors of materials for concrete seeding and rock mulch for selection by Architect.

1.04 PRODUCT HANDLING

- A. Protection:
 - 1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed Work and materials of all other trades.
- B. Replacements:
 - 1. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 NATURAL BOULDERS AND ROCK

- A. Includes material to be used at visitor paths and material to be embedded in shotcrete at Exhibit Pools.
 - 1. Type 1: Natural boulders per as scheduled.
 - 2. Type 2: Rounded aggregate - 1 x 4 round rock
 - 3. Type 3: Drain rock - CalTrans type 2 permeable material
 - 4. Type 4: Seeded cobble used in Shotcrete

2.02 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of Architect.

PART 3 EXECUTION

3.01 SUB-GRADE PREPARATION

- A. Conform to all requirements of Section 31 20 00 Earthwork, except as specifically modified herein.

3.02 INSTALLING BOULDERS AT VISITOR PATH AREAS, LANDSCAPE AND DEMONSTRATION SEATING AREA

- A. General:
 - 1. Provide all required equipment to install select boulders and stone seating.
 - 2. Employ equipment to minimize damage to the weathered surface of the stones.
- B. Installation:
 - 1. The location of individual stones on site will be under the field direction of Architect.
 - 2. Architect may select individual stones or groups of stones of a specific character for location in any given position.
 - 3. Final placement, height above finish grade, size of stone exposed, etc., shall be determined in the field.
 - 4. In general stones shall be installed so that one-third of the stone is below the finished grade and the weathered side exposed.
 - 5. Stones installed in fill areas shall be installed following the installation of the fill. Excavate for stones and then backfill as required with the specified fill material.

3.03 INSTALLING BOULDERS AT EXHIBIT POOLS

- A. Installation of natural rock materials at exhibit pool is to be done by the shotcrete contractor.
- B. Do not obstruct drainage routes along sloped pool bottoms.

END OF SECTION

SECTION 32

8423

UNDERGROUND SPRINKLERS

PART 1 GENERAL - PERFORMANCE REQUIREMENTS AND GUIDE FOR A BIDDER-DESIGN SYSTEM

1.01 SECTION INCLUDES

- A. Pipe and fittings, valves, sprinkler heads, and accessories.
- B. Control system.
- C. Mainline assembly at point of connection

1.02 RELATED DOCUMENTS

- A. Project documents for the irrigation system do not include complete design, installation details or materials selection. Materials indicated on the bid documents and designs shown are required for the project. Use design data provided in the drawings including but not limited to the mainline location, irrigation controller location, irrigation head layout, and low volume irrigation system location. Final detailing, engineering, materials and product selection needed for complete operable system is the responsibility of the contractor. All documentation showing final design, details, and materials must be submitted, reviewed and approved by the Architect prior to fabrication and installation.
- B. Contractor must adhere to all state, local, and other ordinances that apply to this work.
- C. Supply materials, fittings, valves, wiring and labor to install a fully functional automatic sprinkler system connected to the existing Calsense system. Restore any existing landscape disturbed by the installation.
- D. The Contractor must walk site with the Owner's representative and make itself aware of existing drawings and site conditions and develop an inventory of connections that will be required to make adjacent zonal valves fully restored to service at project completion.
- E. Substitutions of products: At systems that will connect to existing in ground system, use products that are duplicates of existing systems or the updated version of the same products. For new connections, review product selection with Owner prior to ordering. Do not make substitutions without prior approval of Owner.

1.03 RELATED REQUIREMENTS

- A. Section 31 23 16 - Trench Excavation and Backfill: Excavating for irrigation piping.
- B. Section 31 23 23 - Soil Materials: Backfilling for irrigation piping.
- C. Section 32 93 00 Plants: Planting layout and installation

1.04 REFERENCE STANDARDS

- A. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.
- B. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2005.
- C. ASTM D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate piping layout to water source, location of sleeves under pavement, location and coverage of sprinkler heads, components, plant and landscaping features, site structures, schedule of fittings to be used.
- B. Product Data: Provide component and control system and wiring diagrams.
- C. Samples: Provide one outlet of each type, with housing. Accepted samples may be used in the Work.
- D. Record Documents: Record actual locations of all concealed components piping system.
- E. Operation and Maintenance Data:
 - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of products in system.

1.08 PRE-INSTALLATION MEETING

- A. Convene one week prior to commencing work of this Section.

1.09 COORDINATION

- A. Coordinate the work with site backfilling, landscape grading and delivery of plant materials.

PART 2 PRODUCTS

2.01 IRRIGATION SYSTEM

- A. Electric solenoid controlled underground irrigation system, with pressure blow-out drain.
 - 1. Source Power: 120 volt, 2.0 A, 1 phase.
 - 2. Low Voltage Controls: 24 volt, 0.12 A.
 - 3. Manufacturers:
 - a. Calsense Central control irrigation system compatible with existing system used by Owner. System is capable of mixed modes of operation including Ethernet, GPRS, Fiber Optic, direct wire and radio communication.

2.02 PIPE MATERIALS

- A. PVC Pipe: Schedule 40; solvent welded sockets.
- B. Solvent Cement: ASTM D 2564 for PVC pipe and fittings.
- C. Sleeve Material: Schedule 40 PVC.
- D. Polyethylene Distribution Tubing: Rainbird; see drawings for size and type.

2.03 OUTLETS

- A. Manufacturers:
 - 1. Calsense ETG weather monitoring evapotranspiration gages. Provide vandal resistant enclosures when used outside exhibit boundaries.
 - 2. Rainbird bubbler heads, adjustable full circle type.
 - 3. Rainbird pressure compensating full circle bubblers.
 - 4. Rainbird 1800 series spray heads
 - 5. Rainbird match precipitation rate (MPR) Nozzles. a. .
 - 6. Outlets: Plastic construction.
 - 7. Rotary Type Sprinkler Head: Pop-up type with screens; fully adjustable for flow and pressure; size as indicated; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.
 - 8. Spray Type Sprinkler Head: Pop-up, spray patterns as indicated in the drawings.
 - 9. Quick Coupler: Rain Bird.

2.04 VALVES

- A. Manufacturers:
 - 1. Rainbird
 - a. Type: PESB-R valve
 - 2. Valve Boxes:
 - a. VB-JMB jumbo, Rainbird
 - b. VB round, Rainbird

3. Gate Valves: Bronze construction non-rising stem.
4. Backflow Preventers: Bronze body construction, double check valve type.

2.05 WIRE

- A. Control Wire: 14/1 UL/UF, direct burial, red color
- B. Common Wire: 12/1 UL/UF, direct burial, white color
- C. Blue Wire: 14/1
- D. Below-grade Splices:
 1. All wire splices below grade shall be made waterproof with correctly sized wire-splice connectors made for direct burial, and rated for 30 volts.
 2. Install 4 feet of extra wire at each splice.
 3. Install 4 feet of extra wire at each valve.
 4. Color Coding of wire:
 - a. White - Common
 - b. Red - Control
 - c. Blue - Extra
 - d. Green - Stub-out
 - e. Yellow - Sensor
 - f. Any deviation shall be replaced at Contractor's expense.

2.06 FLOW SENSOR

- A. Calsense Flow monitoring sensor; sized for location

2.07 ANTENNAS

- A. Calsense low profile DOME antenna in a preassembled stainless steel enclosure.
- B. Calsense STICK antenna ; verify frequency range available at site.
- C. Calsense YAGI Antenna, broad bandwidth, weather resistant.
- D. Calsense GPRS DISK antenna

2.08 CONTROLS

- A. Manufacturers:
 1. Calsense ET2000e or approved system, wall mounted. Provide for 100 stations.
 2. Select exact model as part of overall irrigation system.
 3. Controller: Automatic controller, microprocessor solid state control with visible readout display, temporary override feature to bypass cycle for inclement weather, timer for a 36 station system, programmable for 7 days in quarter hour increments, with automatic start and shutdown.
 4. Controller Housing: Calsense TP-1 housing; NEMA 250 Type 3; weatherproof, watertight, with lockable access door.

5. Valves: Electric Solenoid; normally closed; wiring, including required fittings and accessories.
6. Wire Conductors: Color coded.
7. Remote control: Calsense RRe-TRAN radio remote control. 48 station output capacity; VHF band transceiver with modem.

2.09 INLINE FERTILIZER SYSTEM

- A. Product: EZ Flo www.ezfloinjection.com <<http://www.ezfloinjection.com>>; See drawings for model number and type.

2.10 LOW PROFILE PUMP STATION

- A. Rainbird Low Profile (LP) pump station. See drawings for locations and connections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of existing utilities and irrigation zones adjacent to the site.
- B. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

- A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.
- B. Layout and stake locations of system components.
- C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

- A. Trench to accommodate grade changes and slope to drains.
- B. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
- B. Connect to utilities.
- C. Set outlets and box covers at finish grade elevations.
- D. Provide for thermal movement of components in system.
- E. Use threaded nipples for risers to each outlet.
- F. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

3.05 FIELD QUALITY CONTROL AND SYSTEM TEST

- A. Field inspection and testing will be performed under provisions of Section 01 4000.
- B. Prior to backfilling, test system for leakage at main piping to maintain 100 psi pressure for one hour.

- C. Test of Mains and Valves: With all valves in place and closed, test at 150 psi minimum for 30 minutes without introduction of additional service or pumping pressure. Testing shall be done with one pressure gauge installed on the line where directed by Landscape Architect. Lines which show loss of pressure exceeding 5 psi at the end of specified test periods shall be rejected. The Contractor shall correct installations rejects, and retesting will be performed as specified herein.
- D. Rejected Systems: Rejected systems or portions of systems requiring repair and retesting in the manner specified.
- E. Final Inspection/Operations and Coverage Check: Prior to request for final inspection or arrival of Landscape Architect, accomplish the following:
- F. Complete all work, including balancing, adjusting the system (pressure reducing valves, flow adjustment keys, nozzles, etc.) to provide optimum coverage without fogging. Backfill all except valve boxes.
- G. Coverage Check: Operate each zone of the system for the Architect's inspection.

3.06 BACKFILLING

- A. Provide 3 inch sand cover over piping.
- B. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

3.07 SYSTEM STARTUP

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Adjust control system to achieve time cycles required.
- C. Adjust head types for full water coverage as directed.

3.08 CLOSEOUT ACTIVITIES

- A. At time of and as part of the final inspection, conduct a training and orientation session for the Owner covering the operation, adjustment and maintenance of the irrigation system. The "as-built" plans and operations manual shall be reviewed and all features explained. The Contractor shall notify the Architect in writing two weeks prior to the training and orientation session. The date and time of the session shall be subject to approval of the Architect.

END OF SECTION

**SECTION 32 92 19
SEEDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. A.The work described in this section includes renovation of all lawn areas and the restoration of areas damaged during the course of the execution of the contract. The work may include such repairs as lawn and landscape renovation or replacement, and soil preparation such as may be necessary to return the site to an “as good as” or “better than” existing conditions as determined by Owner.
- B. Preparation of subsoil.
- C. Placing topsoil.
- D. Soil preparation, including Seeding, mulching and fertilizer.
- E. Aerating existing lawns to be renovated
- F. Re-Seeding lawns
- G. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

1.03 QUALITY ASSURANCE

- A. All products supplied shall comply with applicable state and local codes.
- B. All seed shall be "certified" grade or better.
- C. Inspections and Approvals: During the course of the repair work, coordinate the following inspections and secure approvals prior to continuing on to the next work component, as applicable.
 - 1. For lawn repair and replacement, the owner’s representative shall inspect and approve sub-grade preparation, soil placement and preparation (including top dressing), and seeding or sodding.

1.04 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer .
- C. Maintenance Contract.
- D. Product data for each product type for review by Architect and Owner veterinary staff.
- E. Submit seeding schedules indicating anticipated planting dates for each type.

1.06 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.08 COORDINATION AND SCHEDULING

- A. Planting Season: Hydroseed during the periods between February 15 and October 30. Correlate planting with specified establishment periods to provide required maintenance from date of Substantial Completion.
- B. Weather Limitations: Proceed with seeding only when existing and forecast weather conditions are suitable for work.

PART 2 PRODUCTS

2.01 SEED MIXTURE

- A. Seed Mix 1 - open Savanna area grass:

Species	Pure Live Seed
Cynodon dactylon, hulled	6
Pennisetum ruppelii/setaceum	1
Leymus triticoides "Rio"	8
Elymus glaucus "Anderson"	10
Festuca ovina 'Sheep Fescue'	20
Dactylis glomerata "Rushmore"	20
Eragrostis curvula	3
Elymus trachycaulus "Richmond"	12

- B. Seed Mix 2 - Planter area and Slopes:

Vulpia microstachys	10
Muhlenbergia microsperma	2
Stipa cernua	6
Poa secunda "Native"	5
Muhlenbergia asperifolia "Moapa"	1
Sporobolus airoides "Vega"	2
Festuca idahoensis	5
Agrostis pallens, "Siskiyou"	5
Elymus glaucus "Anderson"	6
Melica californica	4
Hordeum californicum	8

2.02 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 7.0 and maximum 8.0.

2.03 ACCESSORIES

- A. Promatrix BFM @ 2,000 - 3,500 lbs/acre or at a rate satisfying the requirements of Section 32 91 13.19 Soils.
- B. Fertilizer: Biosol Forte 7-2-1 Organic fertilizer; 800 lbs./acre or at a rate satisfying the requirements of Section 32 91 13.19 Soils.
- C. Hydropost Premium Compost; 1,000 lbs./acre or at a rate satisfying the requirements of Section 32 91 13.19 Soils.
- D. AM 120 Mycorrhizal inoculum; 60 lbs./acre
- E. Tri-C Soluble Humate; 1 lb./acre
- F. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- G. Stakes: Softwood lumber, chisel pointed.
- H. String: Inorganic fiber.

2.04 TESTS

- A. Submit minimum 10 oz (280 g) sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.
- B. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 31 22 00.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- C. Provide 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.
- D. For disturbed areas to be newly seeded, place topsoil in accordance with Section 31 22 00.

- E. For Repair/Renovation (all lawn areas not needing full replacement): Aerate all existing lawn areas to a depth of 4- 6 inches using power-driven core aerator or aerifier. Rake soil cores into lawn.
- F. For Repair/Renovation of lawn areas: Loosely distribute a 1/2-inch top dressing of topsoil over areas to be repaired.

3.03 PROTECTION

- A. Promptly remove soil and debris created by hydroseeding work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Identify seeded areas with stakes and string around area periphery. Set string height to 18 inches. Space stakes at 72 inches. Maintain barricades throughout establishment period.

3.04 ESTABLISHMENT PERIOD

- A. Begin care of seeded areas immediately after each area is planted and continue until satisfactory seeded area is established, but for not less than the following periods:
- B. Establish hydroseeded areas by watering, fertilizing, weeding, mowing, trimming, re-seeding and other operations. Roll, re-grade, and re-seed bare or eroded areas and re-mulch to produce a uniformly smooth hydroseeded area.
 - 1. Re-seed bare areas with same materials specified for given area.
 - 2. For areas with seed mix 1:
 - a. Water hydroseeded areas twice daily until first mowing of lawn area. Total application rate not to exceed 1" of water per week.
 - b. Subsequent irrigation - once a day for a month after first mowing, or until rains begin.
 - 3. For areas with seed mix 2:
 - a. Irrigate once per day for 6 weeks following initial seeding. Continue as needed for healthy plant growth.
- C. Mowing (seed mix 1 areas only):
 - 1. Mow seeded areas as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
 - 2. Schedule initial and subsequent mowings to maintain following grass height:
 - a. First mowing when grass is 3" in height
 - b. Mow grass 2 inches high thereafter during establishment period.
- D. Post-fertilization: Apply additional applications of fertilizer to seeded areas 30

and 60 days after initial seeding.

1. Use balanced 16-16-16 fertilizer that will provide actual nitrogen of 1 lb per 1000 sq. ft. of seeded area.
2. Apply fertilizers only when seeded area is dry.

3.05 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. See Section 01 7000 - Execution Requirements, for additional requirements relating to maintenance service.
- C. Provide maintenance of seeded areas from installation until award of Substantial Completion and then for three months after Date of Substantial Completion.
- D. Neatly trim edges and hand clip at planters in visitor occupied areas.
- E. Immediately remove clippings after mowing and trimming.
- F. Keep site consistently moist for 6-8 weeks after seeding.
- G. Roll surface to remove minor depressions or irregularities.
- H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides. All products and applications subject to Owner review and approval
- I. Immediately reseed areas that show bare spots.
- J. Protect seeded areas with warning signs during maintenance period.

3.06 APPROVALS

- A. Approvals: Upon completion of the work and all inspections are completed, coordinate a final walk-through of the site restoration with the Owner's Representative for final approval of the work of this Section.

END OF SECTION

SECTION 32 9300

PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. New trees, plants, and ground cover.
- B. Relocated trees.
- C. Tree pruning.
- D. **Maintenance.**

1.02 RELATED DOCUMENTS

- A. The Contract Documents in their entirety, including the Drawings, Specifications/Project Manual, Construction Contract Clauses, and any other documents issued as part of the Contract, apply to this Section.

1.03 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals
- B. Section 31 0000 - Site Clearing
- C. Section 31 2000 - Earthwork, Excavation, Filling and Grading
- D. Section 32 0193 - Tree and Planting Protection
- E. Section 32 8423 - Underground Sprinklers
- F. Section 32 9113 - Soil Preparation

1.04 DEFINITIONS

- A. Weeds: Any plant life not specified or scheduled.
- B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.05 REFERENCE STANDARDS

- A. ANSI Z60.1 - American Standard for Nursery Stock; 2004.
- B. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices; 2001.

1.06 SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures.
- B. Within 30 days after award of the Contract, submit to Architect a nursery source and a complete list of recommended procedures and schedule to prune trees.
- C. Within 45 days after award of the Contract, submit to Architect a complete list of materials **(including quantities, sizes and species)** proposed to be furnished and installed demonstrating conformance with the requirements specified. **Plant quantities shown in the drawings have been provided as a convenience to the Contractor. Contractor is responsible for providing the quantities needed to ensure full coverage of planted areas at spacings shown on the plans and in the Plant Schedule.**

- D. Submittal to include invoices identifying sizes and quantities and the names and addresses of all plant material suppliers and growers.
 - 1. This information shall be used for LEED MRc5.
- E. Submit manufacturer's analysis of all fertilizers for the approval of the Architect.
- F. Samples:
 - 1. Drip line river rock: 2 one gallon samples.

1.07 PROTECTION OF EXISTING CONDITIONS

- A. Protect work, adjacent property, the public, and be responsible for any damage or injury arising from this contract due to actions or neglect.

1.08 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.
- B. Installer Qualifications: Company specializing in installing plants with three years experience.
 - 1. Provide at least one experienced person who shall be present at all times during execution of this portion of the work, who shall be familiar with the type of materials being installed and the proper materials and methods for their installation, and who shall direct all work performed under this section.
 - 2. Staff shall be of sufficient size to be able to furnish required materials, deliver, plant and install all materials as shown on plans and promptly expedite the work.
 - 3. Submit statement listing quantity and type of equipment proposed for use on the job.
- C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.
- D. Tree Pruning: NAA - Pruning Standards for Shade Trees.
- E. Plant Material:
 - 1. Plants and planting materials shall meet or exceed the specifications of Federal, State and County laws requiring inspection for plant disease and insect control.
 - 2. Plants not meeting the specified sizes and quantities at time of inspection are subject to rejection and replacement.
- F. Inspection:
 - 1. Architect inspection:
 - a. A. Notification: The Contractor shall give 48 hours notice to the Landscape Architect when an inspection is desired.
 - b. Rough grades: Architect will review subgrades prior to placement of topsoil.
 - c. Finish grades: Architect will review finish grade prior to any planting or seeding.
 - d. 3. Plant Material: Architect will review and approve all plant material at the site prior to installation. Remove unsatisfactory material from site immediately.

e. 4. Plant Locations: Architect will review, adjust and approve plant locations

2. Veterinarian inspection
 - a. All organic materials that are in contact with animals need to be approved by Owner's Veterinarian Staff and Owner's horticultural representative.
 - b. Includes trees, shrubs, plantings, mulch, fertilizer, compost and amendments.
- 3.

1.09 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for herbicide composition.
- B. Plant Materials: Certified by federal department of agriculture; free of disease or hazardous insects.

1.10 ORDERING PLANT MATERIAL

- A. Documentation:
 1. Submit documentation to Architect at least 30 days prior to start of work under this section that plant materials have been ordered, unless otherwise noted.
 2. Submit documentation to Architect within 14 days after award of contract for the work under this section that plant materials indicated in the Plant Schedule as requiring a Tree have been ordered.
 3. Arrange procedure for review of plant material with Architect at time of submission.
- B. Review:
- C. Plants shall be subject to review by Architect for conformance to quantity and size specifications upon delivery to project site. Such review shall not impair the subsequent right to review and require re-submission during progress of the Work.

1.11 SUBSTITUTIONS

- A. Substitutions in sizes, species or quantities of plant materials will not be permitted unless authorized in writing by Architect.
- B. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price.
- C. If Contractor claims that some species of the plants specified are not obtainable and Architect is able to locate source(s) within one week, Contractor will pay for the Architect's time locating source(s) for the plant materials with a credit back to Architect for the time spent by the Architect at Architect's regular hourly billing rates.
- D. If the size of plant material is greater than that requested, any additional cost will be the Contractor's responsibility.
- E. Such proof shall be substantiated and submitted in writing to the Architect at least 30 days prior to start of work under this section.
- F. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

- e. 4. Plant Locations: Architect will review, adjust and approve plant locations

1.12 DELIVERY, STORAGE, AND HANDLING

A. Plant Material:

1. Protect and maintain plant life until planted.
2. Deliver plant life materials immediately prior to placement.
3. Keep plants moist.
4. When shipped by truck, pack to provide protection against climate and breakage or drying.
5. When shipped by rail, pack carefully and properly ventilate; prevent damage to bark, branches, and root system.
6. Install plants immediately upon delivery to project site. If there is unavoidable delay set trees, shrubs and plantings in shade, protect from weather and mechanical damage, and keep moist as follows:
 - a. Heel-in bare root stock and freshly dug herbaceous plants in a bed containing adequate topsoil or other acceptable material to keep roots moist. Soak roots in water two hours if dried out.
 - b. Set balled stock on ground and cover ball with damp soil or other acceptable material.
 - c. Do not remove container grown stock from containers until planting time.
 - d. Periodically water root systems of trees and shrubs stored on site using a fine mist spray. Water as often as necessary to maintain root system in moist condition.
 - e. Place plants in flats, pots or other containers in a sheltered spot protected from sun, wind, and mechanical damage. Keep roots moist.
7. Immediately remove from site all plants which are not true to name or which do not comply with specified requirements.

1.13 FIELD CONDITIONS

- A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.
- B. Do not install plant life when wind velocity exceeds 30 mph.
- C. Install frost-tender trees, shrubs, and plantings only after danger of frost is past or sufficiently before frost season to allow for establishment before first frost.

1.14 MAINTENANCE

- A. **Maintain planting from start of installation for a period of at least sixty (60) days after completion of planting operations or until all plants are in a healthy growing condition acceptable to the Owner's personnel.**
- B. **Maintenance shall include cultivating, weeding, watering, pruning (only as directed by Owner personnel), and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.**
 1. **Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.**
 2. **Straighten, repair and adjust guy wires and stakes as required.**

3. **Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.**

1.15 WARRANTY AND REPLACEMENTS

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide one year warranty.
 1. Warrantee period to begin upon written approval of Substantial Completion.
- C. Warranty: Include coverage for one year following Substantial Completion; replace dead or unhealthy plants.
- D. Plant Material: Guarantee in a healthy, thriving condition all trees and shrubs for one year from date of final acceptance; all ground cover until active, vigorous growth is evident. During the guarantee period, all dead diseased, dying, broken or disappeared plant materials from any cause except those noted below shall be replaced immediately by the Contractor at no additional expense to the Owner. Use specified plants and plant as specified; guarantee until active, healthy growth is evident.
- E. Seeded Areas: Guarantee a relatively uniform, acceptable stand of grass with no bare spots whatsoever in seeded areas at time of provisional review (Punchlist). Reseed with the seed and in the manner originally specified any seeded area which fails to vigorously establish a uniform stand for any reason whatsoever. Fill to finish grade with approved topsoil and seed as specified all seeded areas which evidence settlement or erosion. Repeat all such reseeded until final acceptance at Contractor's expense.
- F. Sodding: For soil preparation, lay fresh sod with tight, staggered joints in a running bond pattern. In sloped areas, lay sod up and down slope. Trim edges adjacent to walks, curbs, etc. for a neat, tight fit. After initial watering has settled out, roll diagonally with 300lb. roller. Water deeply again after rolling. Repair any depressions and fill any gaps which develop through the guarantee period. Protection requirements include fertilizing repair and ongoing maintenance per paragraph above apply to sodded areas as well.

PART 2 PRODUCTS

2.01 TREES, PLANTS, AND GROUND COVER

- A. Regional Materials: Plants harvested within 500 mile radius of Project Site
- B. Plant Health:
 1. Plants must be sound, healthy and vigorous, fully rooted, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or any adverse conditions that would prevent thriving growth.
- C. Plant Size:
 1. Plants shall be true to species and variety specified and shall conform to sizes except that plants larger than specified may be used if approved by Architect.
 - a. Use of such plants shall not increase the Contract price.
 - b. If larger plants are used, the container shall be increased in proportion to the size of the plant.

2. Height and spread dimensions specified refer to main body of plant and not branch tip to tip.
3. Plant dimensions shall be measured when their branches are in their normal position.
4. Caliper measurement will be taken at a point on the trunk 6-inches above natural ground line for trees up to 4-inches in caliper and at a point 12-inches above the natural ground line for trees above-4 inches in caliper.
5. If a range of size is given, no plant shall be less than the minimum size and not less than 75% of the plants shall be as large as the maximum size specified.
6. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Do not prune to obtain required sizes.
7. All plants should be fully rooted without being root bound in their specified containers.

D. Labels:

1. Label all plants with durable, legible labels stating correct plant name and size. Attach securely to each plant. Plants supplied in flats shall have one label per flat.

E. Container Grown Plants:

1. Shall have grown in the containers in which delivered for a length of time sufficient to develop fibrous roots so that root mass will retain its shape and hold together when removed from the container but not so long as to become root-bound.
2. Samples must prove no root-bound conditions exist. Root-bound plants and container plants that have cracked or broken balls of earth when taken from container shall not be planted.

3. Use rigid containers that will hold ball shape and protect root mass during shipping.
- F. Balled and Burlapped Plants:
1. Provide balled and burlapped stock when required trees or shrubs exceed maximum size recommended by ANSI Z60.1 for container grown stock.
 2. Firm, natural balls of soil in sizes shown in American Standard for Nursery Stock; wrapped firmly with burlap or approved material; bound carefully with twine, cord, or wire mesh.

2.02 DAMAGED PLANTS

- A. Plants shall not be pruned before delivery.
- B. Trees which have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected.
- C. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 inch which have not completely calloused, will be rejected.
- D. Trees with asymmetrical canopies, skirted canopies (excessively high branching) and topped or lollipopped pruned in the nursery will be rejected.

2.03 PLANT LIST

- A. Provide the individual plant species and sizes as shown on the drawings.
- B. Provide the mix of individual plant species according to the total quantity shown on the drawings for each tree/shrub/perennial/groundcover planting area.

2.04 PLANTING SOIL AND SOIL AMENDMENTS

- A. Planting soil and soil amendments are specified in Section 329113 Soil Preparation.

2.05 FERTILIZERS

- A. Fertilizers are specified in Section 329113 Soil Preparation.

2.06 MULCH MATERIALS

- A. Mulch materials are specified in Section 329113 Soil Preparation.

2.07 ACCESSORIES

- A. Wrapping Materials:
 1. Protect all trees from sun scald with tree bark-wrap.
- B. Splash zone aggregate at building driplines as indicated: Smooth river rock, 1 inch (25.4 mm) minimum and 3 inch (76 mm) maximum size. Depth as indicated.
- C. Landscape Edging: Border Concepts Border Stretch 1/8" x 6" steel edging.
 1. Enamel finish
 2. At border of splash zone aggregate; locations per drawings.

PART 3 EXECUTION

3.01 PREPARATION OF SUBGRADE

- A. The subgrade preparation is specified in Section 329113 Soil Preparation.

3.02 LAYOUT OF PLANT PITS AND PLANTING AREAS

- A. Layout plants or stake positions in locations shown on drawings for Architect's review and acceptance.
 - 1. Architect will adjust locations in the field before planting begins.
 - 2. Architect reserves right to refuse acceptance if, in his or her opinion, an insufficient number of plants are available on site. All plants specified for each area to be planted must be available for layout .
- B. Excavate plant pits to the following dimensions:
 - 1. Trees:
 - a. Depth of rootball; width 2 times the rootball diameter or 5'-0", whichever is greater.
 - 2. Shrubs and herbaceous plants:

- a. Depth of rootball; width of rootball plus 1'-0" minimum on all sides.
3. Form soil mound in the center of each pit to support root crown.

3.03 PLANT PLACEMENT

A. General:

1. Pre-planting Period: protect plants at all times from sun or drying winds.
 - a. Plants that cannot be planted immediately on delivery shall be kept in the shade, protected from wind, and maintained at each species optimum moisture content.
 - b. All plants specified on the planting plans must be present on site and located for final placement and review by Architect prior to any planting. Planting must be organized by each planting area in the construction documents.

B. Container Removal:

1. Canned stock shall be removed carefully after container has been cut on two sides with approved cutter.
2. Do not lift or handle container plants by tops, stems, or trunks at any time.
3. After removing plant from container, scarify side of rootball to prevent root-bound condition.

C. Balled and Burlapped Plants:

1. Remove ALL balling materials.
2. Scarify (deglaze) clay ball. Some cases require removal of loose soil clods around ball.
 - a. Save the water for use as instructed below.

D. Plant Placement:

1. Use planting mix as specified in Section 329113 Soil Preparation to backfill plant pits.
2. Place plant and rotate to best advantage from principal viewpoints of adjacent walkways.
3. Place plant on soil mound (where applicable) and arrange roots radially.
4. Set plant plumb and brace rigidly in position until planting soil has been tamped by hand solidly around the ball and roots.
5. Place top of root ball slightly above grade to allow in planting depth for 4 inch layer of mulch to be added after planting.
6. When plant pits have been backfilled approximately 2/3 full, completely flood the pit, using the water that was saved from removing clay from balled and burlapped material or rooting hormone, before installing remainder of the planting soil to top of pit.
7. Firm soil with hands to eliminate air pockets.
8. Form 3 inch to 4 inch soil saucer around planting pit. Maintain through establishment period.

3.04 PLANTING SOIL PLACEMENT

- A. The planting soil placement is specified in Section 329113 Soil Preparation.

3.05 TOP DRESS FERTILIZER

A. First Application:

1. Immediately after completing mulching of shrub and ground cover beds, apply Top Dress Fertilizer at the rate of seven (7) pounds per 1000 square feet.
2. Subsequent Application:
 - a. Beginning April 15 and extending to August 15 of the first full growing season or one month after first application for planting completed during the first growing season, make monthly applications of Top Dress Fertilizer to all shrub and ground cover beds at the rate of seven (7) pounds per 1000 square feet.
 - b. In planting areas for which Final Acceptance occurs during the first growing season continue the top dress fertilizer application at specified rates and intervals for a period of 1 year from First Application until warranty inspection.

3. Soil Analysis:
 - a. At the discretion of the Architect, obtain soil fertilizer analysis at any time during the Top Dress Fertilizer application period. Such analysis to be from an accredited soils laboratory.
 - b. Submit results of testing to Architect.

3.06 TREE PRUNING

- A. Perform pruning of trees as recommended in ANSI A300.
- B. Prune newly planted trees as required to remove dead, broken, and split branches.

3.07 CLEAN UP

- A. Keep work areas clean, neat and orderly at all times.
- B. Keep paved areas clean during planting and maintenance operations.
- C. Clean up and remove deleterious materials and debris from the entire work area prior to Final Acceptance.

END OF SECTION

**SECTION 33 10 00
SITE WATER SYSTEMS**

PART 1: GENERAL

1-01 SECTION INCLUDES:

- A. Furnish and Install pipe and fittings for water piping.
- B. Valves and valve boxes, water meter and box.
- C. Backflow preventor, detector check valve, post indicator valve, fire department connection.
- D. Accessories.

1-02 RELATED SECTIONS:

- A. Division 0 – Contract General Conditions.
- B. Section 31 14 00- Soil Materials
- C. Section 31 23 00-Trench Excavation and Backfilling

1-03 REFERENCES:

- A. ANSI/ASTM D1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- B. ANSI/ASTM D2466 – Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- C. ANSI/AWWA C110 – Ductile Iron and Grey-Iron Fittings, 3 inch through 48 inch, for Water and Other liquids.
- D. ANSI/AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- E. ANSI/AWWA C500 – Gate Valves, 3 through 48 in NPS for Water and Sewage Systems.
- E. ANSI/AWWA C900-Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water.
- F. ASTM D1785-Poly (Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and Class 200.
- H. ASTM D2855-Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- I. ASTM D3139 – Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1-04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1-05 COORDINATION:

- A. Coordinate work with Owner personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner personnel.

1-06 EXISTING UTILITIES:

- A. The Engineer has indicated on the plans the location of all known existing utility facilities within the work area. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals have been shown where information was available. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- C. Contractor shall verify all utilities within the work area, including using hand method. Contractor shall protect all existing utilities not designated to be removed.
- D. Maintain all existing utility mains and service lines in constant service during construction of the work.

1-07 PROJECT RECORD DOCUMENTS:

- A. Submit under provisions of Section 01 70 00.
- B. Accurately record actual locations of utilities encountered.

PART 2: PRODUCTS

2-01 WATER PIPE:

- A. For Above Ground Pipe:
 - 1. Ductile Iron Pipe
(ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51)
Class 50 with cement – mortar lining and seal coating
(ANSI/AWWA C104/A21.4). with Ductile Iron Fittings(ANSI/AWWA C110/A21.10) and flanged joints.
- B. For Underground Pipe:
 - 2. With Schedule 80 PVC Fittings and Solvent Welded joints (ASTM D2855)(ANSI/ASTM D2464) (for pipe 3" and smaller)
PVC Pipe (ASTM D1785) Schedule 40; 1120 high impact.
 - 3. (for pipe 4" and larger): PVC Pipe C900 Class 200(ANSI/AWWA). 1120 high impact. With Cast Iron Fittings(ANSI/AWWA C111) and compression gasket ring Joints: (ASTM D3139)

2-02 GATE VALVES

- A. 1/2" and smaller: Nibco T-580 -66 bronze ball valve or an approved equal.
- B. Between 2" and 3" gate valves-Brass disc or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.
- C. 3 inches and Over:
 - 1. C500 (ANSI/AWWA) Iron body, bronze trim, non-rising stem with square nut or Control handle wheel, single wedge, threaded or flanged.

2-03 VALVE BOXES AND COVERS, WATER METERS AND BOXES

- A. Precast Reinforced Concrete. Cast Iron lid marked for water service. Christy G5 traffic box or approved equal. One piece of PVC riser extension shall be provided.
- B. Water meters and boxes shall be as per City of Fresno Standard.

2-04 BACKFLOW PREVENTOR, DETECTOR CHECK VALVE, VAULT, POST INDICATOR VALVE AND FIRE DEPARTMENT CONNECTION

- A. Backflow preventor, detector check valve, vault, post indicator valve and fire department connection shall be as per detail drawing and meet City of Fresno Standard

2-05 ACCESSORIES:

- A. Concrete for Thrust Blocks and Valve Box Surface Collars: Class 3, 5 ½ sack Concrete.
- B. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.

PART 3: EXECUTION

3-01 EXAMINATION:

- A. Verify site conditions. Locate, identify, and protect existing above and below grade utilities from damage.
- B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor should furnish such fittings, as may be required to meet existing conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner.

3-02 PREPARATION:

- A. Protect all improvement not authorized for removal.
- B. Employ equipment and methods appropriate to the work site.
- C. Identify location of proposed water facilities to be constructed. Expose connection points to existing system.

- D. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater as necessary.
- G. Comply with safety requirements as they pertain to excavations, per Section 02225/3-01C.

3-03 EXCAVATION:

- A. Excavate soil required to locate existing utilities and install the work, use hand method as necessary in congested area.
- B. Employ equipment and methods appropriate to the work site.
- C. Cut trenches just wide enough to enable installation and proper backfill and do not interfere with 45 degree bearing splay of foundations. When excavating through tree roots, cut roots by hand.
- D. Excavate trenches to provide the minimum cover required.
- E. Excavate trenches, pits, or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings.
- F. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure.
- G. Stockpile excavated material to be returned to trench adjacent thereto in location, which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove unsuitable or excess materials not being used, from site.

3-04 INSTALLATION AND BEDDING OF WATER PIPELINE

- A. Where trench has been overexcavated, place bedding material at the bottom of excavations, level soil materials in continuous layers not exceeding 6 inches uncompacted depth.
- B. Backfill around sides and to a level one foot above the top of pipe with bedding soil.
- C. Install pipe at locations and depths indicated on plans. All of the water pipeline will have a minimum of 36" of cover.
- D. Install Pipe, fittings and associated materials in accordance with manufacturers recommendations.
- E. Route Pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings not by bedding. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- F. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change of direction in loose-joint pipe, per detail on plans.
- G. Backfill trench or other excavation in accordance with Section 31 23 00.

3-05 INSTALLATION-VALVES

- A. Set valves on solid bearing, center and plumb valve box and any necessary extensions over valve. Set box cover flush with finished grade.

- B. Form and place concrete for thrust block.
- C. Pour concrete collar around top of valve box per detail on plans.

3-06 INSTALLATION – THREADED CONNECTIONS

- A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.
- B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel into plastic.
- C. A non hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe, sealant may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

3-07 INSTALLATION -WATER METER, BACKFLOW PREVENTOR, DETECTOR CHECK VALVE, VAULT, POST INDICATOR VALVE AND FIRE DEPARTMENT CONNECTION

- A. Install water meter, backflow preventor, detector check valve, vault, post indicator valve and fire department connection as per detail drawing and City of Fresno Standard.

3-08 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect all domestic water piping systems in accordance with AWWA Standard C601, “AWWA Standard for Disinfecting Water Mains”. Disinfection process shall be performed in cooperation with health department having jurisdiction. During procedure, signs shall be posted at each water outlet stating, “Chlorination – Do Not Drink”. After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the engineer.

3-09 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed as per Section 01400.
- B. Pressure-test all water pipelines.
- C. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

END OF SECTION

SECTION 33 13 00
DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1: GENERAL

1.01 SUMMARY

- A. Work Included
 - 1. Disinfection of potable water distribution system.
 - 2. Pressure testing of water system.
 - 3. Testing and reporting results.

1.02 RELATED DOCUMENTS

- A. In addition to the Drawings, the general provisions of the Contract, including General and Special Conditions, and the Division 01 specification Section, the following Documents are related to and assist in the definition of the requirements of this Section:

Section 33 10 00 – Site Water Systems

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI/AWWA C651.
- B. Applicator Qualifications:
 - 1. Water Treatment Firm: Company experienced in disinfecting potable water systems specified in this Section with minimum three years experience.
- C. Testing Laboratory Qualifications:
 - 1. Testing laboratory qualified in testing potable water, certified by the State of California.
- D. Regulatory Requirements
 - 1. Work under this Section shall be done in accordance with Specifications Section 01 41 00, Regulatory Requirements.

FC – Department of Health – Fresno County Department of Environmental Health
- E. References
 - 1. In accordance with Specifications Section 01 42 19, Reference Standards and the following.

AWWA C652 - Standard for Disinfection of Water Storage Facilities.
ANSI/AWWA B300 - Standard for Hypochlorites.
ANSI/AWWA B301 - Standard for Liquid Chlorine.
ANSI/AWWA B303 - Standard for Sodium Chlorite.
ANSI/AWWA C601 and C651 - Standards for Disinfecting Water Mains.

1.04 SUBMITTALS

- A. Submit in accordance with Specification Section 01 33 00, Submittal Procedures. Test Reports

- a. Indicate results comparative to specified requirements.
- 2. Certificate
 - a. Certify that cleanliness of water distribution system meets or exceeds the following requirement:
 - 1) Coliform M.P.N./100 ML water is 1.1 or less.

1.05 PROJECT RECORD DOCUMENTS

- A. In Accordance with Section 01781, Project Record Documents.
 - 1. Disinfection report; record:
 - a. Type and form of disinfectant used.
 - b. Date and time of disinfectant injection start and time of completion.
 - c. Test locations.
 - d. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - e. Date and time of flushing start and completion.
 - f. Disinfectant residual after flushing in ppm for each outlet tested.
 - 2. Bacteriological report; record:
 - a. Date issued, project name, and testing laboratory name, address, and telephone number.
 - b. Time and date of water sample collection.
 - c. Name of person collecting samples.
 - d. Test locations.
 - e. Coliform bacteria test results for each outlet tested.
 - f. Certification that water conforms, or fails to conform, to bacterial standards of Section 33 13 00/3.03.
 - g. Bacteriologist's signature and authority.

PART 2: PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals:
 - 1. Hypochlorite, in accordance with ANSI/AWWA B300.
 - 2. Liquid Chlorine, in accordance with ANSI/AWWA B301.
 - 3. Sodium Chlorite, in accordance with ANSI/AWWA B303.

PART 3: EXECUTION

3.01 EXAMINATION

- A. Verify that piping system and appurtenances has been cleaned and inspected.
- B. Schedule disinfection activity to occur prior to pressure testing and pressurizing of installed system.

3.02 PREPARATION

- A. Limit contaminated materials from entering water piping and appurtenances during construction.
 - 1. Remove, by initial flushing with potable water, contaminated materials which may have entered the system during construction.
- B. Provide required equipment and facilities to perform the work of disinfection.
 - 1. Provide sufficient number of suitable outlets to permit flushing of facilities at a velocity of at least 5.5 feet per second. to permit the obtaining of bacteriologic test

- 2. samples, and to permit pressure testing.
- 2. Outlets provided shall be in addition to these which may be shown on the plans, and shall conform to Section 33 10 00: Site Water Systems.
- C. Provide sufficient number of valves (complete with valve boxes), as necessary, to isolate system for flushing, pressure testing and disinfection purposes.
 - 1. Valves and valve boxes shall be in addition to those shown on the plans, and shall conform to Section 33 10 00: Site Water Systems.
- D. Provide drainage so that water facilities cannot be contaminated by flushing outlets.

3.03 EXECUTION

- A. General:
 - 1. Perform work in accordance with ANSI/AWWA C651.
- B. Water System, Pipelines, Pumps, Valves and Fittings.
 - 1. Disinfection Process:
 - a. Disinfect at each water system improvement location where connection and/or alteration is made to the existing potable water system located downstream.
 - b. Disinfect after initial flushing and prior to allowing the system at such location to be pressurized.
 - c. Introduce chlorine gas or chlorine compound solution made with liquid chlorine, calcium hypochlorite in solution or sodium hypochlorite solution mixed with water into the water piping and appurtenances to form a chlorine concentration of approximately 100 parts per million (ppm), or that which will provide a minimum residual of 50 ppm in all parts of the water piping and appurtenances after 24 hours have elapsed.
 - d. The placing of HTH capsules or tablets in pipe sections during the laying process will be considered an acceptable method of introducing chlorine for the test.
 - 2. Sterilization Period
 - a. During the sterilization period, all valves (except those isolating the system being disinfected) and other accessories shall be operated.
 - b. After a minimum of 24 hours have elapsed since introduction of the chlorine, flush treated water from the water piping and appurtenances using potable water.
 - 1) After a minimum of 48 hours after flushing per Section 33 13 00/3.02A, have bacteriologic samples of water from the piping and appurtenances to be tested extracted from the system by testing laboratory.
 - 3. Bacteriological Tests:
 - a. Have bacteriologic tests performed by testing laboratory per Section 033 13 00/1.03.
 - b. If the bacteriologic tests show a coliform M.P.N./100 ML water of 1.1 or less on all samples at a particular installation site, the water facilities tested will be considered clear.
 - c. In the event the coliform number is above 1.1, the sterilization and testing procedure shall be repeated until the required standard is reached.
 - 4. Pressure Test
 - a. Pressure test system to a hydrostatic pressure of 100 pounds per square inch gauge, only after bacteriologic tests have passed, for each construction location.
 - b. Maintain pressure test for 90 minutes.
 - c. Pressure tests shall be performed in the presence of the Agency's

- representative.
- d. Repair any leaks detected by hydrostatic pressure test and repeat disinfection and testing process.
- 5. All costs of disinfection, bacteriologic testing and reporting, and pressure testing shall be borne by the Contractor, and including all additional outlets, valves and valve boxes necessary to accomplish the work.

C. Water Tanks

- 1. Preparation
 - a. Upon completion of tank painting, the tanks shall be cleaned and filled with water.
- 2. Disinfection
 - a. The tanks shall be disinfected in accordance with AWWA C652.
 - b. Disinfection shall be by application of chlorine in a chlorine bearing compound form.
- 3. Sterilization Period
 - a. The chlorinated water shall remain in the tank for at least 24 hours.
 - b. The tank shall then be drained and filled to capacity with potable water.
- 4. Bacteriological Tests:
 - a. Water samples shall be taken by the Engineer and delivered to a certified water laboratory for bacteriological and volatile organics testing.
 - b. Should the test indicate the presence of coliform organisms or volatile organics, the entire disinfection procedure shall be repeated.

3.04 QUALITY CONTROL

- A. Provide copies of testing and reports.

END OF SECTION

**SECTION 33 30 00
SITE SEWER SYSTEMS**

PART 1: GENERAL

1-01 SECTION INCLUDES:

- A. Furnish and Install site sanitary sewer collection systems including pipe and fitting.
- B. Sewer manhole, cover and frame.
- C. Cleanout.
- D. Sewer lift station.

1-02 RELATED SECTIONS:

- A. Division 0 – Contract General Conditions.
- B. Section 31 14 00- Soil Materials
- C. Section 31 23 00-Trench Excavation and Backfilling
- D. Appendix A, B, C & E – Sewer Lift Station

1-03 REFERENCES:

- A. American Water Works Association(AWWA)
- B. American Society for Testing and Materials(ASTM)
- C. Designation D3034 – Polyvinyl Chloride(PVC) pipe.

1-04 SUBMITTALS

- A. Submit under provisions of Division 0 – Contract General Conditions.
- B. Certificates of compliance for material.
- C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install products supplied.

1-05 COORDINATION

- A. Coordinate work with Owner personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner personnel.

1-06 EXISTING UTILITIES:

- A. The Engineer has indicated on the plans the location of all known existing utility facilities within the work area. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals have been shown where information was available. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- C. Contractor shall verify all utilities within the work area, including using hand method. Contractor shall protect all existing utilities not designated to be removed.
- D. Maintain all existing utility mains and service lines in constant service during construction of the work.

1-07 PROJECT RECORD DOCUMENTS:

- A. Submit under provisions of Section 01 70 00.
- B. Accurately record actual locations of utilities encountered.

PART 2: PRODUCTS

2-01 MATERIALS:

- A. Sanitary sewer pipelines shall be Polyvinyl Chloride(PVC) pipe for sanitary sewers conforming to ASTM Designation: 3034, SDR35.
- B. Cleanout Boxes shall be precast reinforced concrete and cast iron lid marked for sewer service. Christy F8 or approved equal.
- C. Sewer manhole, cover, frame, cleanout and box shall be as per detail drawing.
- D. Sewer lift station (Lion Holding Area) shall be as per detail drawing and Appendix A & E.
- E. Sewer lift station (Northeast) shall be as per detail drawing and Appendix B.
- F. Sewer lift station (Southeast) shall be as per detail drawing and Appendix C.
- G. Concrete for structures shall conform to Section 03 30 00 "Cast-in-Place Concrete" and be constructed per detailed drawing.

PART 3: EXECUTION

3-01 EXAMINATION:

- A. Verify site conditions. Locate, identify, and protect existing above and below grade utilities from damage.

3-02 PREPARATION:

- A. Protect all improvement not authorized for removal.
- B. Employ equipment and methods appropriate to the work site.
- C. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.

- D. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater as necessary.
- E. Comply with safety requirements as they pertain to excavations, per Section 02225/3-01C.

3-03 EXCAVATION:

- A. Excavate soil required to locate existing utilities and install the work, use hand method as necessary in congested area.
- B. Employ equipment and methods appropriate to the work site.
- C. Cut trenches just wide enough to enable installation and proper backfill and do not interfere with 45 degree bearing splay of foundations. When excavating through tree roots, cut roots by hand.
- D. Excavate trenches to provide the minimum cover required.
- E. Excavate trenches, pits, or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings.
- F. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure.
- G. Stockpile excavated material to be returned to trench adjacent thereto in location, which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove unsuitable or excess materials not being used, from site.

3-04 PIPE INSTALLATION:

- A. Pipe Laying: Sewer pipe shall be laid in strict conformity to the prescribed line and grade. The elevation of the pipe invert shall not deviate from the design elevation by more than +2 percent to the pipe size concerned, or 1 inch, whichever is greater. The rate of deviation from grade or returning to grade shall be limited to 1/16 inch per foot of pipe. Pipe laying shall proceed upgrade with the bell ends of bell and spigot pipe placed upstream. Each section of pipe shall be laid to line and grade as herein specified and in such a manner as to form a watertight, concentric joint with the adjoining pipe. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses. Pipe shall not be laid when the condition of the trench or weather is unsuitable. All open ends of pipe and fittings shall be adequately and securely closed whenever the work is discontinued.
- B. Sewer Systems Plugs: Temporary plugs of brick or mortar shall be installed on all sewer projects at points of connection to existing facilities. These plugs shall remain in place until completion of the balling and flushing operation., drainage, or any other condition from entering the existing system, shall be installed or removed in the presence of and under the direct supervision of the Engineer. Until the system has been pumped clear of accumulated water, the plugs shall not be removed. This water must not be allowed to enter adjacent sewer or drainage systems.

3-05 INSTALLATION OF CLEANOUTS

- A. Install cleanouts at end of lines, at changes of direction greater than 45 degrees, and at spacing not greater than of 100-foot intervals. Locate cleanouts in accessible locations and bring flush to finished surface.

3-06 INSTALLATION OF SEWER MANHOLE AND LIFT STATION

- A. Install sewer manhole and lift station as indicated on the construction plans, in accordance with the manufacturer's recommendations and as specified herein

3-07 BACKFILLING TO FINISH GRADE AND FINISH GRADING:

- A. Backfill from bottom of the trench to pipe grade with type B and C soil.
- B. After installation of pipes and appurtenances and backfill of pipe bedding material.
- C. Backfill trenches above pipe bedding material and to within 6 inches of finish subgrade with type A, B, & C soils. Compact all soil backfill not exceeding 8 inches in uncompacted thickness. Maintain optimum moisture content of fill materials.
- D. Backfill final 6 inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with type B or C soils.
- E. Backfill final 6 inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil with type A soil.
- F. Obtain 85 percent relative compaction of backfill from bottom of backfill to a level of 2 feet below finish subgrade, and obtain minimum of 95 percent relative compaction of backfill in top 2 feet below finish subgrade, in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement.
- G. Obtain minimum of 85 percent relative compaction of backfill in areas to receive sod, other vegetation, or bare soil.

3-08 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed as per Section 01 40 00.
- B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.
- C. After cleaning per Section 3-02 C, each section of sewer constructed shall be tested in accordance with acceptable "Low Pressure Air Test for Sanitary Sewers" methods such as presented in the Journal of Sanitary Engineering, Division ASCE, April 1964.
- D. Internal Inspection: Upon completion of construction and prior to final inspection, the contractor shall clean the entire new pipeline of all dirt and debris. Sewer pipes shall be cleaned by the controlled balling method.

END OF SECTION

**SECTION 33 40 00
STORM DRAINAGE IMPROVEMENTS**

PART 1: GENERAL

1-01 SECTION INCLUDED:

- A. Furnishing and installing storm drainage facilities, including pipe, cleanout, manhole structures, inlet structures and pump station.

1-02 RELATED SECTIONS:

- A. Division 00 – Contract General Conditions.
- B. Section 01 5000 – Temporary Facilities.
- C. Section 31 1100 – Clearing of Work Site for Site Improvements.
- D. Section 31 1400 – Soil Materials.
- E. Section 31 2300 – Trench Excavation and Backfilling.
- F. Appendix D – Storm Drainage Pumps
- G. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to the work of this section.

1-03 REFERENCES:

- A. ANSI/ASTM C76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- B. ANSI/ASTM C443 – Joints for Circular Concrete Sewer and Culvert Pipe, using rubber gaskets.
- C. ANSI/ASTM C478 – Precast Reinforced Concrete Manhole Sections.
- D. California Test Method No. 216 (Dry Method).

1-04 SUBMITTALS

- A. Submit under provisions of Division 00 – Contract General Conditions.
- B. Certificates of compliance for material.
- C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install products supplied.

1-05 COORDINATION:

- A. Coordinate work with Owner personnel.

- B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner personnel.

1-06 EXISTING UTILITIES:

- A. The Engineer has indicated on the plans the location of all known existing utility facilities within the work area. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals have been shown where information was available. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- C. Contractor shall verify all utilities within the work area, including using hand method. Contractor shall protect all existing utilities not designated to be removed.
- D. Maintain all existing utility mains and service lines in constant service during construction of the work.

1-07 PROJECT RECORD DOCUMENTS:

- A. Submit under provisions of Section 01 70 00.
- B. Accurately record actual locations of utilities encountered.

PART 2: PRODUCTS

2-01 MATERIALS:

- A. Reinforced Concrete Pipe for pipe larger than 12": ANSI/ASTM C76, Class 4, with rubber gasket joints per ANSI/ASTM C443.
- B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35 for pipe 12" or less.
- C. Storm drain manhole, frame and cover shall be as per detail drawing.
- D. Cast in Place Concrete: Per Section 03 30 00.
- E. Reinforcement: Per Section 03 20 00.
- F. Mortar: Composed of one part, by weight, Portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.
- G. Storm drain inlets shall be Dura Drain P-6, Christy U-32 inlet.
- H. Soil Fill for Concrete Pipe Bedding Envelope: Type B or C per Section 31 14 00.
- I. Cleanout shall be constructed as per detail drawing.
- J. Storm drain pump station shall be as per detail drawing and Appendix D.

PART 3: EXECUTION

3-01 EXAMINATION:

- A. Verify site conditions. Locate, identify, and protect existing above and below grade utilities from damage.

3-02 PREPARATION:

- A. Protect all improvements not authorized for removal.
- B. Employ equipment and methods appropriate to the work site.
- C. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.
- D. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater as necessary.
- E. Comply with safety requirements as they pertain to excavations, per Section 31 23 00/3-01C.

3-03 EXCAVATION:

- A. Excavate soil required to locate existing utilities and install the work, use hand method as necessary in congested area.
- B. Employ equipment and methods appropriate to the work site.
- C. Cut trenches just wide enough to enable installation and proper backfill and do not interfere with 45 degree bearing splay of foundations. When excavating through tree roots, cut roots by hand.
- D. Excavate trenches to provide the minimum cover required.
- E. Excavate trenches, pits, or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings.
- F. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure.
- G. Stockpile excavated material to be returned to trench adjacent thereto in location, which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove unsuitable or excess materials not being used, from site.

3-04 INSTALLATION AND BEDDING OF STORM DRAIN PIPE:

- A. Install the pipe and fittings to the lines and grades shown on the construction plans.
- B. Install pipe and fittings in accordance with the manufacturer's recommendations.
- C. Lay all pipe with bell end of pipe upgrade from structure to structure.

- D. Excavate suitable bell holes in the bedding material, so that the bells do not bear on the subgrade or bedding.
- E. Ensure that all joints are watertight.
- F. Bed concrete pipe in Type B or C soil envelope, and compact to a minimum of 85 percent relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (4 inches below the outside bottom of the pipe barrel) to a level 12 inches above the outside top of the pipe barrel.

3-05 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTENANCES:

- A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.
- B. Construct cast-in-place concrete per Section 03 30 00.
- C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.
- D. Joint precast manhole and structure riser sections with a minimum thickness of ½ inch of mortar per Section 33 40 00/2-01G to make a watertight joint. Neatly point the inside and outside of the joint. Set sections plumb.
- E. Construct cleanout per detail drawing.

3-06 BACKFILLING TO FINISH GRADE AND FINISH GRADING:

- A. Backfill from bottom of the trench to pipe grade with Type B and C soil.
- B. After installation of pipes and appurtenances and backfill of pipe bedding material.
- C. Backfill trenches above pipe bedding material and to within 6 inches of finish subgrade with Type A, B, & C soils. Compact all soil backfill not exceeding 8 inches in uncompacted thickness. Maintain optimum moisture content of fill materials.
- D. Backfill final 6 inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type B or C soils.
- E. Backfill final 6 inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil with Type A soil.
- F. Obtain 85 percent relative compaction of backfill from bottom of backfill to a level of 2 feet below finish subgrade, and obtain minimum of 95 percent relative compaction of backfill in top 2 feet below finish subgrade, in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement.
- G. Obtain minimum of 85 percent relative compaction of backfill in areas to receive sod, other vegetation, or bare soil.

3-07 TOLERANCES:

- A. Pipe laying tolerances:

1. Above grade: Not to exceed 1/4 inch above planned grade.
 2. Below grade: Not to exceed 1/2 inch below planned grade.
 3. Alignment: Not to exceed 2 inches from planned alignment, if gradual and regular over a distance of 20 feet.
- B. Structure finish grade tolerance: Within 1/4 inch of planned grade, but must match adjacent improvements.

3-08 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed as per Section 01 4000.
- B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.
- C. If tests indicate work does not meet specified requirements, re-compact, or remove and replace, and retest.

END OF SECTION

**SECTION 33 50 00
OFFSITE STREET AND UTILITIES**

PART 1: GENERAL

1-01 DESCRIPTION

- A. Work Included: Furnishing all labor, materials and equipment necessary to construct street improvements, street storm drainage, water and sewer improvements at the locations as shown on plan applicable to PG&E, Fresno Metropolitan Flood Control District, and City of Fresno Standards.
- B. Drawings, General and Supplementary Conditions, and Division-1 Specifications sections, apply to the work of this section.

1-02 QUALITY ASSURANCE

- A. Standards: City of Fresno and Fresno Metropolitan Flood Control District Standard Drawings and Specifications, latest Edition.
- B. All work shall comply with the rules and regulations of the Division of Industrial Safety and all other local, state and federal agencies having jurisdiction. Nothing contained herein shall be construed as permitting work that is contrary to such rules, regulations and codes.

1-03 SUBMITTALS

- A. Comply with all City of Fresno requirements regarding submittals.

1-04 SCOPE OF WORK

- A. The contractor shall construct street improvements as shown on the construction plans per the City of Fresno standard, including removal and construction of existing sidewalk, driveway, ramp, and pavement.
- B. The Contractor will pay for and coordinate with the city for the wet tie connections to existing water main and providing of new water services, new fire services, water meter as well as trench resurfacing. The Contractor shall also furnish and install the detector check valves and vault, remove and replace existing concrete improvements, trench resurfacing and striping.
- C. Sewer facilities shall consist of constructing new sewer services at the locations as shown on plan. Also included is the trench and resurfacing and striping.
- D. The Contractor shall construct a new storm drainage pipeline as shown on the plans per FMFCD standards including trench resurfacing and striping.
- E. The Contractor is responsible for all coordination and project scheduling With Pacific Gas and Electric Company, AT&T Telephone Company and other utility companies regarding their work of relocating and/or undergrounding their facilities within the street right of ways. Such responsibility shall include, but not necessarily be limited to: the Contractor establishing and maintaining communication with the utility companies regarding the Contractor's schedule and that of the utility companies; the preparation of street and sidewalk subgrade so that the utility companies can trench for their underground facilities; the establishment of surveyed street curb grades and alignments for the utility companies so that they may accurately locate their facilities; and the possible requirement to schedule

work around existing utilities poles until such time as the utility companies complete their relocation or installations. Such coordination may require the Contractor to schedule multiple move-ins of equipment and personnel so that his work can be accomplished, as required by the construction documents. The Architect has made a diligent attempt to provide the various utility companies with project plans of the work prior to bidding. It is the Owner's responsibility to contract with the utility companies for the relocation work and to pay all costs to the utility companies that may be chargeable by the utility companies for their work.

1-05 EXISTING CONDITIONS

- A. Contractor shall be held to have visited the site prior to submitting a bid proposal to determine existing conditions, nature of materials to be encountered and to evaluate other information concerning or affecting the work to be performed under the contract. Water facilities shall consist of construction of a new water main, water services, fire services and irrigation services. The Contractor will make the wet tie connection to the existing water main.
- B. Before commencing excavation, the Contractor shall notify all utility authorities or utility companies having possible interest in the work of the Contractor's intention to excavate proximate to existing facilities and the Contractor shall verify the location of any utilities within the work area.
- C. Service laterals have been shown where information was available. The location of said facilities shall be considered approximate only, until exposed by the Contractor.
- D. Contractor shall verify all utilities within the work area, including using hand method. Contractor shall protect all existing utilities not designated to be removed.
- E. All existing utility mains and service lines shall be kept in constant service during the construction of this project. Hand excavating shall be employed where necessary to safely expose existing utilities.
- F. Full compensation for all costs involved in locating, verifying, protecting, exposing, relocating, reconstruction and otherwise providing for utilities shall be included in the amount bid for the various items of work and no separate payment shall be made therefore.

1-06 DUST AND TRAFFIC CONTROL

- A. Dust Control
 - 1. The Contractor shall maintain a Dust Control Plan on the site of the work, including any haul roads to or from the site. Contractor shall use whatever means are necessary, such as watering, sweeping or oiling, so as to cause the least possible dust nuisance to the public. Any dust control measure ordered by the Engineer shall promptly and immediately be carried out.
 - 2. If the Contractor fails to provide dust control measures so ordered within a period of 2 hours from the time ordered by the Engineer the Engineer may employ other forces to eliminate or prevent the dust nuisance. The full cost thereof, in addition to the penalty as herein provided, shall be deducted from any monies owed the Contractor. Full compensation for dust control shall be included in the amount bid for the various items of work and no separate payment will be made therefore.

B. Traffic Control

1. A traffic control plan shall be submitted by the Contractor to the City of Fresno for review and approval prior to the issuance of the encroachment permit.
2. Traffic control measures shall be fully and completely carried out at all times to the satisfaction of the City of Fresno. If the Contractor fails to provide satisfactory traffic control the owner may obtain services from other sources and deduct from the contract the cost thereof.
3. Through traffic shall be provided for during non-working hours including, but not limited to, weekends, holidays and at night.
4. The Contractor shall comply with all requirements of the City of Fresno Encroachment permits.
5. Full compensation for traffic control shall be included in the amount bid for the various items of work and no separate payment will be made therefore.

1-07 PROTECTIVE MEASURES

- A. Furnish, place and maintain all supports, shoring and sheeting piling which may be required for the sides of excavation or for protection of adjacent existing improvements. The adequacy of such systems shall be the complete responsibility of the Contractor.
- B. Maintain all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.
- C. Forty-eight (48) hours prior to beginning construction, the Contractor shall notify the owners of all properties adjacent to the proposed construction. The Contractor shall also provide the property owners with an estimate of the length of time that their properties will be affected by the construction activities. Contractor shall provide access to all adjacent properties.

1-08 PERMITS

- A. The Contractor shall secure and pay for all permits required for work under this contract including, but not limited to, the City of Fresno Encroachment Permit
- B. All costs associated with obtaining permits as required by construction and as indicated Herein shall be included in the price bid for the various items of work and no separate payment will be made therefore.
- C. The Contractor shall pay all inspection fees required by governmental agencies.
- D. The Contractor shall obtain a permit from the Division of Industrial Safety of the State of California prior to the commencement of construction. Full compensation for said permit shall be included in the price bid for the various items of work and no separate payment will be made therefore.
- E. Full compensation for all costs involved in worker protection from caving ground in excavations shall be included in the lump sum price bid for the work under this contract.

1-09 FINISH ELEVATIONS AND LINES

- A. Surveying for all offsite improvements shall be provided by the Contractor and all costs associated there with shall be included in the Contractor's bid proposal.

- B. Carefully preserve all data and monuments set by the District's Civil Engineer and, if displaced or lost, the Contractor's Engineer or Surveyor shall immediately replace such monuments to the satisfaction of the Engineer and at no additional cost to the Owner.

1-10 REPRESENTATION OF PLANS

- A. The basic topographic ground feature information shown on the Plans was obtained by field survey. The Contractor shall carefully examine the site of work and shall satisfy himself as to the conditions to be encountered, any changes thereto which have occurred, and any condition or feature which needs additional investigation.

1-11 MONITORING OF CONSTRUCTION SITE

- A. The Contractor shall monitor the construction site on a regular basis during non-working hours, including weekends and holidays to ensure that no situations arising, relating to the condition of the work site, which could pose a threat to public safety. In addition the Contractor shall furnish to the Owner and the City of Fresno Public Works Division, prior to the issuance of the "Notice to Proceed", a list of persons, together with their addresses and home telephone numbers, who are authorized to act on behalf of the Contractor in an emergency arising out of conditions at the work site after normal working hours.
- B. Safe pedestrian crossings shall be maintained at all existing crosswalks and intersections. The Contractor shall secure the site of work at all times. Children shall not be allowed in or along the excavation, on spoil piles or at other undesirable locations within the work. The Contractor shall provide suitable traffic and pedestrian warning devices and signs necessary at or near the work as required by safety considerations and/or jurisdictional authorities. Convenient pedestrian detours and/or flagmen and/or safe temporary bridges over excavations, complete with adequate safety rails, shall be provided as necessary.

1-12 COMPACTION AND COMPACTION TESTS

- A. The Contractor shall be fully responsible for timely compaction and suitability of material for compaction. Where necessary, wet and pumping material shall be removed from the trench or excavation by the Contractor and replaced with suitable approved material as necessary to complete operations within the times allowed.
- B. Compaction requirements for all excavations within public streets, shall be in accordance with the County of Fresno and City of Fresno Encroachment Permits and their standard specifications.
- C. Initial compaction testing shall be provided by the Owner. The Contractor shall file adequate notice to the Engineer when he desires compaction testing. All required compaction retesting of backfill because of failure to pass the initial compaction test shall be at the expense of the Contractor. Full compensation for all costs involved in meeting and satisfying the above requirements shall be included in the amount bid for the various items of work and no separate payment will be made therefore.

1-13 FEES

- A. Fees for the offsite street and utilities improvements are clarified as follows:
 - 1. Fees to be paid by Contractor and to be included as part of his bid:
 - a. Encroachment permit fees
 - b. All City of Fresno Water Division changes.The Contractor shall also be responsible to secure and pay for a City of Fresno Encroachment Permit, as well as all the required bonds and

insurance. All references made by the "General Notes for the Sewer and Water Construction" to the "Developer" shall be interpreted to mean "Contractor", except "The Owner shall pay for all initial compaction tests". Contractor shall pay for all required retests.

1-14 RECORD DRAWINGS

- A. Comply with all requirements of Section 01 70 00 of these Specifications.

PART 2: MATERIALS

- A. All materials incorporated in water facilities construction shall conform with the City of Fresno Standard Plans and Specifications.

PART 3: EXECUTION

- A. Construction of street water, sewer and storm drain facilities shall be performed in accordance with the City of Fresno and the Fresno Metropolitan Flood Control District Standard Plans and Specifications. Contractor shall be responsible for contacting the City of Fresno Public Works Division to schedule wet tie connection.
- B. The Contractor shall be responsible to protect all other existing and proposed utilities and improvements affected by his work.
- C. The Contractor shall cooperate with all other contractors on the job to insure that his activities do not delay or hinder the construction activities of others.
- D. The Contractor is responsible for lawfully disposing of excess earth from trenching and offsite grading.
- E. The Contractor shall coordinate his efforts with other forces performing on-site work such that said forces are provided with adequate access to the site.

END OF SECTION