

Piedmont Middle School New Gymnasium and Site Work Increment 1

AT

Piedmont Middle School

955 Piedmont Road
San Jose, CA 95132

-TECHNICAL MANUAL-

**BID SET
NOT FOR CONSTRUCTION**

October 2022
MDG #2106

Berryessa Union School District

1376 Piedmont Road
San Jose, CA 95132

ARCHITECT

McKim Design Group

4595 Cherry Ave. 1st Floor
San Jose, CA 95118
(408) 927.8110

SPECIFICATIONS FOR

**Piedmont Middle School
New Modular Gymnasium and Site Work
Increment 1**

TABLE OF CONTENTS

DIVISION 2 – EXISTING CONDITIONS

02 41 19 Selective Demolition

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07 92 00 Joint Sealants

DIVISION 9 - FINISHES

09 91 00 Painting

DIVISION 26 - ELECTRICAL

26 05 00 General Electrical Requirements
26 05 19 Line Voltage Wire and Cable
26 05 26 Grounding
26 05 42 Conduits, Raceways and Fittings
26 05 43 Underground Ducts
26 05 44 In Grade Pull Boxes
26 28 16 Circuit Breakers

DIVISION 31 – EARTHWORK

31 10 00 Site Clearing
31 23 00 Excavation & Fill
31 25 00 Erosion Control

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 12 16 Asphaltic Concrete Paving
32 13 14 Site Concrete
32 31 13 Chain Link Fence
32 80 00 Irrigation – Design Build

DIVISION 33 – UTILITIES

33 11 16 Water Systems
33 11 19 Fire Suppression Systems
33 31 00 Sanitary Sewer
33 41 00 Storm Drainage

End of Document

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Demolishing designated building equipment and fixtures.
- B. Demolishing designated construction.
- C. Cutting and alterations for completion of the Work.
- D. Removing designated items for reuse and Owner's retention.
- E. Protecting items designated to remain.
- F. Removing demolished materials.

1.2 SUBMITTALS

- A. See general conditions for submittal requirements.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
 - 1. Indicate demolition and removal sequence.
 - 2. Indicate location of items designated for reuse and Owner's retention.
 - 3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

1.4 QUALITY ASSURANCE

- A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.
- B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.5 PRE-DEMOLITION MEETING

- A. See Administrative Section regarding pre-installation meetings.
- B. Convene site meeting one week prior to beginning demolition to confirm scope understanding.

1.6 SCHEDULING

- A. Schedule Work to coincide with new construction and modernization.
- B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and activities in adjacent buildings on school campus.
- C. Coordinate utility and building service interruptions with Owner.
- D. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
- E. Schedule tie-ins to existing systems to minimize disruption.
- F. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas of adjacent buildings on school campus.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions of the work in place before beginning work; report existence of hazardous materials or unsafe structural conditions.

3.2 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Existing Utilities:
 - 1. General: Coordinate disconnection and capping of existing gas, water, sewer and electrical utilities; verify work is complete before starting demolition work affecting those utilities. Do not interrupt existing utility service to operating facilities, except when authorized in writing by Owner. Provide not less than 72 hours' notice to Owner if shutdown of service is required. Make provision for temporary service during interruption of existing utility service, acceptable to Owner.
 - 2. Mechanical: Refer to Division 22 – PLUMBING; disconnecting, removing and capping existing gas, water and sewer utilities.
 - 3. Electrical: Refer to Division 26 – ELECTRICAL; disconnecting, removing, and capping existing electrical utilities. Owner will make arrangements with telephone company concerning their equipment and lines.
- D. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public and Owner, and existing improvements indicated to remain.
- E. Prevent movement of structures; provide temporary bracing and shoring required to ensure safety of existing structures.
- F. Provide appropriate temporary signage including signage for exit or building egress.
- G. Do not close or obstruct building egress path.
- H. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.
- I. Hazardous Materials:
 - 1. General: Identify, collect, and legally dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.
- J. Protection:
 - 1. Site: Protect existing adjacent installations not scheduled for demolition from damage; take measures to prevent damage to existing turf, paving, trees, streets, curbs, walks, sewers, etc., during demolition and construction.
 - 2. Trees:
 - a) General: Protect trees adjacent to and overhanging the Project Site from impact of any kind.
 - b) [Repair and Replacement off site elements: Per the city Municipal Code where this project occurs.](#)
 - c) Tree Preservation:
 - 1. General: Owner's Representative shall designate the following:
 - 2. Tree Enclosure Area: Material, topsoil, vehicle or equipment not permitted within tree enclosure area.
 - 3. Tree Canopy Area: Do not alter ground under and around designated area.

4. Retained Trees: Irrigated, aerated and maintained as required to ensure survival.
- d) Trenching and Excavation: Report the encounter of any tree root system to the Owner. Owner will provide services of an Arborist to repair major damage to root systems.
3. Safety Precautions: Prevent damage to existing elements to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building being removed. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.

3.3 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.4 DEMOLITION

- A. General: Perform demolition as shown and remove from the site. Use methods required to complete Work within limitations of governing regulations. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
 1. Conduct demolition to minimize interference with adjacent and occupied building areas.
 2. Maintain protected egress from and access to adjacent existing buildings at all times.
 3. Do not close or obstruct roadways or sidewalks without permits.
- B. Explosives: Use not permitted.
- C. Cutting and Removal: Remove existing work as shown; cut in neat straight lines, parallel to adjacent elements or plumb to vertical surfaces; grind smooth saw cut edges of concrete slabs or walks. Neatly remove existing finish materials back to clean straight line on nearest support to facilitate installation of new materials, patches or repairs. Use methods that prevent damage to other work, and provide proper surfaces for installation of repairs and new work.
- D. Prepare and follow an organized plan for demolition and removal of items.
 1. Shut off, cap, and otherwise protect existing public utility lines in accordance with the requirements of the public agency or utility having jurisdiction.
 2. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
 3. Completely remove items scheduled to be so demolished and removed, leaving surfaces clean, solid, and ready to receive new materials specified elsewhere.
 4. In all activities, comply with pertinent regulations of governmental agencies having jurisdiction.
- E. Carefully remove building and site components indicated to be reused.
 1. Disassemble components as required to permit removal.
 2. Package small and loose parts to avoid loss.
 3. Mark components and packaged parts to permit reinstallation.
 4. Store components, protected from construction operations, until reinstalled.

- F. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- G. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- H. Remove temporary Work.

3.5 DISPOSAL

- A. General: Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
- B. Haul Routes:
 - 1. General: Establish haul routes in advance; post flagmen for the safety of the public and workmen.
 - 2. Maintenance: Keep streets free of mud, rubbish, etc., assume responsibility for damages resulting from hauling operations; hold Owner free of liability in connection therewith

3.6 SCHEDULES

- A. Remove, store and protect the following materials and equipment for reinstallation in the project.
 - 1. N/A
- B. Remove the following equipment and materials for Owner's retention. Deliver to location designated by Owner.
 - 1. N/A
- C. Protect the following materials and equipment remaining.
 - 1. (e) buildings including portables.
 - 2. (e) irrigation system, valves, etc..except where modifications are required.
 - 3. (e) concrete and AC paving not being removed.
 - 4. (e) fencing and playground equipment not being removed.
- D. Demolish the following materials and equipment remaining.
 - 1. (e) concrete sidewalks and AC paving.
 - 2. (e) site soil, landscape, etc.
 - 3. (e) fencing and gates.

3.7 REPLACEMENT

- A. In the event items are mistakenly demolished, promptly notify the Architect. Contractor shall replace the demolished item to the approval of the Architect at no additional cost to the Owner.

END OF SECTION

SECTION 07 92 00
JOINT SEALERS

PART I – GENERAL

1.01 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and backing.

1.02 REFERENCES

- A. ASTM C834 – Latex Sealing Compounds.
- B. ASTM D1056 – Flexible Cellular Materials – Sponge or Expanded Rubber.
- C. FS TT-S-227 – Sealing Compound: Elastomeric Type, Multi-Component.
- D. FS TT-S-230 – Sealing Compound: Elastomeric Type, Single Component.
- E. FS TT-S-1543a – Sealing Compound: Silicone Type.
- F. FS TT-S-001657 – Sealing Compound: Single Component, Butyl Rubber Based.

1.03 SUBMITTALS FOR REVIEW

- A. Submit product data under provisions of the contract.
- B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, color availability and shore hardness.
- C. Color of visible sealant to match adjacent painted surface unless specifically noted otherwise

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years experience.
- B. Applicator: Company Specializing in applying the work of this Section with minimum three years experience.
- C. Conform to Sealant and Waterproofers Institute requirements for materials.

1.05 FIELD SAMPLES

- A. Provide samples under provisions of the contract.
- B. Construct one field sample illustrating sealant type, color, and tooled surface, maximum 12 inches long, in each differing sealant application.
- C. Do not proceed with remainder of sealant application until approved by the Architect.
- D. Approved sample may remain as part of the Work. Disapproved sample shall be removed.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation. Deliver materials in unopened containers, store in dry, covered area.

PART II – PRODUCTS

2.01 SEALANTS

- A. Use sealants selected from the following types, as indicated on drawings or as appropriate to the joint being sealed. Refer to schedule for additional approved applications.
 - 1. Type 1: One-part moisture curing Polyurethane sealant. FS TT-S-230C, Type II, non-sag, Class A DYNATROL I, manufactured by Pecora Corp., Harleysville, PA, SIKAFLEX-1a, manufactured by Silka Corp., Lyndhurst, NJ, or equal.
 - a. Elongation Capability: 25 percent.
 - b. Shore A Hardness Range: 20 to 40.
 - 2. Type 2: Multi-part Polyurethane Base. FS TT-S-227E, Class A, Type II, non-sag, DYNATROL II, manufactured by Pecora Corp., Harleysville, PA, SIKAFLEX-2c N/A, manufactured by Sika Corp., Lyndhurst, NJ, or equal.

- a. Elongation Capability: 50 percent.
 - b. Shore A Hardness Range: 20 to 35.
3. Type 3: One-part moisture curing Polyurethane sealant. FS TT-S-230C, Type 1, self leveling, Class A, UREXPAN NR-201, manufactured by Pecora Corp., Harleysville, PA, VULKEM 45, manufactured by MAMECO International Inc., Cleveland, OH, or equal.
 - a. Elongation Capability: 25 percent.
 - b. Shore A Hardness Range: 35.
4. Type 4: Multi-part Polyurethane Base. FS TT-S-227, Type I, self-leveling, Class A, DYNATRED or UREXPAN NR-200, manufactured by Sika Corp., Harleysville, PA, SIKAFLEX-2c N/A, manufactured by Sika Corp., Lyndhurst, NJ or equal.
 - a. Elongation Capability: 250 – 300 percent.
 - b. Shore A Hardness Range: 40.
5. Type 5: One-part Silicone Sealant. FS TT-S-1543a Type S, non-sag, Class A, 863 ACETOXY Silicone Sealant, manufactured by Pecora Corp., Harleysville, PA, SCS 1200, manufactured by General Electric Co., Waterford, NY, or equal.
 - a. Elongation Capability: 25 percent.
 - b. Shore A Hardness Range: 27.
6. Type 6: One-part, non-sag, acrylic latex sealing compound, ASTM C834, AC-20 manufactured by Pecora Corp., Harleysville, PA, ACRYLIC LATEX No. 834 manufactured by Tremco, Beachwood, OH, or equal.
7. Type 7: One-part, non-sag, butyl rubber base acoustical sealant ASTM C834, BA-98, manufactured by Pecora Corp., Harleysville, PA, SHEETROCK ACOUSTICAL SEALANT manufactured by USG, Chicago, IL, or equal.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 25 percent larger than joint width; DENVERFOAM or GREENROD, manufactured by Pecora Corp., Harleysville, PA. SONOFOAM BACKER ROD, manufactured by Sonneborn building Products, Minneapolis, MN, or equal.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application. Apply to bottom of joints which are too shallow to receive foam backer rod.
- E. Sealant Tape: Butyl sealant tape between sheet metal laps and at concealed locations. ADCO GT-206 or approved equal.

2.03 FIRESTOP SEALANTS

- A. Refer to Section 07 27 00, Fire stopping if applicable.

PART III – EXECUTION

3.01 EXAMINATION

- A. Verify that joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Beginning of installation means installer accepts existing surfaces.

3.02 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant. Remove dust with compressed air.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with manufacturer's recommendations.
- E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions, using hand pointing tools, hand-operated pressure guns or air operated guns with reciprocal pumps and hoses.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width. Where sealant is applied to concrete, concrete is to be fully cured.
- D. Install bond breaker where joint backing is not used. Install removable masking material to maintain clean lines and protect adjoining surfaces.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges. Do not install sealant on wet or damp surfaces.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Tool joints concave, channel shaped or as detailed. Use slicking agent type recommended by manufacturer.

3.04 CLEANING AND REPAIRING

- A. Clean adjacent soiled surfaces immediately before sealant cures.
- B. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished installation from the work of other sections.
- B. Protect sealants until cured.

3.06 SCHEDULE

- A. Exterior Joints; Unless Specified Otherwise in Individual Sections:
 - 1. Joints between metal frames and concrete or masonry: Sealant Type (1).
 - 2. Joints Between Impervious Materials: Sealant Type (1).
 - 3. Vertical Expansion and Control Joints: Sealant Type (2).
 - 4. Joints in sheet metal flashings: Sealant Type (1).
 - 5. Perimeters of window frames, door frames, louvers and similar openings, and where metal, wood or other materials abut or join masonry, concrete or each other: Sealant Type (1).
 - 6. Horizontal expansion, control and abutment joints in sidewalks, concrete floors: Sealant Type (4). Joints where a self-leveling sealant cannot be used because of slope: Sealant Type (2).
 - 7. Glass glazing, cap beads (on glass), to metal and surfaces made of a silica substance: Sealant Type (5).
- B. Interior Joints; Unless Specified Otherwise in Individual Sections:
 - 1. Vertical expansion and control joints: Sealant Type (1).
 - 2. Joints between impervious materials: Sealant Type (1).
 - 3. Horizontal expansion, control, isolation and abutment joints: Sealant Type (3) or (4).
 - 4. Window and door perimeters: Sealant Type (1).
 - 5. Gypsum Board Joints: Sealant Type (1).
 - 6. For sink, tub or bath areas including countertop joints: Sealant Type (5).
 - 7. Other interior joints as indicated or shown: Sealant Type (1).
 - 8. Intersection of wall surface and cap strip at resilient flooring integral cove: Sealant Type (1).
 - 9. Intersection of metal or wood thresholds and floor substrate, where building components are mechanically attached and required sealing: Sealant Type (6).

10. Perimeter of sound-rated walls, at intersection of gypsum board and abutting surfaces, both sides of wall: Sealant Type (7).

END OF SECTION

SECTION 09 91 00
PAINTING

1 PART 1 GENERAL

1.1 WORK INCLUDED

- A. Surface preparation.
- B. Prime coat application.
- C. Finish coat application.

1.2 WORK NOT INCLUDED

- A. Surfaces Not To Be Painted:
 - 1. Prefinished wall, ceiling and floor coverings.
 - 2. Items with factory-applied final finish except roof-mounted equipment or electrical panels, or equipment on painted walls (Roof mounted equipment and electrical equipment on painted walls (interior and exterior) shall be painted if visible.
 - 3. Concealed ducts, pipes and conduit.
 - 4. Glass, plastic laminate, ceramic tile, anodized aluminum.
 - 5. Steel items embedded in concrete. Exposed areas are to be painted.
 - 6. Surfaces specifically scheduled or noted on the drawings not be painted.
 - 7. Fire-Rated Labels on Doors or Frames.
 - 8. Exterior Tags on Modular Buildings

1.3 REFERENCES

- A. AQMD – Local Air Quality Management District, Regulations.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- C. ASTM D4444 – Use and Calibration of Hand-Held Moisture Meters.

1.4 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with ten years experience.
- B. Applicator: Company specializing in commercial painting and finishing with five years experience.

1.5 REGULATORY REQUIREMENTS

- A. Conform to AQMD Regulations concerning VOC Emissions.
- B. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

1.6 SUBMITTALS FOR REVIEW

- A. Submit product data under provisions of the contract.
- B. Provide product data on all finishing products.
- C. Submit samples under provisions of the contract.
- D. Submit three samples 8-1/2 inch x 11 inch in size illustrating range of colors and textures available for each surface finishing product scheduled for selection
- E. Prepare wood samples on type and quality of wood specified.
- F. Submit manufacturer's application instructions under provisions of the contract.

1.7 FIELD SAMPLES

- A. Provide samples under provisions of the contract.

- B. Provide field sample panel, illustrating coating color, texture and finish for each color scheduled.
- C. Locate as approved by Architect.
- D. Approved sample may remain as part of the Work.
- E. Do not proceed with coating application until sample panel has been approved.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labelled containers.
- B. Container labeling to include manufacture's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.
- C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area unless permitted otherwise by manufacturer's instructions.
- D. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during and 48 hours after application of finishes, unless permitted otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain, or when relative humidity is above 50 percent, unless permitted otherwise by manufacturer's instructions.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and transparent Finishes: 65 degrees F for interior or exterior, unless permitted otherwise by manufacturer's instructions.
- E. Provide lighting level sufficient to conduct painting operations.

1.10 EXTRA STOCK

- A. Provide an extra stock equaling ten percent (10%) of each color, type and gloss of paint used on the Work, but not more than five gallons for each.
 - 1. Label each container with color, texture and room locations in addition to the manufacturer's label.

1.11 GUARANTEE

- A. Guarantee the painting work against peeling, fading, cracking, blistering or crazing for a period of two years from the Date of Substantial Completion.

2 PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Kelly Moore, San Carlos, CA. Basis of design is based on DuraPoxy HP Interior/ Exterior (Ultra Premium), Acryshield Exterior (Premium) and DuraPoxy Interior (Ultra Premium) paint finish. Model numbers listed in the schedule below may need to adjust based on the current paints provided by manufacturer.

Note: The DuraPoxy HP line shall be used at all interior and exterior doors and frames on both sides and all faces and edges. All other exterior surfaces shall be painted with the AcryShield paint finish.

2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
- B. Colors and Glosses: The Architect will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained

from the materials proposed to be used in the Work. Architect will select a minimum of 4 colors for the interior and 4 colors for the exterior per building. If the building is over 6,000 square feet, the architect may select up to 6 colors for the interior, with no more than 4 colors being used in any single room.

1. Preliminary Interior Sheen Schedule (final sheens to be verified with Architect):

- a. Gypsum Board – All areas other than restrooms: Satin
- b. Gypsum Board at restrooms: Semi-gloss
- c. Handrails, Metal Doors & Frames, other metals: Semi-Gloss
- d. Interior Wood: Semi-gloss or clear coat
- e. Ceiling Tiles: Satin
- f. Exposed Ductwork: Satin or Semi-gloss

2. Preliminary Exterior Sheen Schedule (final sheens to be verified with architect):

- a. Cement Plaster: Satin or Semi-Gloss
- b. Metal fascia, leader-heads, rainwater leaders, downspouts, perforated metals, miscellaneous metals: Semi-gloss
- c. Handrails, Metal Doors & Frames: Semi-Gloss
- d. Exterior Wood: Semi-gloss or Satin
- e. Mechanical louvers, metal trim, expansion joints, other metals within the cement plaster system: Satin or Semi-gloss

- C. Undercoats and Thinners: Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer and use only to be recommended limits. Insofar as practicable, use undercoat, finish coat and thinner material as parts of a unified system of paint finish.
- D. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.
- E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.

2.3 APPLICATION EQUIPMENT

- A. For application of the approved paint, use only such equipment as is recommended by the manufacturer.
- B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.

2.4 FINISHES

- A. Refer to schedule at end of section for surface finish. Notwithstanding product numbers listed in schedule, Contractor shall conform to most recent product numbers as published by the manufacturer.

3 PART 3 EXECUTION

3.1 INSPECTION

- 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 not identified to be prepared by you under section 3.3.
- C. Measure moisture content of new surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Located Wood: 15 percent, measured in accordance with ASTM D4442 and ASTM D4444.

- 4. Exterior Located Wood: 19 percent, measured in accordance with ASTM D4442 and ASTM D4444.
- D. Beginning of installation means acceptance of existing surfaces.

3.2 MATERIALS PREPARATION

- A. Mix and prepare painting material in accordance with manufacturer's recommendations.
- B. Store materials not in actual use in tightly covered containers.
- C. Maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue.
- D. Stir all materials before application to produce a mixture of uniform density and as required during the application of materials. Do not stir into the material any film which may form on the surface. Remove the film and strain the material before using.

3.3 SURFACE PREPARATION

- A. Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect work of this Section.
- C. Shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- F. Gypsum Board Surfaces: Fill minor defects, joints and nail head depressions with spackling compound. Prime in accordance with primer manufacturer's recommendations.
- G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer as specified in schedule. When time permits, allow to weather a minimum of 6 months prior to coating. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner, then prime as required. When weathering is not possible or surface has been treated with chromates or silicates, clean all galvanized metal with appropriate metal prep and passivator remover. To ensure passivator has been removed, perform the following test:
 - a. With a 2% to 5% copper sulfate solution, place a swab or droplets to the prepared area. If copper sulfate causes the galvanized to blacken, the passivator has been removed and is ready for paint application.
 - b. If the copper sulfate has no effect on the galvanized, continue with metal prep solution or use a Scotch pad to abrade it, being careful not to remove the galvanization itself. Apply the required primer, allow drying as described in the product data sheets and test adhesion prior to applying required finish coats.
- H. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: 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 or corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- I. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- J. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by 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. Spot prime paint after repairs.
- K. Shop Primed Steel Surfaces: 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.

- L. Wood Scheduled to Receive Paint Finish: Remove dust, grit and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- M. Wood Doors and Cabinet Work scheduled for field-applied transparent or solid stain finish:
 - 1. Sand surfaces thoroughly with a 5/0, 180 grit sandpaper.
 - 2. Apply coatings as specified in the schedule to all surfaces, sides and edges, all six sides. Avoid streaking or uneven application.
- N. Wood Doors Scheduled for Painting: Seal top, bottom and all edges with primer and then paint. Leave labels intact and readable.
- O. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- P. Painted Steel Posts, Downspouts, Etc: Wire brush any loose or flaking paint. Scrape any bubbles and wire brush back to a point where paint has solid adhesion. Spot prime areas prior to final application of finish.
- Q. Aluminum scheduled to be painted shall be cleaned and etched as recommended by the manufacturer for proper application of finish.

3.4 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

3.5 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish. Number of coats specified is a minimum. Additional coats shall be applied at no extra cost, if coatings show evidence of uneven application, uneven pigmentation, brush strokes or otherwise unsatisfactory distribution of material.
NOTE: BACK ROLL AFTER EACH APPLICATION.
- D. Under coats shall be lighter and brighter in tint than finish coat.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.
- G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- H. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- J. Seal Tops, bottoms and cutouts for hardware and accessories of wood or plastic laminate covered doors.
- K. Split paint door frames to match color of walls on each side of opening.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Section Divisions 15 and 16 for color coding and identification banding requirements of equipment, duct work, piping, and conduit.
 - 1. Unless otherwise indicated, conform to the following color coding system:

TYPE of PIPING	PRODUCT NUMBER	COLOR
Chilled Water	Ameritone 1986	Vista Gray
Condenser Water	Sinclair 7532	Canvas Tan
Domestic Hot Water	Sinclair 7518	Admiral Blue

Domestic Cold Water	Sinclair 7530	Edison Blue
Plant Air	Copper	Clear Lacquer
Vacuum	Sinclair 7500	Shasta White
Oxygen	Sinclair 7535	John Deere Green
Cold Soft Water	Sinclair 7575	OSHA Violet
Steam	Sinclair 7534	Caterpillar Yellow
Hot Water	Sinclair 7533	Ferguson Gray
Soil Waste	Sinclair 7531	Loam Brown
Fire	Sinclair 7570	OSHA Red
Fuel Gas	Sinclair 7572	OSHA Orange
Deionized Water		Light Blue

2. Verify appropriate specific color designations with paint manufacturer.
 3. Conform to Owner's special requirements for color coding. Match existing coding system where required.
- B. Paint shop primed equipment.
 - C. Remove **all (finished and unfinished)** louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished and confirmed with architect not to paint.
 - E. Replace identification markings on mechanical or electrical equipment when painted accidentally.
 - F. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint, limit of sight line. Paint dampers exposed behind louvers and grilles, to match face panels.
 - G. Paint exposed conduit and electrical equipment occurring in finished areas.
 - H. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - I. Color code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows names and numbering, using stencils or other approved systems.
 - J. Replace electrical plates, hardware, light fixture trim and fittings removed prior to finishing.

3.7 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.8 SCHEDULE – EXTERIOR SURFACES

		Other	Kelly Moore DuraPoxy HP	Kelly Moore AcryShield
A.	Wood – Flat - Acrylic			
	1. One Coat			255
	2. Two Coats			1240
B.	Wood – Semi-Gloss - Acrylic			
	1. One Coat			255
	2. Two Coats			1250
C.	Wood – Gloss - Acrylic			

	1. One Coat	S-30 Griptec		
	2. One Coat	S-39 Beyond		
	3. One Coat	S-39 Beyond		
D.	Wood – Stain- Transparent – Acrylic			
	1. Two Coats			1285
E.	Wood – Stain – Solid – Acrylic			
	1. Two Coats			1240
F.	Wood – Clear – Spar Varnish			
	1. Three Coats	Old Master Spar Marine Varnish		
G.	Concrete – Flat – Acrylic			
	1. One Coat			247
	2. Two Coats			1240
H.	Concrete – Low Sheen – Acrylic			
	1. One Coat			247
	2. Two Coats			1245
I.	Concrete – Elastomeric			
	1. One Coat	247		
	2. Two Coats	1128		
J.	Concrete Block – Flat – Acrylic			
	1. One Coat	521		
	2. Two Coats			1240
K.	Concrete Block – Low Sheen – Acrylic			
	1. One Coat	521		
	2. Two Coats			1245
L.	Concrete Block – Elastomeric			
	1. One Coat	521		
	2. Two Coats	1128		
M.	Cement Plaster – Flat – Acrylic			
	1. One Coat			247
	2. Two Coats			1240
N.	Cement Plaster – Low Sheen – Acrylic			
	1. One Coat			247
	2. Two Coats			1245
O.	Cement Plaster – Elastomeric			
	1. One Coat	247		
	2. Two Coats	1128		
P.	Ferrous – Flat – Acrylic			

	1. One Coat	5725		
	2. One Coat			1240
	3. One Coat			1240
Q.	Ferrous – Semi-Gloss – Acrylic			
	1. One Coat	5725		
	2. One Coat	5885		
	3. One Coat	5885		
R.	Ferrous – Gloss – Alkyd			
	1. One Coat	265		
	2. One Coat	1999		
	3. One Coat	1999		
S.	Ferrous – Factory Primed: Touch-up primer coat in lieu of full primer coat. Finish coats as specified above.			
T.	Galvanized and Aluminum – Flat - Acrylic			
	1. One Coat	Surface Prep: SSPC-SP1 Krud Kutter Metal Clean		
	2. One Coat	5725		
	3. One Coat			1240
	4. One Coat			1240
U.	Galvanized and Aluminum – Semi Gloss – Acrylic			
	1. One Coat	Surface Prep: SSPC-SP1 Krud Kutter Metal Clean		
	2. One Coat	5725		
	3. One Coat	5885		
	4. One Coat	5885		
V.	Galvanized and Aluminum – Gloss – Alkyd			
	1. One Coat	Surface Prep: SSPC-SP1 Krud Kutter Metal Clean		
	2. One Coat	5725		
	3. One Coat	1999		
	4. One Coat	1999		
W	Entry Doors, & Door Casings - Semi-Gloss – Interior/ Exterior High Performance Acrylic			
	1. One Coat	295		
	2. One Coat			2888
	3. One Coat			2888

3.9 **SCHEDULE – INTERIOR SURFACES**

		Other	Kelly Moore DuraPoxy	Kelly Moore DuraPoxy HP
A.	Wood – Matte - Acrylic			
	1. One Coat	295/973		
	2. Two Coats		1600	
B.	Wood – Semi-Gloss - Acrylic			
	1. One Coat	295/973		
	2. Two Coats		1685	
C.	Wood – Eggshell - Acrylic			
	1. One Coat	295/973		
	2. Two Coats		1686	
D.	Wood – Gloss – Acrylic			
	1. One Coat	295/973		
	2. Two Coats		1680	
E.	Wood – Stain – Transparent, Non-Yellowing - Flat – Lacquer			
	1. One Coat	GemGlo 6700 Series		
	2. One Coat	Gemini Precat Sealer 210-0222		
	3. Two Coats	Gemini Precat 510- 0277		
F.	Wood – Stain – Transparent, Non-Yellowing – Semi-Gloss - Lacquer			
	1. One Coat	GemGlo 6700 Series		
	2. One Coat	Gemini Precat Sealer 210-0222		
	3. Two Coats	Gemini Precat		
	1. One Coat	GemGlo 6700 Series		
	2. One Coat	Gemini Precat Sealer 210-0222		
	3. Two Coats	Gemini Precat 510-0275		
G.	Wood – Stain – Transparent, Non-Yellowing – Gloss - Lacquer			
	1. One Coat	GemGlo 6700 Series		
	2. One Coat	Gemini Precat Sealer 210-0222		
	3. Two Coats	Gemini Precat 510-0274		
H.	Wood – Stain – High Solids – Satin – Acrylic Urethane			
	1. One Coat	Old Masters Stain		

	2. One Coat	2097		
	3. Two Coats	2097		
I.	Wood – Stain – High Solids – Semi-Gloss - Acrylic Urethane			
	1. One Coat	Old Masters Stain		
	2. One Coat	2094		
	3. Two Coats	2094		
J.	Wood – Stain Solid – Gloss - Acrylic Urethane			
	1. One Coat	Old Masters Stain		
	2. One Coat	2096		
	3. Two Coats	2096		
K.	Concrete, Plaster, Masonry – Matte - Acrylic			
	1. One Coat	971		
	2. One Coat		1600	
L.	Concrete, Plaster, Masonry – Eggshell - Acrylic			
	1. One Coat	971		
	2. Two Coats		1686	
M.	Gypsum Board – Matte - Acrylic			
	1. One Coat	971		
	2. One Coat		1600	
N.	Gypsum Board – Semi-Gloss - Acrylic			
	1. One Coat	971		
	2. Two Coats		1685	
O.	Gypsum Board – Eggshell - Acrylic			
	1. One Coat	971		
	2. Two Coats		1686	
P.	Gypsum Board – Gloss - Acrylic			
	1. One Coat	971		
	2. Two Coats		1680	
Q.	Ferrous – Matte – Acrylic			
	1. One Coat	5725		
	2. One Coat		1600	
	3. One Coat		1600	
R.	Ferrous – Semi-Gloss – Acrylic			
	1. One Coat	5725		
	2. One Coat		1685	
	3. One Coat		1685	
S.	Ferrous – Gloss – Acrylic			
	1. One Coat	5725		
	2. One Coat		1680	
	3. One Coat		1680	

T.	Ferrous – Factory Primed: Touch-up primer coat in lieu of full primer coat. Finish coats as specified above.			
U.	Galvanized and Aluminum – Matte - Acrylic			
	1. One Coat	Surface Prep: SSPC-SP1 Krud Kutter Metal Clean & Etch		
	2. One Coat	5725		
	3. One Coat		1600	
	4. One Coat		1600	
V.	Galvanized and Aluminum – Semi-Gloss - Acrylic			
	1. One Coat	Surface Prep: SSPC-SP1 Krud Kutter Metal Clean & Etch		
	2. One Coat	5725		
	3. One Coat		1685	
	4. One Coat		1685	
W	Galvanized and Aluminum – Gloss - Acrylic			
	1. One Coat	Surface Prep: SSPC-SP1 Krud Kutter Metal Clean & Etch		
	2. One Coat	5725		
	3. One Coat		1680	
	4. One Coat		1680	
X.	Acoustical Ceiling Tiles – sheen per Manufacturer Recommendation			
	1. One Coat	295		
	2. Two Coats	485		
Y.	Window Systems - Satin – Interior/ Exterior High Performance Acrylic			
	1. One Coat	295/973		
	2. One Coat			2888
	3. One Coat			2888
Z.	Entry Doors, & Door Casings - Semi-Gloss – Interior/ Exterior High Performance Acrylic			
	1. One Coat	295/973		
	2. One Coat			2888
	3. One Coat			2888

3.10 SPECIAL COATINGS

- A. Exterior metal handrails, guardrails, ornamental metal fences and gates and exterior stairs, total 5.5 to 8.5 mil thickness, as recommended by the manufacturer:

		Tnemec		Rustoleum	
1.	Unprimed or shop primed –				

	Ferrous – Gloss - Polyurethane				
	a. One Coat	50-330		9100	
	b. One Coat	74		9700	
2.	Unprimed or shop primed – Ferrous – Semi-Gloss - Polyurethane				
	a. One Coat	50-330		9100	
	b. One Coat	75		9700	
3.	Galvanized or Aluminum – Gloss - Polyurethane				
	a. One Coat	P-66		9100	
	b. One Coat	74		9700	
4.	Galvanized or Aluminum –Semi- Gloss - Polyurethane				
	a. One Coat	P-66		9100	
	b. One Coat	75		9700	

END OF SECTION

SECTION 260500**GENERAL ELECTRICAL REQUIREMENTS****PART 1 – GENERAL****1.01 Description of Work:**

- A. The work of this Section consists of providing all required labor, supervision, materials and equipment to satisfactorily complete all electrical installations that are shown on the Drawings, included in these specifications, or otherwise needed for a complete and fully operating facility.
- B. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

1.02 Related Work:

- A. This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 01 and apply to all Sections of Division 26.

1.03 Submittals:

- A. As specified in Division 01. Submit to the Architect shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Information to be submitted includes manufacturer's descriptive literature of cataloged products, equipment, drawings, diagrams, performance and characteristic curves as applicable, test data and catalog cuts. Obtain written approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Furnish manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.
- B. Organize submittals for equipment and items related to each specification section together as a package.
- C. Proposed substitutions of products will not be reviewed or approved prior to awarding of the Contract.
- D. Substitutions shall be proven to the Architect or Engineer to be equal or superior to the specified product. Architect's decision is final. The Contractor shall pay all costs incurred by the Architect and Engineer in reviewing and processing any proposed substitutions whether or not a proposed substitution is accepted.
- E. If a proposed substitution is rejected, the contractor shall furnish the specified product at no increase in contract price.

GENERAL ELECTRICAL REQUIREMENTS

- F. If a proposed substitution is accepted, the contractor shall be completely responsible for all dimensional changes, electrical changes, or changes to other work which are a result of the substitution. The accepted substitution shall be made at no additional cost to the owner or design consultants.

1.04 Quality Assurance:

- A. Codes: All electrical equipment and materials, including installation and testing, shall conform to the latest editions following applicable codes:
1. California Electrical Code (CEC).
 2. Occupational Safety and Health Act (OSHA) standards.
 3. All applicable local codes, rules and regulations.
 4. Electrical Contractor shall possess a C-10 license and all other licenses as may be required. Licenses shall be in effect at start of this contract and be maintained throughout the duration of this contract.
- B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.
- C. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA).
- D. Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Provide service entrance labels for all equipment required by the NEC to have such labels.
- E. The electrical contractor shall guarantee all work and materials installed under this contract for a period of one (1) year from date of acceptance by owner.
- F. All work and materials covered by this specification shall be subject to inspection at any and all times by representatives of the owner. Work shall not be closed in or covered before inspection and approval by the owner or his representative. Any material found not conforming with these specifications shall, within 3 days after being notified by the owner, be removed from premises; if said material has been installed, entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the contractor.

1.05 Contract Documents:

- A. Drawings and Specifications:
1. In the case of conflict between the drawings and specifications, the specifications shall take precedence.
 2. Drawings and specifications are intended to comply with all law, ordinances, rules and regulations of constituted authorities having jurisdiction, and where referred to in the Contract Documents, said laws, ordinance, rules and regulations shall be considered as a

GENERAL ELECTRICAL REQUIREMENTS

part of said Contract Documents within the limits specified. The Contractor shall bear all expenses of correcting work done contrary to said laws, ordinance, rules and regulations if the Contractor knew or should have known that the work as performed is contrary to said laws, ordinances, rules and regulations and if the Contractor performed same (1) without first consulting the Architect for further instructions regarding said work and/or (2) disregarded the Architect's instructions regarding said work.

B. Drawings: The Electrical Drawings shall govern the general layout of the completed construction.

1. Locations of equipment, panels, pullboxes, conduits, stub-ups, ground connections are approximate unless dimensioned; verify locations with the Architect prior to installation.
2. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for those installations.
3. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Architect for approval.
4. The general arrangement and location of existing conduits, piping, apparatus, etc., is approximate. The drawings and specifications are for the assistance and guidance of the contractor, exact locations, distances and elevations are governed by actual field conditions. Accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Architect.
5. All drawings and divisions of these specifications shall be considered as whole. The contractor shall report any apparent discrepancies to the Architect prior to submitting bids.
6. The contractor shall be held responsible to have examined the site and compared it with the specifications and plans and to have satisfied himself as to the conditions under which the work is to be performed. He shall be held responsible for knowledge of all existing conditions whether or not accurately described. No subsequent allowance shall be made for any extra expense due to failure to make such examination.

1.06 Closeout Submittals:

- A. Manuals: Furnish manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 01.

1.07 Coordination:

- A. Coordinate the electrical work with the other trades, code authorities, utilities and the Architect.
- B. Provide and install all trenching, backfilling, conduit, pull boxes, splice boxes, etc. for all Utility Company services to the locations indicated on the Drawings. All materials and construction shall be in accordance with the requirements for all the Utility Companies. Prior to performing any

work, the Electrical Contractor shall coordinate with the various Utility Companies and obtain utility company engineering drawings. Verify that all such work and materials shown on the Drawings are of sufficient sizes and correctly located to provide services on the site. The Electrical Contractor shall verify with all the Utility Companies that additional contractor furnished and installed work is not required. If additional work, materials, or changes are required by any of the Utility Companies, the Electrical Contractor shall advise the Architect of such changes and no further work shall then be performed until instructed to do so by the Architect. The Electrical Contractor shall coordinate with the various Utility Companies to schedule inspections and to obtain service connections.

- C. The Electrical Contractor shall schedule all utility work necessary for utility inspections, connections, cable installation, etc. for the new electrical service to meet the construction schedule.
- D. Utility Company charges shall be paid by the Owner.
- E. Contractor shall pay all inspection and other applicable fees and procure all permits necessary for the completion of this work.
- F. Where connections must be made to existing installations, properly schedule all the required work, including the power shutdown periods.
- G. When two trades join together in an area, make certain that no electrical work is omitted.

1.08 Job Conditions:

- A. Operations: Perform all work in compliance with Division 01
 - 1. Keep the number and duration of power shutdown periods to a minimum.
 - 2. Show all proposed shutdowns and their expected duration on the construction schedule. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities.
 - 3. Carry out shutdown only after the schedule has been approved, in writing, by the owner. Submit power interruption schedule 15 days prior to date of interruption.
- B. Construction Power: Unless otherwise noted in Division 01 of these specifications, contractor shall make all arrangements and provide all necessary facilities for temporary construction power from the owner's on site source. Energy costs shall be paid for by the Owner.
- C. Storage: Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from weather, dust, water, or construction operations.

1.09 Damaged Products:

- A. Notify the Architect in writing in the event that any equipment or material is damaged. Obtain approval from the Architect before making repairs to damaged products.

1.10 Locations:

GENERAL ELECTRICAL REQUIREMENTS

- A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located.
- B. Dry Locations: All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
- C. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.

1.11 Safety and Indemnity:

- A. The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continually and not be limited to normal working hours. The contractor shall provide and maintain throughout the work site proper safeguards including, but not limited to, enclosures, barriers, warning signs, lights, etc. to prevent accidental injury to people or damage to property.
- B. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
- C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the Engineer, their Consultants or their officers, agents and employees.
- D. If a work area is encountered that contains hazardous materials, the contractor is advised to coordinate with the owner and it's abatement consultant for abatement of hazardous material by the Owner's Representative. "Hazardous materials" means any toxic substance regulated or controlled by OSHA, EPA, State of California or local rules, regulations and laws. Nothing herein shall be construed to create a liability for Aurum Consulting Engineers regarding hazardous materials abatement measures, or discovery of hazardous materials.

1.12 Access Doors:

- A. The contractor shall install access panels as required where floors, walls or ceilings must be penetrated for access to electrical, control, fire alarm or other specified electrical devices. The minimum size panel shall be 14" x 14" in usable opening. Where access by a service person is required, minimum usable opening shall be 18" x 24".
- B. All access doors installed lower than 7'-0" above finished floor and exposed to public access shall have keyed locks.

GENERAL ELECTRICAL REQUIREMENTS

- C. Where specific information or details relating to access panels differ from Division 26 paragraph 1.12 of these specifications, or shown on the electrical drawings and details or under other Divisions of work, those requirements shall supersede these specifications.

1.13 Arc Flash:

- A. The contractor shall install a clearly visible arc flash warning to the inside door of all panelboards and industrial control panels, as well as to the front of all switchboards and motor control centers that are a part of this project.
- B. The warning shall have the following wording: line 1 "WARNING" (in large letters), line 2 "Potential Arc Flash Hazard" (in medium letters), line 3 & 4 "Appropriate Personal Protective Equipment and Tools required when working on this equipment".

1.14 Emergency Boxes:

- A. All boxes and enclosures for emergency circuits shall be permanently marked with a readily visible red spray painted mark.

PART 2 - PRODUCTS

2.01 Standard of Quality:

- A. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are established to be equal to the specified product and approved by the Architect prior to installation.
- B. Material and Equipment: Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.
- C. Service Support: Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.
- D. Manufacturer's Recommendations: Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.02 Nameplates:

- A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, the model designation, and shop order number.
- B. Identify each piece of equipment and related controls with a rigid laminated engraved plastic nameplate. Unless otherwise noted, nameplates shall be melamine plastic 0.125 inch thick, white

with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 0.5 by 2.5 inches unless otherwise noted. Where not otherwise specified, lettering shall be a minimum of 0.25 inch high normal block style. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel or brass screws.

2.03 Fasteners:

- A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.04 Finish requirements:

- A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Architect.
- B. Wiring System: In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

PART 3 - EXECUTION

3.01 Workmanship:

- A. Ensure that all equipment and materials fit properly in their installation.
- B. Perform any required work to correct improperly fit installation at no additional expense to the owner.
- C. All electrical equipment and materials shall be installed in a neat and workmanship manner in accordance with the "NECA-1 Standard Practices for Good Workmanship in Electrical Contracting". Workmanship of the entire job shall be first class in every respect.

3.02 Equipment Installations:

- A. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
- B. Do all the cutting and patching necessary for the proper installation of work and repair any damage done.
- C. Earthquake restraints: all electrical equipment, including conduits over 2 inches in diameter, shall be braced or anchored to resist a horizontal force acting in any direction as per CBC Section 1616A Title 24, part 2 and ASCE7-10, Sections 13.3 and 13.6 and Table 13.6-1.
- D. Structural work: All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved by a California registered structural consulting engineer prior to the execution of any construction. At all floor slabs and structural concrete walls to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by

means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.

3.03 Field Test:

- A. Test shall be in accordance with Acceptance testing specifications issued by the National Electrical Testing Association (NETA).
- B. Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all circuits and components, and demonstrate as ready for service. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Architect prior to any test so that the tests may be witnessed.
- C. Provide instruments, other equipment and material required for the tests. These shall be of the type designed for the type of tests to be performed. Test instrument shall be calibrated by a recognized testing laboratory within three months prior to performing tests.
- D. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.
- E. Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Architect. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.
- F. Maintain records of each test and submit five copies to the Architect when testing is complete. All tests shall be witnessed by the Architect. These records shall include:
 - 1. Name of equipment tested.
 - 2. Date of report.
 - 3. Date of test.
 - 4. Description of test setup.
 - 5. Identification and rating of test equipment.
 - 6. Test results and data.
 - 7. Name of person performing test.
 - 8. Owner or Architect's initials.
- G. Items requiring testing shall be as noted in the additional electrical sections of these specifications.

3.04 Cleaning Equipment:

- A. Thoroughly clean all soiled surfaces of installed equipment and materials.

3.05 Painting of Equipment:

- A. Factory Applied: Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section.
- B. Field Applied: Paint electrical equipment as required to match finish of adjacent surfaces.

3.06 Records:

- A. Maintain one copy of the contract Drawing Sheets on the site of the work for recording the "as built" condition. After completion of the work, the Contractor shall carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:
 - 1. Cable Size and Type: Provide the size and type of each cable installed on project.
 - 2. Substructure: Where the location of all underground conduits, pull boxes, stub ups and etc. where are found to be different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
 - 3. Size of all conduit runs.
 - 4. Routes of concealed conduit runs and conduit runs below grade.
 - 5. Homerun points of all branch circuit.
 - 6. Location of all switchgear, panels, MCC, lighting control panels, pullcans, etc.
 - 7. Changes made as a result of all approved change orders, addendums, or field authorized revisions.
 - 8. As Builds: At the completion of the Work the Contractor shall review, certify, correct and turn over the marked up Drawings to the Architect for his use in preparing "as built" plans.
 - 9. As built Drawings shall be delivered to the Architect within ten (10) days of completion of construction.

3.07 Clean Up:

- A. Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Architect.

3.08 Mechanical and Plumbing Electrical Work:

GENERAL ELECTRICAL REQUIREMENTS

- A. The requirements for electrical power and/or devices for all mechanical and plumbing equipment supplied and/or installed under this Contract shall be coordinated and verified with the following:
 - 1. Mechanical and Plumbing Drawings.
 - 2. Mechanical and Plumbing sections of these Specifications.
 - 3. Manufacturers of the Mechanical and Plumbing equipment supplied.
- B. The coordination and verification shall include the voltage, ampacity, phase, location and type of disconnect, control, and connection required. Any changes that are required as a result of this coordination and verification shall be a part of this Contract.
- C. The Electrical Contractor shall furnish and install the following for all mechanical and plumbing equipment:
 - 1. Line voltage conduit and wiring.
 - 2. Disconnect switches.
 - 3. Manual line motor starters.
- D. Automatic line voltage controls and magnetic starters shall be furnished by the Mechanical and/or Plumbing Contractor and installed and connected by the Electrical Contractor. When subcontracted for by the Mechanical and/or Plumbing Contractor, all line voltage control wiring installed by the Electrical Contractor shall be done per directions from the Mechanical and/or Plumbing Contractor.
- E. All low voltage control wiring for Mechanical and Plumbing equipment shall be installed in conduit. Furnishing, installation and connection of all low voltage conduit, boxes, wiring and controls shall be by the Mechanical and/or Plumbing Contractor.
- F. Disconnects (Motor And Circuit)
 - 1. Disconnect switches shall be provided and located at all motors.
 - 2. Switches for three-phase motors shall be heavy-duty, horsepower rated three-pole, and surface mounted except as noted on drawings.
 - 3. Switches containing more than three poles shall be as specified on the drawings.
 - 4. Switches for single-phase, fractional horsepower motors shall be heavy-duty, horsepower rated.
 - 5. Disconnect switches shall be as manufactured by ITE- Siemens, General Electric or Square D.
- G. Disconnects (Motor: Fused):
 - 1. Disconnect switches shall be provided and located at all motors.
 - 2. Switches for three-phase motors shall be heavy-duty, horsepower rated three-pole, and surface mounted except as noted on drawings.
 - 3. Switches containing more than three poles shall be as specified on the drawings.
 - 4. Switches for single-phase, fractional horsepower motors shall be heavy-duty, horsepower rated.
 - 5. Disconnect switches shall be as manufactured by ITE- Siemens, General Electric or Square D.

- H. Manual motor starters, where required, shall have toggle type operators with pilot light and melting alloy type overload relays, SQUARE D COMPANY, Class 2510, Type FG-1P (surface) or Type FS-1P (flush) or ITE, WESTINGHOUSE or GENERAL ELECTRIC equal.

END OF SECTION

SECTION 260519

LINE VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.01 Description of Work:

- A. The work of this Section consists of providing all wire and cable rated 600 volts or less, including splices and terminations, as shown on the Drawings and as described herein.

1.02 Related Work:

- A. See the following Specification Section for work related to the work in this Section:

- 1. 260542 Conduits, Raceways and Fittings.
- 2. 260533 Junction and Pull Boxes.

1.03 Quality Assurance

- A. Field tests shall be performed as specified in paragraph 3.04 of this Section.

PART 2 - PRODUCTS

2.01 Conductors:

- A. Conductors shall be copper, type THHN/THWN/MTW oil and gasoline resistant, 600 volt rated insulation.
- B. Conductors shall be stranded copper.
- C. Minimum power and control wire size shall be No. 12 AWG unless otherwise noted.
- D. All conductors used on this Project shall be of the same type and conductor material.

2.02 Cables:

- A. All individual conductors shall be copper with type THHN/THWN, 600 volt rated insulation.
- D. Insulation Marking - All insulated conductors shall be identified with printing colored to contrast with the insulation color.

- E. Color Coding - As specified in paragraph 3.03.
- F. Special Wiring - Where special wiring is proposed by an equipment manufacturer, submit the special wiring requirements to the Owner's Representative and, if approved, provide same. Special wire shall be the type required by the equipment manufacturer.
- G. Other Wiring - Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and as approved by the Owner's Representative.
- H. Manufacturer - Acceptable manufacturers including Cablec, Southwire, or equal.

2.03 Terminations:

- A. Manufacturer - Terminals as manufactured by T&B, Burndy or equal.
- B. Wire Terminations – Stranded conductors shall be terminated in clamping type terminations which serve to contain all the strands of the conductor. Curling of a stranded conductor around a screw type terminal is not allowed. For screw type terminations, use a fork type stake-on termination on the stranded conductor. Use only a stake-on tool approved for the fork terminals selected.
- C. End Seals - Heat shrink plastic caps of proper size for the wire on which used.

2.04 Tape:

- A. Tape used for terminations and cable marking shall be compatible with the insulation and jacket of the cable and shall be of plastic material.

PART 3 - EXECUTION

3.01 Cable Installation:

- A. Clean Raceways - Clean all raceways prior to installation of cables as specified in Section 260542 - Conduits Raceway and Fittings.
- B. All line voltage wiring shall be installed in conduit.
- C. All feeder conductors shall be continuous from equipment to equipment. Splices in feeders are not permitted unless specifically noted or approved by the Electrical Engineer.

- D. All branch circuit wiring shall be run concealed in ceiling spaces, walls, below floors or in crawl spaces unless noted otherwise.
- E. Cable Pulling - Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.
- F. Bending Radius - Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.
- G. Equipment Grounding Conductors - Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in all conduits or all raceways.
- H. Panelboard Wiring - In panels, bundle incoming wire and cables which are No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

3.02 Cable Terminations and Splices:

- A. Splices - UL Listed wirenuts.
- B. Terminations - Shall comply with the following:
 - 1. Make up and form cable and orient terminals to minimize cable strain and stress on device being terminated on.
 - 2. Burnish oxide from conductor prior to inserting in oxide breaking compound filled terminal.

3.03 Circuit and Conductor Identification:

- A. Color Coding - Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. Conductor colors shall be as follows:

<u>VOLTAGE</u>	<u>208/120V</u>	<u>480/277V</u>
Phase A	Black	Brown

Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Grey
Ground	Green	Green

- B. Color coding shall be in the conductor insulation for all conductors #10 AWG and smaller; for larger conductors, color shall be either in the insulation or in colored plastic tape applied at every location where the conductor is readily accessible.
- C. Circuit Identification - All underground distribution and service circuits shall be provided with plastic identification tags in each secondary box and at each termination. Tags shall identify the source transformer of the circuit and the building number(s) serviced by the circuit.

3.04 Field Tests:

- A. All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and ground of not less than the requirements of the CEC. All circuits shall be tested for proper neutral connections.
- B. Insulation Resistance Tests: Perform insulation resistance tests on circuits with #2 AWG and larger conductors to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests before all equipment has been connected. Test the insulation with a 500Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.

END OF SECTION

SECTION 260526

GROUNDING

PART 1 GENERAL

1.1 Section Includes:

- A. Conduits, wires, ground rods and other materials for the electrical grounding system.

1.2 Related Sections:

- A. Section 260500 - Electrical General Requirements.

PART 2 PRODUCTS

2.1 Ground Rod:

- A. "Copperweld" ground rod conforming to or exceeding requirements of U.L. Specification No. 467 (ANSI C-33.8). Rod shall be 3/4" diameter and 10' in length, unless otherwise noted on the Drawings.

2.2 Below Grade Connections:

- A. Compression fittings, Thomas & Betts, Series 52000, 53000 or 54000 or approved equal.

2.3 Hardware:

- A. Bolts, nuts and washers shall be bronze, cadmium plated steel or other non-corrosive materials, approved for the purpose.

2.4 Waterproof Sealant:

- A. Use Kearney "Aqua Seal" mastic sealant on all below grade clamp or compression type connections.

PART 3 EXECUTION

3.1 Grounding and Bonding:

- A. Grounding and bonding shall be as required by codes and local authorities.

- B. All electrical equipment shall be grounded, including, but not limited to, panel boards, terminal cabinets and outlet boxes.
- C. The ground pole of receptacles shall be connected to their outlet boxes by means of a copper ground wire connecting to a screw in the back of the box.
- D. A green insulated copper ground wire, sized to comply with codes, shall be installed in all conduit runs.
- E. All metal parts of pull boxes shall be grounded per code requirements.
- F. All ground conductors shall be green insulated copper.
- G. The ground system electrodes shall be tested for resistance before the equipment ground conductors are connected. Maximum ground system resistance shall be 25 ohms. Install up to two additional ground rods to meet the 25 ohm requirement. Multiple ground rods shall not be less than 10 feet apart.
- H. Grounding of the panels and buildings shall be completed as indicated on the Drawings.

END OF SECTION

SECTION 260542

CONDUITS, RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.01 Description of Work:

- A. The work of this section consists of furnishing and installing conduits, raceways and fittings as shown on the Drawings and as described herein.

1.02 Related Work:

- A. See the following specification sections for work related to the work in this section:
 - 1. 260543 Underground Ducts
 - 2. 260544 In Grade Pull Boxes
 - 3. 260533 Junction and Pull Boxes

PART 2 - PRODUCTS

2.01 Conduits, Raceways:

- A. Electrical Metallic Tubing (EMT) shall be hot-dip galvanized after fabrication. Couplings shall be compression or set-screw type.
- B. Flexible Conduit: Flexible metal conduit shall be galvanized steel.
- C. Galvanized Rigid Steel Conduit (GRS) shall be hot-dip galvanized after fabrication. Couplings shall be threaded type.
- D. Rigid Non-metallic Conduit: Rigid non-metallic conduit shall be PVC Schedule 40 (PVC-40 or NEMA Type EPC-40) conduit approved for underground use and for use with 90° C wires.

2.02 Conduit Supports:

- A. Supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer.
- B. Supports for multiple conduits shall be hot-dipped galvanized Unistrut or Superstrut channels, or approved equal. All associated hardware shall be hot-dip galvanized.
- C. Supports for EMT conduits shall be galvanized pressed steel single hole straps.
- D. Clamp fasteners shall be by wedge anchors. Shot in anchors shall not be allowed.

2.03 Fittings:

- A. Provide threaded-type couplings and connectors for rigid steel conduits; provide steel compression (watertight), or steel set-screw type for EMT, (die-cast zinc or malleable iron type fittings are not allowed). Provide threaded couplings and Meyers hubs for rigid steel conduit exposed to weather.
- B. Fittings for flexible conduit shall be Appleton, Chicago, IL, Type ST, O-Z Gedney Series 4Q by General Signal Corp., Terryville, CT, T & B 5300 series, or approved equal.
- C. Fittings for use with rigid steel shall be galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse Hinds Condulets, Syracuse, NY, Appleton Unilets, Chicago, IL, or approved equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.
- D. Fittings for use with rigid non-metallic conduit shall be PVC and have solvent-weld-type conduit connections.
- E. Union couplings for conduits shall be the Erickson type and shall be Appleton, Chicago, IL, Type EC, O-Z Gedney 3-piece Series 4 by General Signal Corp., Terryville, CT, or approved equal. Threadless coupling shall not be used.
- F. Bushings:
 - 1. Bushings shall be the insulated type.
 - 2. Bushings for rigid steel shall be insulated grounding type, O-Z Gedney Type HBLG, Appleton Type GIB, or approved equal.
- G. Conduit Sealants:
 - 1. Fire Retardant Types: Fire stop material shall be reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL Classification 35L4 or as specified on the Drawings.

PART 3 - EXECUTION

3.01 Conduit, Raceway and Fitting Installation:

- A. For conduit runs exposed to weather provide rigid metal (GRS).
- B. For conduit run underground, in concrete or masonry block wall and under concrete slabs, install minimum $\frac{3}{4}$ " size nonmetallic (PVC) with PVC elbows. Where conduits transition from underground or under slab to above grade install wrapped rigid metal (GRS) elbows and risers.
- C. For conduit runs concealed in steel or wood framed walls or in ceiling spaces or exposed in interior spaces above six feet over the finished floor, install EMT.
- D. Flexible metal conduit shall be used only for the connection of recessed lighting fixtures and motor connections unless otherwise noted on the Drawings. Liquid-tight steel flexible conduit shall be used for motor connections.

- E. The minimum size raceway shall be 1/2-inch unless indicated otherwise on the Drawings.
- F. Installation shall comply with the CEC.
- G. From pull point to pull point, the sum of the angles of all of the bends and offset shall not exceed 360 degrees.
- H. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits concealed except where otherwise shown on the drawings.
 - 1. Exposed Conduits: Support exposed conduits within three feet of any equipment or device and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps.
 - a. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel or at right angles to building lines.
 - b. Group exposed conduits together. Arrange such conduits uniformly and neatly.
 - 2. Support all conduits within three feet of any junction box, coupling, bend or fixture.
 - 3. Support conduit risers in shafts with Unistrut Superstrut, or approved equal, channels and straps.
- I. Moisture Seals: Provide in accordance with NEC paragraphs 230-8 and 300-5(g).
- J. Where PVC conduit transitions from underground to above grade, provide rigid steel 90's with risers. Rigid steel shall be half-lap wrapped with 20 mil tape and extend minimum 12" above grade.
- K. Provide a nylon pull cord in each empty raceway.
- L. Provide galvanized rigid steel factory fittings for galvanized rigid steel conduit.
- M. Slope all underground raceways to provide drainage; for example, slope conduit from equipment located inside a building to the pull box or manhole located outside the building.
- N. Conduits shall be blown out and swabbed prior to pulling wires, or installation of pull cord in empty conduits.

END OF SECTION

SECTION 260543

UNDERGROUND DUCTS

PART 1 - GENERAL

1.01 Description of Work:

- A. The work of this section consists of furnishing and installing raceways, and raceway spacers with necessary excavation.

1.02 Related Work:

- A. See the following specification sections for work related to the work of this section.
 - 1. 02200 Excavation and Backfill
 - 2. 260542 Conduit Raceway and Fittings

1.03 Standards and Codes:

- A. Work and material shall be in compliance with and according to the requirements of the latest revision of the following standards and codes.
 - 1. National Electrical Code (NEC) (Latest Revision)
 - 2. California Electrical Code (CEC).
 - 3. Underground Installations CEC - Article 300.5
 - 4. Rigid NonMetallic Conduit CEC - Article 347

PART 2 - PRODUCTS

2.01 Raceways:

- A. As specified in Section 260542 Conduits, Raceways and Fittings.

PART 3 - EXECUTION

3.01 Excavation:

- A. As specified in Section 02200, Excavation and Backfill and as required for the work shown on the Drawings.

3.02 Install raceways as indicated on drawings.

3.03 Sand Encasement:

A. As specified in Section 02200 - Excavation and Backfill.

3.04 Backfill:

A. As specified in Section 02200 - Excavation and Backfill.

END OF SECTION

SECTION 260544
IN GRADE PULL BOXES

PART 1 - GENERAL

1.01 Description of Work:

- A. The work of this section consists of providing all labor, supervision, tools, materials, and performing all work necessary to furnish and install pre-cast concrete vaults, and pull boxes with necessary excavation.

1.02 Related Work:

- A. See the following specification sections for work related to the work of this section.
 - 1. 02200 Excavation and Backfill.
 - 2. 260543 Underground Ducts.

1.03 Submittals:

- A. As specified in Section 260500 and Division 01.
 - 1. Catalog Data: Provide manufacturer's descriptive literature - Pre-cast Vaults, Pull Boxes and Accessories.

PART 2 - PRODUCTS

2.01 Materials and Equipment:

- A. General Requirements:
 - 1. Pull boxes for electrical power, controls and other communication circuits shall consist of pre-cast reinforced concrete boxes, extensions' bases, and covers as specified herein and as indicated on the Drawings. Pre-cast units shall be the product of a manufacturer regularly engaged in the manufacture of pre-cast vaults and pull boxes. Acceptable manufacturers are Christy, Utility Vault, Brooks, Associated Concrete or equal.
- B. Construction:

1. Pre-cast concrete vaults and pull boxes for electrical power distribution and communication circuits with associated risers and tops shall conform to ASTM C478 and ACI 318. Pull boxes shall be the type noted on the Drawings and shall be constructed in accordance with the applicable details as shown. Tops and walls shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Duct entrances and windows shall be located near the corners of structures to facilitate cable racking.

C. Covers:

1. The word "ELECTRICAL" shall be cast in the top face of all electrical cable boxes. The word "Signal" or "Fire Alarm" shall be cast in the top of the boxes utilized for these systems.

PART 3 - EXECUTION

3.01 Installation:

- A. Install pull boxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not shown on the Drawings.
- B. Pre-cast pull boxes shall be installed approximately where indicated on the Drawings. The exact location of each pull box shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. All cable boxes and secondary pull boxes shall be installed with a minimum of 6-inch thick crushed rock or sand bedding.
- C. Paved areas - Vaults and pull boxes located in areas to be paved shall be installed such that the top of the cover shall be flush with the finished surface of the paving.
- D. Unpaved Areas - In unpaved areas, the top of vaults and pull box covers shall be approximately 2 inches above finished grade.
- E. Joint Seals - Section joints of pre-cast vaults and pull boxes shall be sealed with compound as recommended by the manufacturer.
- F. Trenching, Backfilling, and Compaction - Trenching, backfilling and compaction shall be as specified in Section 02200 - Excavation and Backfill.

END OF SECTION

CIRCUIT BREAKERS

SECTION 262816**CIRCUIT BREAKERS****PART 1 - GENERAL****1.01 Description of Work:**

- A. The work of this Section consists of providing circuit breakers as shown on the Drawings and as described herein.

1.02 Related Work: See the following Specification Sections for work related to the work in this Section.

- A. 260500 General Electrical Requirements
- B. 262413 Switchboards
- C. 262416 Panelboards and Distribution Panels

1.03 Submittals:

- A. Shop Drawings - Submittals shall be in accordance with Section 260500 and Division 01. For each circuit breaker furnished under this Contract, submit manufacturer's name, catalog data, and the following information:
 - 1. Terminal connection sizes.
 - 2. Voltage rating.
 - 3. Breaker manufacturer, types, trip ratings and interrupting ratings.
- B. Single Submittal - A single complete submittal is required for all products covered by this Section.
- C. Closeout Submittals: Submit in accordance with and Section 260500, operation and maintenance data for circuit breakers including nameplate data, parts lists, manufacturer's circuit breaker timer, current, coordination curves, factory and field test reports and recommended maintenance procedures.

PART 2 - PRODUCTS**2.01 Circuit Breaker:** Each circuit breaker shall consist of the following:

- A. A molded case breaker with an over center toggle-type mechanism, providing quick-make, quick-break action. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Multipole circuit breakers shall

CIRCUIT BREAKERS

have variable magnetic trip elements which are set by a single adjustment to assure uniform tripping characteristics in each pole. Circuit breakers shall be of the bolt-on type unless otherwise noted.

- B. Breaker shall be calibrated for operation in an ambient temperature of 40°C.
- C. Each circuit breaker shall have trip indication by handle position and shall be trip-free.
- D. Three pole breakers shall be common trip.
- E. The circuit breakers shall be constructed to accommodate the supply connection at either end of the circuit breaker. Circuit breaker shall be suitable for mounting and operation in any position.
- F. Breakers shall be rated as shown on Drawings.
- G. Circuit breaker and/or Fuse/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations for use in the end use equipment in which it is installed. Any series rated combination used shall be marked on the end use equipment per CEC section 110-22.
- H. Breakers shall be UL listed. Circuit breakers shall have removable lugs.
- I. Lugs shall be UL listed for copper and aluminum conductors.
- J. Breakers shall be UL listed for installation of mechanical screw type lugs.
- K. Circuit breakers serving HACR rated loads shall be HACR type. Circuit breakers serving other motor loads shall be motor rated.

PART 3 - EXECUTION**3.01 Mounting:**

- A. The highest breaker operating handle shall not be higher than 72 inches above the floor.

END OF SECTION

SECTION 31 10 00

SITE CLEARING & DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General provisions of the Contract.
- B. CALTRANS Standard Specifications, Section 7-1.13

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Protection of existing improvements indicated to remain.
 - 2. Protection of existing improvements adjacent to the job site.
 - 3. Removal of vegetation.
 - 4. Clearing and grubbing.
 - 5. Removal of existing below-grade improvements.

1.03 PROJECT CONDITIONS

- A. Traffic: Conduct site-clearing operations to ensure minimum interference with traffic associated with Piedmont Middle School driveways, parking lots and other adjacent buildings occupied or other used facilities. No closure or obstruction of streets or other occupied or used facilities will be allowed without expressed written permission of District staff, District's representative and other authorities having jurisdiction over the site.
- B. A Survey shall be prepared prior to beginning removals or excavation. Contractor shall compare existing survey information with Contract Documents and notify District's representatives of any discrepancies. If discrepancies do exist, Contractor shall supply location, elevation, size, and conduit material to facilitate conflicts between existing and proposed utilities. Contractor shall hire a utility locator to locate utilities at least two working days prior to beginning removals or excavation.
- C. Protection of Existing Improvements: The Contractor is hereby advised that certain facilities may exist within the limits of work. Such facilities may include but are not limited to, existing water works, sanitary sewerage, storm drainage, natural gas, electric, telephone, fiber optic cable, irrigation lines, cable TV, asphalt and concrete flat work and buildings. The Contractor shall at all times protect those facilities not indicated to be removed, whether or not shown to be protected, and shall remove only those facilities indicated to be removed in accordance with the Contract Documents and the direction of the authorized representative of the district of the facility. Where the existing facilities interfere with the Contractor in the performance of his work under the Contract, the Contractor shall bear full responsibility for the location, protection, and

relocation or restoration of such facility, in accordance with the requirements of the district of such facility. Contractor shall coordinate field installation of scope of work with field location of utilities identified by Contractor during field survey of utilities. Contractor shall provide elevations of conflicts for existing and new utilities where identified in the field.

- D. The presence of such facilities shown on the Civil Drawings and provided for in the Contract Documents is for the convenience of the Contractor in preparing his proposal and planning his work and is prepared from the best information available to the Engineer at the time of preparation. The District makes no warranty, expressed or implied, as to the adequacy, completeness, and accuracy of such information. The Contractor shall satisfy himself with regard to the existence of such facilities and their impact on his operation. Should the Contractor discover any apparent discrepancy between the Contract Documents and conditions found in the field, he shall immediately bring such discovery to the attention of the Engineer. The bidder shall include in his proposal a sum to cover the cost of all items necessary to perform the work as set forth in the Contract Documents. No allowance of any kind whatsoever will be made to the Contractor because of lack of such examination or knowledge. The submission of a proposal will be considered conclusive evidence that the Contractor has made such an examination.
- E. The existing surface conditions of the project site were provided by Berryessa Union School District for the Piedmont Middle School and were compiled by Carroll Engineering dated 4-28-21.
- F. The Contractor shall protect all public and private property, insofar as it may be endangered by his operations and take every reasonable precaution to avoid damage to such property. The Contractor shall restore and bear the cost of any public or private improvement, facility, or structure within the limits of work, within adjacent street rights-of-way, easements, or work area which is damaged or injured directly or indirectly by or on account of any act, omission, or neglect in the execution of work. This is intended to address those facilities not designated for removal but visibly evident, correctly shown on the plans, marked by the District or by district of said improvement, facility, or structure. Said marking shall include any markings made by USA (Underground Service Alert).
 - 1. In restoring any damaged or injured improvement, facility, or structure, the Contractor shall restore it to a condition substantially equivalent to, or better than, that existing before such damage occurred.

1.04 EXISTING SERVICES

- A. General: Indicated locations are approximate; determine exact location before commencing work, See Section 1.03.
- B. Existing Utility System: The existing utility systems (sanitary, water, storm, gas, electric, telecommunication, and data) shall remain in service to other buildings while the new utility systems are being installed.

PART 2 - EXECUTION

2.01 SITE CLEARING

- A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions, as required to permit installation of new utilities or improvements or as directed by the representative of the District. Remove similar items elsewhere on site or premises specifically indicated. Removal includes digging out and off-site disposal of stumps and roots in accordance with CALTRANS Standard Specifications, Section 7-1.13.
 - 1. The Contractor shall cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new utilities.
 - 2. Clean and careful manner shall be the use of pruning shears, saws, and cutting roots in a manner that does not tear or rip protective outer layer of the root.
 - 3. The earth surface within protective fencing shall not be altered except as acceptable to the District. Any grading or trenching necessary within the dripline shall be done by hand per the discretion of the District.
- B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated.
 - 1. Completely remove deleterious materials, including, but not limited to stumps, roots, and other debris.
 - 2. Fill depressions caused by clearing and grubbing operations with satisfactory soil materials that are in accordance with the soils report. If the soils report does not address filling of depressions, the following requirements shall be used.
 - a. Place fill materials in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a minimum density of 85% compaction. This compaction effort shall not relieve the Contractor of any other obligation for compaction that may be required under the specifications for earthwork.

3.03 DISPOSAL OF WASTE MATERIALS

- A. Roadway: Contractor shall sweep and wash down all paved areas within the public street rights-of-way at the end of each working day or as otherwise directed by the District's representative.
- B. Burning on District's Property: Burning is not permitted.
- C. Removal from District's Property: Remove waste materials (including, but not necessarily limited to asphalt concrete, trees, other waste compiled from construction) and unsuitable or excess topsoil from District's property and dispose of in accordance with CALTRANS Standard Specification Section 7-1.13.
- D. Permits: Contractor shall obtain all necessary permits and/or approvals and pay all applicable fees including but not limited to, permit fees, license fees and disposal fees associated with the removal, haulage and disposal of waste materials from the District's Property.

- E. Covered Vehicles: All loads of waste materials carried by trucks or other vehicles shall be fully covered by tarpaulins or similar devices as approved by the California State Highway Patrol in such a manner that will ensure that no portion of the load will be discharged during transit to the disposal site.
- F. Maintenance of Adjacent Streets: The Contractor shall maintain the public streets adjacent to the construction site free of debris or materials posing a hazard to the public traveling along
- G. Branches, trimmings and debris remaining upon completion of each operation shall become property of the Contractor and shall be promptly removed from the Site.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General provisions of Contract Agreement form, including Appendices and Exhibits.
- B. Division 1 Specification Sections
- C. 2019 California Building Code, Title 24, Part 2, Sections 1804A, 3304 and appropriate sections for educational facilities apply to this section.
- D. Standard specifications of the state of California, Department of Transportation (CALTRANS).
- E. A copy of the survey is available for review with McKim Design Group.
- F. Geotechnical Investigation. Copy of Report is available for review with the School. Report prepared by Cornerstone Earth Group. Project No. 1332-2-2, dated September 12, 2022.

1.02 SUMMARY

- A. This section includes the following:
 - 1. Preparing and grading subgrades for walks, building pad, pavements, and landscaping (including fine grading, placement of topsoil and addition of specified soil amendments).
 - 2. Subbase for walks and pavements.
 - 3. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
- B. The following sections contain requirements that relate to this section:
 - 1. Section 31 10 00, Site Clearing and Demolition, for site stripping, grubbing, topsoil removal, and tree protection.
 - 2. Section 32 13 13, Civil Site Concrete, for walkways, concrete encasement, thrust blocks, and similar appurtenances for pipeline, drainage, and utility systems.
 - 3. Refer to Landscape Soil Specification for preparation of soil for planting.
- C. Reference Standards:
 - 1. Contractor shall perform work in accordance with applicable requirements of state and local agencies having jurisdiction over the project. Contractor shall perform work in accordance with applicable standards and requirements of utility companies.
 - 2. American Association of State Highway and Transportation Officials (AASHTO): Standards.
 - 3. American National Standards Institute (ANSI): Standards.

4. American Society of Testing Materials (ASTM):
 - a. Materials and testing standards as identified throughout this Section.
 - b. ASTM D2487 "Classification of Soils for Engineering Purposes."
5. California, Department of Transportation (CALTRANS): Standard Specifications.
6. California Occupational Safety and Health Administration (CALOSHA): Construction Safety Orders.
 - a. California State Industrial Accident Commission (CSIAC): Trench Construction Safety Orders.
 - b. U.S. Occupational Safety and Health Administration (OSHA): Standards – 29 CFR, PART 1926 Safety and Health Regulations for Construction, Subpart P – Excavations.

1.03 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base or subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.
- E. Base Course: The layer placed between the subbase or subgrade and surface pavement in a paving system.
- F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the District's representative. Unauthorized excavation, as well as remedial work directed by the District's representative, shall be at the Contractor's sole risk and expense.
- H. Unsuitable Soil: Poor yielding soil that the District's representative determines as unsatisfactory for footings, slabs, trenches or pavement subgrades.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- J. Utilities: include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.
- K. Waste Material: Excess material generated from utility trenches, pavement sections, or other structures associated with the project.

1.04 SUBMITTALS

- A. Wet Weather Construction Plan: Contractor shall submit a plan outlining procedures and methods that shall be implemented during the wet weather construction, plan shall address the following:
 - 1. Open trench protection;
 - 2. Protection of exposed soils (graded or stockpiled);
 - 3. Protection of materials (pipe, conduit, wiring or other pertinent items).
- B. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources, including drainage fill;
 - 2. One optimum moisture-maximum density curve for each soil material;
 - 3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements set forth on the plans, in the soils report, or as required under applicable ordinances or codes of all governmental agencies having jurisdiction over the project.
- B. Testing and Inspection Service: District will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
- C. Safety Standards: All excavation should be constructed in accordance with OSHA and CAL-OSHA Safety Standards. Safety in and around utility trench is the responsibility of the underground contractors.
- D. Pre-installation Conference: Conduct conference at Project site.
 - 1. Before commencing earthwork, meet with representatives of the governing authorities, District, District's representative, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.06 PROJECT CONDITIONS

A. General:

1. Earthwork operations shall be conducted so as to prevent windblown dust and dirt from interfering with the surrounding normal operations. Contractor shall assume liability for all claims of windblown damage and dirt. Since the area of disturbance is less than 1 acre, a Storm Water Pollution Prevention Plan (SWPPP) has not been prepared for the project, but Best Management Practices (BMP's) shall be employed on-site.
2. Bench Marks, monuments, signs and other reference points shall be maintained and protected; if disturbed or destroyed, they shall be replaced by the Contractor as directed by the District at the Contractors expense.

B. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the District or others except when permitted in writing by the District's representative and then only after acceptable temporary utility services have been provided.

1. Provide a minimum two working days' notice to the District's representative and receive written notice to proceed before interrupting any utility.
2. Notify Underground Service Alert (USA) at (800) 227-2600 at least two working days prior to beginning removal, grading, excavation, trenching, or other earthwork related activities.

C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active. Coordinate with Piedmont Middle School maintenance staff to shutoff or switch over services of existing buildings.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Backfill and Fill Materials: Satisfactory soil material shall be on-site soil materials with an organic content of less than 3-percent by weight or without visible organ matter and free of deleterious materials or hazardous substances may be used as engineered fill. On-site soil material to be reviewed by District's Geotechnical Engineer for satisfactory conditions prior to incorporation into earthwork.

B. Subbase and Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, conforming with CALTRANS Class 2 aggregate base or ASTM D2940, with at least 95 percent passing a 1-1/2 inch (38 mm) sieve and not more than 8 percent passing a No. 200 (75 micrometer) sieve as approved by the project Geotechnical Engineer.

C. Engineered Fill: Subbase or base materials approved by Geotechnical Engineer. In general, engineered fill shall be predominantly granular, shall not contain any rocks or lumps larger than 3-inches in greatest dimension, shall not contain more than 15- percent of material larger than 1 ½ inches, shall have a Plastic Index of 15 or less, and shall contain sufficient fines to allow excavation to be made without caving. All import

fill shall meet the requirements of engineered fill and shall be approved by the District's Geotechnical Engineer prior to incorporation into the earthwork.

- D. Pipe and Conduit Bedding Material: Bedding material shall be clean, washed, granular material derived from decomposed or crushed rock. Such material shall be free of organic material, mica, clay, silts, oils, and other deleterious materials. Sand bedding shall have a maximum particle size of 1/4-inch with gradation that allows 90 to 100 percent passing a No. 4 sieve and not more than 10 percent to pass a No. 200 sieve.
- E. Drainage Fill: Washed, poorly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2 inch (38 mm) sieve and not more than 5 percent passing a No. 8 (2.36 mm) sieve.
- F. Filtering Material: Poorly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2 inch (38 mm) sieve and 0 to 5 percent passing a No. 50 (300 micrometer) sieve.
- G. Fill: On-site soil free of organic material, debris, rocks, and clods and approved by the Project Geotechnical Engineer.
- H. Topsoil: Material excavated from the project site with sufficient organic content to render it unsuitable for engineered fill, but which can be used for landscaping purposes. Material must be free of roots, rocks larger than 1/2 inch, debris, vegetation, and foreign or deleterious material which may be harmful to plant growth. Stockpile organic laden topsoil in the location indicated on the plans or as directed by the District's representative.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. 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.
- C. Soil preparation is specified in section 31 92 13, Landscape Soil Preparation.

3.02 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.03 EXCAVATION

- A. Hand Digging: If determined by District, or District's representatives, utilities including but not limited to, fiber optic, telephone, signal wire, and electrical wire shall be carefully excavated by hand digging or other protective methods approved by the districts representatives.
- B. General:
 - 1. Contractor shall excavate to required subgrade elevations regardless of the character of material and obstructions encountered.
 - 2. All excavation should be constructed in accordance with OSHA and CAL-OSHA Safety Standards. Safety in and around utility trenches is the responsibility of the underground contractor.

3.04 EXCAVATION FOR STRUCTURES

- A. Not used.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.06 EXCAVATION FOR PIPELINE AND UTILITY TRENCHES

- A. All excavation should be constructed in accordance with OSHA and CAL-OSHA Safety Standards. Safety in and around utility trench is the responsibility of the underground contractors.
- B. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
- C. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: A minimum of 6 inches (150 mm) each side of pipe or conduit.
- D. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes and conduit 1 inches (100 mm) or larger in nominal diameter and for multiple conduit duct banks, place and compact sand bedding as shown on the

plans, shape bedding to provide support to a minimum of 180 degrees of pipe circumference. Fill depressions with tamped sand backfill.

2. Where rock or another unyielding bearing surface is encountered, extend trench excavation a minimum of 6 inches (150 mm) below outside of conduit barrel or pipe bell to receive bedding course.

- E. Daily Limits: The Contractor shall excavate only that length of trench in which he can safely and properly install pipe and backfill daily. No trenches may be left open when the Contractor is not actively prosecuting work related to that trench. To facilitate the prosecution of the work, the Contractor may request to use plates to cover open trenches. The use of steel plates shall be dependent upon the prior approval of the Engineer. Contractor will be responsible for the maintenance and cost associated with the steel plates.
- F. Excess Material: Contractor is responsible for handling, transporting and removing excess spoil generated from trenching activities. Disposal of Waste Material shall be in accordance with Section 31 10 00 Site Clearing and Demolition, Part 3.02 Disposal of Waste Material.

3.07 APPROVAL OF SUBGRADE

- A. Notify District's representative when excavations have reached required subgrade.
- B. When District's representative determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 1. Unforeseen additional excavation and replacement material shall be reviewed according to the Contract provisions for Changes in Work.
- C. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by the District's representative.

3.08 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the District's representative.
 1. Fill unauthorized excavations under other construction as directed by the District's representative.
- B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the District's representative.

3.09 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
 1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for record documents.
 3. Testing, inspecting, and approval of underground utilities.
 4. Concrete formwork removal.
 5. Removal of trash and debris from excavation.
- B. Controlled Low Strength Material (CLSM)
 1. Where utility lines will parallel footings or cross perpendicular to footings, utility shall be protected for anticipated foundation settlement. To address this situation per the Geotechnical Report, backfill shall be CLSM.
 2. Controlled low strength material shall be 1-sack cement sand slurry with a slump of 7 to 9 inches and a 28 day unconfined compressive strength of 75 to 150 psi. CLSM shall be mixed in a transit mixer. Certification tickets shall be submitted at the request of the Engineer. Where CLSM2 is called for by the Engineer, a 2-sack cement sand slurry shall be provided by the contractor.

3.11 PIPELINE AND UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on unyielding bearing surfaces. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Where trenches that carry below or pass under footings and that are excavated within 18 inches (450 mm) of footings, backfill the trench in the manner shown on the plans or as directed by the Civil Engineer. If concrete backfill is permitted, place concrete to level of bottom of footings.
- C. Provide 4 inch (100 mm) thick concrete base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways or in other areas where loading from vehicular traffic is indicated on the plans. After installation and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.
- D. Place and compact initial backfill of sand conforming to 3.15 - Compaction above over the pipe or utility conduit.
 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of pipe or utility conduit to avoid damage or displacement of the pipe or utility system.

- E. Coordinate backfilling with testing of the pipeline or utility.
- F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 SUBSURFACE DRAINAGE BACKFILL

- A. Subsurface Drain: Place a layer of filter fabric around perimeter of drainage trench or at footing, as indicated. Place a 6 inch (150 mm) compacted course of filtering material on filter fabric to support drainage pipe. After installing and testing, encase drainage pipe in a minimum of 6 inches (150 mm) of compacted filtering material and wrap in filter fabric, overlapping edges at least 6 inches (150 mm).
- B. Drainage Backfill: Place and compact drainage backfill of filtering material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade. Overlay drainage backfill with one layer of filter fabric, overlapping edges at least 6 inches (150 mm).
- C. Impervious Fill: Place and compact impervious fill material over drainage backfill to final subgrade.

3.13 FILL

- A. Placement of all engineered fill shall be placed on prepared subgrade in the manner approved by the District's Geotechnical Engineer. In general, fill material shall be placed in lifts not to exceed 8-inches in uncompacted thickness and shall be compacted by mechanical means only. Due to equipment limitations, thinner lifts may be necessary to achieve the recommended level of compaction. Engineered fill shall be moisture conditioned to within 2-percent of optimum moisture value and compacted per recommendations.
- B. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 - 1. If fill is placed on existing slopes greater than 4 to 1, Contractor shall construct keyways in undisturbed soil in accordance to District's Geotechnical Engineer's recommendations. At a minimum, keyways shall be on a sloped surface steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- C. Subgrade in areas to receive engineered fill, concrete slabs-on-grade, or pavements shall be scarified, moisture-conditioned, and recompacted to 90% to 95% relative compaction.
- D. Place fill material in layers to required elevations for each location listed below.
 - 1. Under grass use satisfactory excavated, or borrow, soil material.

2. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.
3. Under steps and ramps, use subbase material.
4. Adjacent to footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill or fill material on surfaces that are muddy.
 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.15 COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Except where specifically indicated otherwise on the plans, compact soil subgrade to not less than the following percentages of maximum dry density according to ASTM D1557:
 1. Under structures, building slabs, steps, compact the top 6 inches (300 mm) below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
 2. Under pavement and walkways, compact the top 6 inches (150 mm) below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
 3. Under lawn or unpaved areas, compact the top 6 inches (150 mm) below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between existing adjacent grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances when measured with a 10 foot (3 m) straight edge:

1. Lawn or Unpaved Areas: Plus or minus 1.2 inches (30 mm).
2. Walks: Plus or minus 1.2 inches (30 mm). ADA path of travel cannot exceed 2% in any direction.
3. Pavements: Plus or minus 1/2 inch (13 mm).

3.17 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbase to pavements.
 1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D4254 relative density.
 2. Shape subbase and base to required crown elevations and cross-slope grades.
 3. When thickness of compacted subbase or base course is 6 inches (150 mm) or less, place materials in a single layer.
 4. When thickness of compacted subbase or base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

3.18 DRAINAGE FILL

- A. Under slabs-on-grade, place drainage fill course on prepared subgrade.
 1. Compact drainage fill to required cross sections and thickness.
 2. When compacted thickness of drainage fill is 6 inches (150 mm) or less, place materials in a single layer.
 3. When compacted thickness of drainage fill exceeds 6 inches (150 mm) thick place materials in equal layers, with no layer more than 6 inches (150 mm) thick nor less than 3 inches (75 mm) thick when compacted.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency Services: The District will engage a testing agency to inspect and test engineered fills, trench backfill, and compacted subgrades. Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
 1. Footing Subgrade: At footing subgrades, testing agency will perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the District's representative.
 2. Paved and concrete slab areas: At subgrade and at each compacted fill and backfill layer, testing agency will perform at least one field in-place density test for every 2000 sq. ft. (186 sq. m) or less of paved area or concrete slab, but in no case fewer than three tests.
 3. Foundation Wall Backfill: In each compacted backfill layer, testing agency will perform at least one field in-place density test for each 100 feet (30 m) or less of wall length, but no fewer than two tests along a wall face.

4. Trench Backfill: In each compacted initial and final backfill layer, testing agency will perform at least one field in-place density test for each 150 feet (45 m) or less of trench, but no fewer than two tests.
- B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, ponding and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace material to depth directed by the District's representative; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work.
- D. Survey Control Points: Protect benchmarks and horizontal control points from damage or displacement.
- E. Dust Control: Apply water or non-asphaltic dust palliative as required to maintain dust control during the course of construction operations.

3.21 STOCKPILING OF TOPSOIL

- A. Stockpile stripped or excavated soil materials topsoil at the location indicated on the plans or as directed by the District's representative. Excess excavated soil material to be removed from the Property per 3.22 Disposal of Soil below.

3.22 DISPOSAL OF SOIL

- A. Disposal of Unsuitable Soil and Waste Material generated during Site & Landscape Improvement Project: Remove unsatisfactory soil and waste material, including trash and debris, and dispose of it in accordance with CALTRANS Standard Specifications, Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way."

END OF SECTION

SECTION 31 25 00

EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Description: Provide Erosion Control, as shown and specified per Contract Documents.
- B. Related Documents: CALTRANS Standard Specifications, Section 7-1.13 and CALTRANS Construction Site Best Management Practices Manual
- C. Geotechnical Report. Copy available with the District. Prepared by Cornerstone Earth Group. Project No. 1332-2-2. Dated September 12, 2022.

1.02 SUBMITTALS

- A. Reference Standards:
 - 1. General: Refer to References, for reference standards, applicable codes and definitions.
 - 2. State of California, Department of Water Resources (CDWR): Storm water pollution prevention requirements and submittal documents.
 - 3. CALTRANS Construction Site Best Management Practices Manual.
 - 4. CALTRANS Storm Water Quality Handbooks.
- B. Closeout: Remove temporary erosion control devices from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Straw: Fresh wheat straw, dried and completely free of foreign matter and debris.
- B. Wire: ASTM B211, galvanized steel, not smaller than 20 gage.
- C. Silt Control Fabric:
 - 1. General: Manufactured by Mirafi Moisture Protection or approved substitute.
- D. Mulch Netting:
 - 1. General: Natural fiber netting capable of withstanding a minimum of one year of exposure to the weather without shrinking or disintegration. Netting shall be free of all herbicides.
 - 2. Anchors:
 - a. "J" Pins: Galvanized wire, 0.12 inch diameter x 10 inches long.
 - b. "U" Staples: Galvanized wire, 0.09 inch diameter x 6 inches long.
- E. Fasteners:
 - 1. Nails: FS FF-□105, common wire, galvanized.
 - 2. Wire: 16 or 18 gage steel, galvanized.

2.02 FABRICATION

- A. Bales: Fabricate of straw to uniform standard size bale and wire tie sufficiently to hold bale shape throughout designated period of construction.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Grade, shape and contour site surface as necessary to accommodate grading requirements.

3.02 INSTALLATION

- A. General: Install straw bales and other erosion control barriers at all inlets in and near the work area.
- B. Silt Barriers:
- C. General: Install barriers at all inlets in and near the work area..
 - 1. Fabric Fence: Fabricate with silt control fabric and wood stakes of sufficient length and spacing to resist water pressure anticipated during heavy storm runoff.
 - 2. Fiber Rolls: Anchor in place with wood stakes, as shown on the plans.
- D. Straw Mulch:
 - 1. General: Apply at a rate of two (2) tons per acre, where required.
 - 2. Anchorage:
 - a. General: Embed mulch into the ground to a minimum depth of 2 inches.
 - b. Netting: Where required anchor netting with top and bottom trenches, edges lapped a minimum of 6 inches, and anchored with pins or u-staples at 3'-0" on center, each way and at edges and ends.
- E. Maintenance:
 - 1. General: Repair erosion control facilities and straw bales throughout construction period. Remove silt build up as needed. Repair damage to earth slopes and banks as required to maintain proper drainage and erosion control.
 - 2. Repositioning: Relocate headers, silt fences and straw bales as necessary to facilitate placement of permanent construction, while maintaining required erosion control.
- F. Removal:
 - 1. General: Upon completion of construction, remove and dispose of temporary erosion control products in accordance with CALTRANS Standard Specifications, Section 7-1.13 and repair to condition as shown on the plans.

END OF SECTION

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

- A. Description: Provide Asphalt Concrete Paving, as shown and specified per Contract Documents, including but not limited to C2.1 - C4.3.

1.02 SUBMITTALS

- A. Closeout:
 - 1. General: Exhibit I – Specification Section, Closeout Procedures.
- B. Certificate of Compliance:
 - 1. General: CALTRANS Standard Specifications (Section 39).

1.03 QUALITY REQUIREMENTS

- A. General: Exhibit I – Specification Section, Quality Assurance.
- B. Reference Standards:
 - 1. General: Exhibit I – Specification Section, References, for reference standards, applicable codes and definitions.
- C. State of California, Department of Transportation (CALTRANS): Standard Specifications.
- D. California Building Code (CBC) Section 1129B.5 for Parking Spaces, and Section 1133B.8.3 and 1133B.8.4 for Tactile warning lines.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Surface Course Aggregate: Mineral aggregates for Type "A" asphalt concrete, per CALTRANS Standard Specifications, Section 39-2.02, Type A, 1/2 inch grading; 1/2 inch maximum, medium grading.

2.02 MIXES

- A. General: Plant mixed per CALTRANS Standard Specifications, Section 39, Type A, 1/2 inch maximum medium grading.
- B. Temperature of Asphalt: 275°F minimum; 325°F maximum, when added to aggregate.

PART 3 - EXECUTION

3.01 PERFORMANCE

- A. General: Refer to Section 31 10 00 – “Excavation and Fill” for execution Requirements.

3.02 PREPARATION

- A. Environmental Requirements:
 - 1. Asphalt Surfacing: Do not apply during wet weather, on wet base course, or when atmospheric temperature is below 50°F. If conditions are dry and otherwise acceptable under CALTRANS Standard Specifications, asphalt concrete paving may be conducted (with the prior written approval of the Construction Manager) if either of the following combinations of atmospheric temperature and asphalt concrete mix temperature can be assured:
 - a. Atmospheric temperature is at least 45°F and rising and the temperature of the incoming asphalt mix is greater than 270°F; or
 - b. Atmospheric temperature is at least 50°F and rising and the temperature of incoming asphalt mix is greater than 290°F.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.
- D. Preparation of Subgrade: Clean, shape, and compact to final plane with no uncompacted material and free from elevations or depressions exceeding 3/8 inch in 10'-0" from true plane. Compact to not less than 95% of maximum dry density per ASTM D1557.

3.03 INSTALLATION

- A. Required Thickness After Compaction:
 - 1. Asphalt Concrete Surface Course: 3 inch maximum lift.
- B. Asphalt Paving:
 - 1. Asphalt Concrete Surface Course:
 - a. General: Per CALTRANS Standard Specifications, Section 39-6 except as modified below. Bring all structures, including (but not limited to) curbs, gutters, manholes, valve boxes, catch basins, drainage inlets, electrical boxes, and corrosion test boxes to final grade prior to placing final surface course. Failure to bring such structures to grade prior to placement of the final lift of asphalt concrete will be cause for rejection of the pavement.
 - b. Final Gradation: Smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 95 percent of maximum theoretical unit weight as determined by California Test Method No. 304. Maximum variation 1/8 inch in 10'-0" when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by saw cutting, removal and replacement, or as otherwise directed by the Owner's representative.
- C. Patching: Saw cut existing paving square and plumb at all edges to be joined by new paving. Prime vertical surfaces before installing new work. Warp carefully to flush surface with seal over joints.

END OF SECTION

SECTION 32 13 14

CIVIL SITE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. DESCRIPTION: Provide Non-Architectural Concrete, as shown and specified per Contract Documents. Includes installation of items furnished under other Sections but cast in the concrete.
- B. DEFINITIONS:
 - 1. Architectural Concrete: Concrete which will be permanently exposed to view and which therefore requires special care in selection of the concrete materials, forming, placing and finishing to obtain the desired architectural appearance.
 - 2. Non-Architectural Concrete: Sidewalks & Curbing.

1.02 SUBMITTALS

- A. SHOP DRAWINGS:
 - 1. General: Submit concrete mix designs for review.
 - 2. Aggregate Base:
 - a. Submit aggregate for standard pavement base section
 - 3. Reinforcing: Submit manufacture and installation details, including fastenings, for review.
- B. SAMPLES: Submit concrete finish samples, if requested.
- C. PRODUCT DATA: Submit manufacturer's specifications, data, and installation instructions for review.
- D. CERTIFICATES:
 - 1. General: Submit certification stating that products used to manufacture concrete delivered to the site meets or exceeds the material and testing requirements of these specifications.
 - 2. Reinforcement: Submit mill test and chemical analysis certificates for all reinforcing steel delivered to the site.
- E. PLACEMENT RECORDS: Keep on job site until completion, and open to inspection, record showing time and date of placing concrete in each portion of structure.

1.03 QUALITY ASSURANCE

- A. REFERENCE STANDARDS:
 - 1. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
 - 2. American Concrete Institute (ACI):
 - a. ACI 302.1R: Guide for Floor and Slab Construction.
 - b. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - c. ACI 305R: Hot Weather Concreting.
 - d. ACI 306R: Cold Weather Concreting.

- e. ACI 308: Standard Practice for Curing Concrete.
 - f. ACI 318: Building Code Requirements for Reinforced Concrete.
 - g. ACI 347R: Recommended Practice for Concrete Formwork.
 - h. ACI SP-66: Detailing Manual.
 - 3. American Welding Society (AWS): AWS D1.4 - Structural Welding Code - Reinforcing Steel.
 - 4. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice.
 - 5. National Ready Mixed Concrete Association (NRMCA): Check List for Certification of Ready Mix Concrete Production Facilities.
- B. TESTING: Tests by Testing Laboratory appointed by Owner and under directions of Architect; expense of testing borne by Owner; make tests per Section 1929A of CBC.
- C. ALLOWABLE TOLERANCES:
- 1. Non-Architectural Concrete:
 - a. Variation in cross-sectional dimensions: $-1/8"$ $+1/4"$.
 - b. Variation in surface tolerance: $1/8"$ in 10 ft. in any direction as determined by 10 ft. (3.0m) straight edge.

PART 2 - EXECUTION

2.01 MATERIALS

- A. FORMWORK:
- 1. Forms:
 - a. Lumber: Construction grade Douglas Fir or approved substitute by owner representatives.
 - b. Plywood: PS 1, C Grade Douglas Fir, 5/8 inch minimum; sound undamaged sheets with clean true edges.
 - c. Metal: Gage sufficient to provide equivalent rigidity and strength.
 - d. Fasteners: As required; of sufficient strength and character to maintain formwork in place while placing concrete.
 - e. Corner Formers: Chamfered wood.
 - 2. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.
 - 3. Vapor Barrier:
 - a. General: Moistop, 10 mil thick minimum, manufactured by the Fortifiber Corp.
 - b. Alternate Manufacturers: Comparable products manufactured by 3m Construction Markets, Specified Construction Products Division, or accepted equal.
 - c. Joint Tape: As recommended by manufacturer.
- B. REINFORCEMENT:
- 1. Reinforcement Bars: ASTM A615, deformed; No. 4 and smaller Grade 40; No. 5 and larger Grade 60, or ASTM A 706 where shown.
 - 2. Reinforcing Supports:
 - a. General: Metal chairs, bolsters, bar supports, or spacers, sized and shaped for strength and support during concrete placement.
 - b. Footings: Bottom bars supported with concrete blocks.
 - 3. Tie Wire: 16 gage annealed type.
 - 4. Dowels: ASTM A615, 40Ksi yield grade, plain steel, uncoated.

C. ANCHOR BOLTS: ASTM A307; rolled body bolts with upset threads not permitted.

D. CONCRETE:

1. Cement: ASTM C150, Type I or II.
2. Aggregates:
 - a. General: ASTM C33; Fine Aggregate: Felton Quarry or approved substitute
 - b. Lightweight: ASTM C330; Permanente Limestone or Aromas Granite.
 - c. Exposed aggregate: Contractor shall submit dark aggregate for exposed concrete apron at existing trash enclosure
3. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials.
4. Admixtures:
 - a. Water Reducing Admixture: Use admixture per ASTM C494 to improve placing, reduce water cement ratio, and ultimate shrinkage. Such admixture must receive prior approval of Architect and be included in original design mix.
 - b. Air Entrainment:
 - 1) General: ASTM C260; Manufactured by Euclid Chemical Co.
 - 2) Alternate Manufacturers: Comparable products manufactured by W.R. Meadows, Inc., or accepted equal.
 - c. Hardener:
 - 1) General: "Kure-N-Seal" manufactured by the Sonneborn Building Products Division of the ChemRex Inc.; color selected by the Architect.
 - 2) Alternate Manufacturers: Comparable products manufactured by L. M. Schofield Co., or accepted equal.
 - d. Fly Ash:
 - 1) General: ASTM C-618
 - 2) If pozzolanic additive is used, only 25% of portland cement replacement is allowed.
5. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
6. Membrane Curing Compound: ASTM C309, Type 1D clear (with fugitive dye), guaranteed not to affect bond of subsequent finish materials. Curing compound and areas to receive it must be accepted by Architect before application.
7. Sealer:
 - a. General: Burke Spartan-Cote WB Cure-Seal-Hardener manufactured by White Cap Industries, Inc.
 - b. Alternate Manufacturers: Comparable products manufactured by the Sonneborn Building Products division of the ChemRex Inc., or accepted equal.
8. Bonding Agent for Patching:
 - a. General: Acryl-Set manufactured by Master Builders, Inc.
 - b. Alternate Manufacturers: Comparable products manufactured by W.R. Meadows, Inc., or accepted equal.
9. Non-shrink Grout:
 - a. General: "Masterflo 713" manufactured by MBT Protection & Repair/ChemRex
 - b. Alternate Manufacturers: Comparable products manufactured by W.R. Meadows, Inc., or accepted equal.
10. Color:
 - a. None

E. EXPANSION JOINT MATERIALS: ASTM D 1751, preformed; 1/2 inch thick max., unless otherwise shown.

2.02 MIXES

A. CONCRETE DESIGN:

1. Designed Strength and Class of Concrete:
 - a. Class "B" Concrete: Sidewalk
 - 1) 28 Day strength of 3000 psi.
 - 2) 4" maximum slump.
 - 3) 1" maximum aggregate size.
2. Limiting Quantities and Minimum Strength: Design concrete for strength per CBC Section 1905A, Method B. Mixtures shall be reviewed by Laboratory selected by and with costs of reviewing mixes borne the Owner. The limiting quantities of CBC Table 19A-A-7 do not apply.

B. MIXING OF CONCRETE:

1. General: All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogeneous; mixer must be discharged completely before the mixer is recharged. Conform to requirements of CBC Section 1905A.2.3, Method B.
2. Ready-Mix Concrete:
 - a. General: Mix and deliver in accordance with the requirements set forth in CBC Section 1905A.8.2. Unless waived by Architect, representative of testing laboratory shall maintain continuous inspection at ready-mix plant to run check sieve analysis of aggregate; check design of mix, check cement being used with test reports, check loading of trucks and certify quantities of materials placed in each truck. Ready-mix plant to deliver to Inspector on work certificates with each truck bearing signature of representatives of testing laboratory, stating quantity of cement, water, fine aggregate, coarse aggregates contained in load, and time mixer was loaded.
 - b. Batch Plant Inspection Waiver:
 - 1) General: If the batch plant meets the requirement of CBC 1929 A.5 and the following quality control requirements, the Architect may waive the requirement for continuous batch plant inspection.
 - 2) Testing Laboratory: Inspection by representatives of testing laboratory to be made at start of the work to check the first batching and to furnish mix proportions to Licensed Weighmaster.
 - 3) Weighmaster: Licensed Weighmaster to positively identify materials as to quantity and certify to each load by ticket.
 - 4) Certification: Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Inspector will not accept load without tickets identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.
 - 5) Test Cylinders: A minimum of one (1) set of three (3) cylinders shall be taken and tested for each 50 cubic yards of concrete or fraction thereof placed in any one day.
 - 6) Affidavit: At end of project, Weighmaster shall furnish affidavit for DSA on form satisfactory of DSA, certifying that all concrete furnished conforms in every particular to proportions established by mix designs. Any costs involved in this modified procedure will be paid by the Owner and backcharged to Contractor.
3. Admixtures: Verify compatibility of concrete admixtures when multiple admixtures are called for in a specific mix.
4. Job Mixed Concrete:
 - a. General: Use batch mixer of approved type, with capacity to handle one or more full sack batches, no split sack batches permitted. Operate as recommended by manufacturer, mixing at least one and one half (1-1/2) minutes after all materials are in drum.

- b. Handling and Mixing of Concrete: Architect may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.
- C. GROUT: Provide mortar containing same proportions of cement and sand as used for concrete, with ultimate compressive strength of 3000 psi.

PART 3 - EXECUTION

3.01 PREPARATION

- A. SCHEDULING: Notify Architect and Engineer at least 48 hours prior to placing of concrete.
- B. ENVIRONMENTAL REQUIREMENTS: Per ACI 305R and ACI 306R.
- C. EXAMINATION: Examine conditions of work in place before beginning work; report defects.
- D. MEASUREMENTS: Take field measurements; report variance between plan and field dimensions.
- E. STORAGE: Store cement in weathertight building, permitting easy inspection and identification. Protect from dampness; lumpy or stale cement will be rejected.
- F. PROTECTION: Protect finish surfaces adjacent to locations scheduled for placement of concrete. Inspect forming placed against existing work and establish a tight, leak-proof seal before concrete is poured. Replace finish work defaced by concrete placement operations.

3.02 INSTALLATION

- A. GENERAL: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. EARTHWORK: Refer to Section 31 23 00 for excavation, sub-base and backfill requirements.
- C. FORMWORK:
 - 1. Workmanship: Provide formwork required to produce smooth concrete; straight, plumb and true to plane. Concrete out of line, level or plumb will be rejected. Contractor is responsible for strength of all forms.
 - 2. Erection:
 - a. General: Provide straight, true and sound form material, able to withstand deformation due to loading and the effects of moist curing. Do not reuse warped or delaminated materials that require more than minor patching of contact surfaces.
 - b. Construction: Construct forms to shapes, lines, grades and dimensions indicated; tight to prevent leakage, properly braced and tied together to maintain position and shape. Form bevels, grooves and recesses to neat, straight lines; chamfer corners where indicated. Provide for easy removal without hammering, wedging or prying against concrete.
 - c. Adjustment: Tighten forms, posts and shores during and immediately after concrete placement; readjust as required to maintain grades, levels and camber.
 - d. Footing: Footing forms may be of earth if dimensions are increased by $\frac{1}{4}$ inch for each form surface omitted.
 - 3. Embedded Components:

- a. General: Install straight, level and plumb prior to concrete placement; brace, anchor and support items to prevent displacement or distortion.
 - b. Inserts: Coordinate work of other Sections in setting bolts, anchors, and other components, as required.
- 4. Anchor Bolts: Install as shown. Installation of anchor bolts in wet concrete is NOT allowed.
- 5. Form Coating:
 - a. General: Before placement of reinforcing steel, coat exposed face of forms to prevent moisture absorption from concrete and facilitate removal of forms; seal all cut edges.
 - b. Re-use: Thoroughly clean and recoat form material acceptable for re-use.
- D. REINFORCEMENT:
 - 1. Fabrication: Do not bend or straighten reinforcement in manner that will injure material. Bars with kinks or bends not shown, and heating of bars for bending is not permitted.
 - 2. Placement: Provide minimum center to center distance between parallel bars 2-1/2 times diameter, 1-1/2 inches or 2-1/2 times maximum size coarse aggregate, whichever is greater. Wire bar lap together; splice reinforcing steel with lap of 60 diameters, unless otherwise shown.
 - 3. Welding: All welding shall be observed by a DSA qualified welding inspector.
- E. CAST-IN-PLACE CONCRETE:
 - 1. General: Placement of forms, inserts and reinforcements are subject to approval of Architect. Notify Architect and Structural Engineer at least 48 hours prior to placement of concrete.
 - 2. Cleaning:
 - a. General: Remove dirt, wood chips, sawdust and other debris before concrete pour; use compressed air at inaccessible areas.
 - b. Reinforcing: Clean reinforcement and other embedded items of substances that might impair bonding, prior to placement of concrete.
 - c. Previously Placed Concrete: Roughen to 1/4 inch amplitude; clean with steel brush prior to applying bonding agent.
 - 3. Vapor Barrier:
 - a. General: Install under interior slabs on grade. Lap joints minimum 6 inches and seal watertight.
 - b. Penetrations: Seal watertight; repair penetrations and damage with vapor barrier material and lapped minimum 6 inches over area and sealed with joint tape.
 - 4. Placing of Concrete:
 - a. General: Maintain records for placement of all concrete. Place concrete in dry conditions; keep excavations free of water, ice, loose soil or debris. There shall not be additional water added to the mix without the written permission from the Structural Engineer and Testing Laboratory.
 - b. Weather Requirements: Per ACI 305R (Hot) and ACI 306R (Cold). Additionally, hot weather is defined as any period in which temperature exceeds 85 degrees F.
 - c. Transportation: Handle concrete from mixer to place of deposit as rapidly as possible; using methods to prevent separation or loss of ingredients. Deposit in final position; avoid rehandling or flowing. Do not place partially hardened concrete in work. Do not wheel placement containers directly on top of reinforcing steel.
 - d. Placement:
 - 1) General: Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt placement of concrete in manner that cause cold joints to occur.
 - 2) Footings: Place footings in one continuous pour. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six (6) feet.

- 3) Concrete Slabs:
 - a) General: Lay slabs to required lines and grades, in pattern shown. Water subgrade at exterior concrete the night before placement; dampen again immediately before placement; standing water not allowed.
 - b) Flatness: Per ASTM E1155 - Determining Flatness and Levelness Using the F-Number System, or using a 10'-0" long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch.
- 4) Dry Pack: Dry pack shall be rammed into place under base plates of all columns and elsewhere as indicated on the Drawings. Mixture of one part cement and two parts sand, minimum of mixing water to make a stiff, dry tamping mixture.
- e. Compacting:
 - 1) General: Thoroughly work concrete around reinforcement, embedded components and into corners of forms. Consolidate concrete by internal vibration, only. Do not puddle, tamp or vibrate concrete which has already taken initial set or continue long enough cause segregation of material.
 - 2) Slabs: Consolidate concrete on grade by spading and puddling and internal vibration.
 - 3) Formwork: Consolidate concrete in forms with high speed internal vibrators.
- f. Grout: Use at construction joints, and where shown.
5. Concrete Finishes:
 - a. Slab Finish:
 - 1) General: Uniformly spread, screed and float concrete.
 - 2) Float: Apply at tile setting beds, where shown.
 - 3) Trowel: Apply two (2) steel troweling operations at surfaces to receive carpet, resilient materials, thinset tile and where left exposed, finished to achieve burnished surface. Follow second troweling with light brooming perpendicular to direction of traffic to form non-slip surface.
 - 4) Broom: P.C.C. paving shall have a medium broom finish on all surfaces less than 6% and a heavy broom finish on all surfaces greater than 6%.
 - 5) Hardener: Apply where shown.
 - 6) Sealer: Apply where shown.
 - 7) Exposed Aggregate: Apply where shown. Contractor shall match existing aggregate size and color when matching existing exposed aggregate walkways.
 - b. Joints:
 - 1) General: Mark off exposed joints, where indicated, with 1/4 inch radius edging tool. Markings to be clean cut, straight and square with respect to border. Tool edges of exposed expansion and control joints, border edges, and wherever concrete adjoins other material or vertical surfaces.
 - 2) Control Joints: As shown; 12'-0" maximum at exterior concrete.
6. Curing:
 - a. General: Refer to ACI 308. Protect concrete from premature drying for minimum five (5) days following pour.
 - b. Exterior Slabs: Cover and cure with membrane curing or moist sand; upon completion wash clean.
 - c. Sealer: Apply where shown.
 - d. Concrete in Forms: Keep wet until forms are stripped.
7. Removal of Forms:
 - a. General: Sequence and time in manner to insure safety of concrete structure; remove without damage to concrete surfaces.
 - b. Stripping:
 - 1) General: Maintain forms in place for not less than the following number of days when air temperature in contact with concrete is 60 degrees F or

above. Add an additional day for each day that temperature falls below 60 degrees F, unless otherwise directed.

- 2) Slab Edge Screeds: Five (5) days.
8. Defective Concrete:
- a. General: Remove or cut out defective concrete and repair before concrete is completely cured, as directed by Architect.
 - b. Defective Concrete is:
 - 1) General: Concrete not meeting specified 28-day strength.
 - 2) Durability and Appearance: Concrete containing rock pockets, voids, spalls, cracks, exposed reinforcing, or other defects.
 - 3) Alignment: Incorrectly formed concrete, out of plumb or level.
 - 4) Deleterious Materials: Concrete containing embedded wood or other debris.
 - 5) Unauthorized Patching: Concrete with patched voids that were not filled under Architect's direction.
 - 6) Embedded Items: Concrete not containing required embedded items.
 - c. Patching:
 - 1) General: Repair minor defective work with approved patching material. Serious defects, defects affecting the strength of the structure, or unsatisfactory patching may be cause for complete removal. ALL REPAIRS TO DEFECTIVE CONCRETE INVOLVING STRUCTURAL STRENGTH ARE SUBJECT TO THE APPROVAL OF THE ARCHITECT AND DSA.
 - 2) Preparation: Chip out minor defective areas to a minimum depth of 1 inch, with edges perpendicular to surface. Wet area at least 6 inches around surface to be patched to prevent absorption of water from patching mortar.
 - 3) Repair: Coat with cement wash mix consisting of neat cement and solution of specified bonding agent. Immediately apply patching mortar consisting of 1 part cement to 3 parts fine aggregate mixed with solution with minimum water required for placement.
 - 4) Finishing: Match adjoining surfaces; provide protective covering; keep wet for at least 7 days.

3.03 FIELD QUALITY CONTROL

- A. GENERAL: Per CBC, Section 1905.6; agency selected and paid for by Owner.
- B. FIELD TESTING:
 1. General: Take three (3) cylinders and test, for each 50 cubic yards of each concrete mix being placed each day. Test first cylinder at the age of 7 days and the other at 28 days; cylinder for 28-day test will not be broken if cylinder for 7-day test meets 28 day strength. Hold third cylinder for 56 day test, if required.
 2. Reinforcement: Make one (1) tensile test and one (1) bend test of specimen taken from each 10 tons of unidentified steel lacking a mill certificate delivered to the site.
- C. RETESTING: Cost of retests or coring because of understrength, questionable or defective concrete will be paid for by Contractor.

3.04 CLEANING

- A. GENERAL: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.

END OF SECTION

SECTION 32 31 13
CHAINLINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish all labor, materials, facilities, transportation and services to complete metal fences and gates and related work as shown on the Drawings and specified herein.
- B. Scope of Work:
The general extent of metal fences and gates is shown on the Drawings and includes, but is not limited to, the following:
 - 1. Furnishing and installing chain link fence, hardware, gates, gate center stops, gate center drop rod assembly, hinges, concrete footings, posts, and related appurtenances.
 - 2. Excavation for post bases
 - 3. Concrete foundations for posts & Center drop gates
 - 4. Manual Gates and Hardware
 - 5. Finish painting
- C. Related sections:
 - 1. Submittals

1.02 REFERENCES AND REGULATORY REQUIREMENTS

- A. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A392 - Zinc-Coated Steel Chain-Link Fence Fabric.
- D. ASTM A569 - Steel, Carbon, Hot-Rolled Sheet and Strip, commercial quality.
- E. ASTM F567 - Practice for Installation of Chain-Link Fence.
- F. ASTM F668 - Specification for Poly (Vinyl Chloride) (PVC) - Coated Steel Chain Link Fence Fabric.
- G. ASTM F1083- Pipe, steel, hot-dipped zinc coated (galvanized), welded, for fence structures.
- H. SSPWC - Standard Specifications for Public Works Construction, 1997 Edition.
- I. CLFM - Chain Link Fence Manufacturer's Institute
- J. Chapter 19A, CBC.

1.04 SUBMITTALS

- A. Submit shop drawings including plan layout, grid, spacing of components, accessories, fittings, hardware, anchorages and schedule of components.
- B. Submit manufacturer's technical product data.
- C. Submit manufacturer's installation instructions.
- D. Submit three samples illustrating each fence fabric finish.
- E. Submit per section 01 30 00 / 01 33 00.

1.05 SEQUENCE AND SCHEDULING

- A. Coordinate construction timing with installation of concrete footings.

PART 2 - PRODUCTS

2.01 CHAIN LINK FENCE

A. Chain Link Fabric

1. Selva: Fabric 72 inches high and over shall be knuckled at one selva and twisted at the other; all mesh 60 inches high and under shall be knuckled at both selvages.
2. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12 feet high. Wire sizes includes zinc or aluminum coating.
2. Size: Two (2) inch mesh, 9-gauge (0.148 inch diameter) wide.
3. Galvanized Steel Finish: ASTM A 392, Class 2, with not less than 2.0 oz. Zinc per sq. ft. of uncoated wire surface on wire coated before weaving as determined from the average of two or more samples and not less than 1.8 oz. per sq. ft. of coated wire surface for any individual sample.

B. Fence Framing:

1. Strength requirements for posts and rails conforming to ASTM F 669.
2. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

NPS in Inches	Outside Diameter (OD) in inches	Type 1 Steel	Type II Steel
1	1.315	1.68	1.35
1 1/4	1.660	2.27	1.84
1 1/2	1.900	2.72	2.28
2	2.375	3.65	3.12
2 1/2	2.875	5.79	4.64
3	3.500	7.58	5.71
3 1/2	4.000	9.11	6.56
4	4.500	10.79	---
6	6.625	18.97	---
8	8.625	28.55	---

C. Steel Framework:

1. Posts, Rails, Braces, and Gate Frames:
 - a. Type I pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (Schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.
 - b. Type II pipe: Manufactured from steel conforming to ASTM A 569 or A 446, grade D, cold formed, electric welded with minimum yield strength of 50,000 psi and triple coated with minimum 0.9 oz. zinc per sq. ft. after welding, a chromate conversion coating and a clear polymer overcoat. Corrosion protection on inside surfaces shall protect metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5% Red Rust.
2. End, corner, and pull posts for the following fabric heights:
 - a. Up to 6 feet: 2.375 inch OD Type I or II steel pipe, 2 inch galvanized steel tube weighing 2.60 lbs. per lin. ft.
 - b. Over 6 feet: 2.875 inch OD Type I or II steel pipe, 2 1/2 inch steel tube weighing 5.10 lbs. per lin. ft.
3. Line or intermediate posts for following fabric heights:
 - a. Up to 6 feet: 1.90 inch OD type I or II steel pipe, 1.875 inch.

- b. Over 6 feet: 2.375 inch OD Type I or II steel pipe, 1.70 inch C section weighing 2.70 lbs. per lin. ft.
 - 4. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate width as follows:
 - a. Up to 6 feet: 2.875 inch OD type I or II steel pipe, 2 ½ inch galvanized steel tube weighing 5.0 lbs. per lin. ft.
 - b. Over 6 feet to 13 feet: 4.00 inch OD Type I or II steel pipe.
 - 5. Special Fabricated Gate: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as detailed:
 - a. Top Rail: Manufacturer's longest length, with expansion-type couplings, approximately 6 inches long, for each joint. Provide means for attaching top rail securely to each gate corner, pull, and end post.
 - b. Galvanized Steel: ¼ inch NPS (1.66 inch OD) Type I or II steel pipe or 1.625 inch by 1.25 inch roll-formed C sections weighing 1.35 lb. per ft.
 - 6. Concrete Footings for posts: Concrete for footings shall be Class "B" (2500 psi) and crowned to shed water. Size as shown below unless noted otherwise on drawings.
 - a. Up to 6 feet: 32" deep and 12" in diameter
 - b. Over 6 feet to 9 feet: 42" deep and 12" in diameter
 - c. Over 9 feet: 60" deep and 16" in diameter

-Posts shall stop 4" from bottom of post hole when installed
- D. Fittings and Accessories
 - 1. Material: Comply with ASTM F626-96. Mill-finished aluminum or galvanized iron or steel, to suit manufacturer's standards.
 - a. Zinc Coating: Unless specified otherwise, galvanized steel fence fittings and accessories in accordance with ASTM A153/A153M-95, with zinc weights per Table 1.
 - b. Tension Wire: 0.177 inch diameter metallic-coated steel marcelled tension wire conforming to ASTM A 842 with finish to match fabric
 - c. Type II Zinc Coated in following class:
 - Class 2, with a minimum coating weight of 1.20 oz. Pper sq. ft. of uncoated wire surface
 - 2. Tie Wires: 7 gauge galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating surface area in accordance with ASTM A 641, Class 3 or 9 gauge (0.106 inch diameter) aluminum wire alloy 1100-H14 or equal, to match fabric core material.
 - 3. Post and Line Caps: Provide weather-tight closure cap for each post. Provide line post caps with loop to receive wire or top rail.
 - 4. Tension or Stretcher Bands: Hot-dipped galvanized steel with minimum length 2 inches less than full height of fabric, minimum cross-section of 3/16 inch by 3/4 inch and minimum of 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric integrally woven into post.
 - 5. Tension and Brace Bands: Minimum 3/4 inch wide hot-dipped galvanized steel with minimum 1.2 oz zinc coating per sq. ft. of surface area.
 - 6. Fabric Ties: Minimum 7 gauge. Aluminum ties will not be allowed.

2.02 FABRICATION

A. Fabrication

- 1. Provide all new stock of standard sizes specified or detailed. Fabricate materials in shop to produce high grade metal work. Form and fabricate to meet required conditions.
- 2. Include bolts, screws and other fastenings necessary to secure the work.
- 3. Conform applicable work to latest edition of AISC Specifications and AWS D1.1 for Welding in Building Construction

4. Accurately make and tightly fit joints and intersections in true planes with adequate fastenings.
5. Coordinate the work with work of other sections. Provide all punchings and drillings indicated or required for the attachment of the work to other sections.
6. Welding: Weld joints, unless otherwise indicated or specified, using shielded electric arc method. Use coated welding rods, not fluxed or type recommended by manufacturer for use with parent metal.
7. Grinding: Grind welds to smooth, flush joints.

2.03 GATES

- A. Manually operated gate shall be fabricated to size and configuration indicated on drawings complete with gate hardware. When no hardware is detailed, provide 1" dia. minimum pole slide and 'C' latch and sleeve in ground. Hardware shall accommodate padlock.
- B. Gate Frames: 1-1/2 inch diameter steel pipe, welded corners, hot dip galvanized after fabrication.
- C. Sizes: As indicated on the drawings, minimum widths of gates shall not be less than 36".
- D. Hardware: Heavy-duty, galvanized ferrous metal industrial quality as manufactured by Master Nalco, Fontana, CA, or equal as approved in accordance with Division I for product options and substitutions.
 1. Hinges: Industrial malleable, three each leaf, ball and socket type, Series 15750.
 2. Gate Fork Latch: Malleable, Series 16600. Remove fork latch at gates requiring panic exit devices, see note 5 below.
 3. Latch Assembly: Malleable, Series 17200, drop rods at double gates.
 4. Locking: Provide padlock capability.
 5. Gate Hardware: Shall be mounted at 40" [or as noted on details](#), above finish floor.
 - a. All attachments to gate shall be welded. No clamp-on or bolted fittings will be permitted.
- E. When a pair of gates is called for, contractor to include minimum 1" diameter cane bolt or pole slide with locking function to lock bolt in **UP** and **DOWN** position. Provide 12" diameter concrete base with steel sleeve to receive pole slide or cane bolt. Minimum depth of sleeve to be 6", minimum depth of concrete to be 8". Sleeve to be 1/2" greater diameter than pole/cane bolt. Note: **Accessible gates cannot have cane bolts.**

2.04 FINISH

- A. Following fabrication and prior to application of coatings, all metal shall be cleaned in a caustic solution to remove all grease, scale and rust.
- B. Chromate Conversion and Clear Acrylic Urethane Coating: Class 1A pipe, in accordance with Section 210-4, SSPWC. Color to be selected by Architect.
- C. Interior Surface Coating for Class 1A Pipe: In accordance with Section 210.3.2 SSPWC.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prior to excavation of footings, layout all equipment for approval by Architect.
- B. Preparation of Surfaces: It shall be the responsibility of this trade section to prepare all surfaces requiring paint finish. These surfaces shall be prepared to the standard of the trade and left without discrepancies, ready to receive paint, and in a condition acceptable for painting.

3.02 INSTALLATION OF CHAIN LINK FENCE

- A. Conform to layout shown on Drawings, except as modified by the Owner.
- B. Erect in strict conformance with approved Drawings, Shop Drawings, and manufacturer's recommendations.

- C. Install new footings in conformance with the specifications and as shown in Drawings.
- D. Post shall be installed vertical and plumb.
- E. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted. Apply fabric to outside of framework.
- F. Excavation: Drill or hand-excavate (using post hole digger) holes for posts to diameter and spacing indicated in firm, undisturbed or compacted soil.
- G. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation. Space maximum 8 feet o.c., unless otherwise indicated. Match spacing of existing fencing when fencing is indicated to match existing.
- H. Top Rails: Run rail continuously through line posts caps, bending to radius for curved runs and at other posts termination into rail end attached to posts or post caps fabricated to receive rail. Provide expansion coupling as recommended by fencing manufacturer.
- I. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- J. [Bottom Rails: Install bottom rails between posts 2" above finished grade unless otherwise noted on drawings. Provide all necessary trim and accessories as required for a complete installation.](#)
- K. Fabric: Leave approximately 2 inches between finish grade and bottom selvages unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- L. Tension or Stretcher Bars: Thread through or clamp to fabric 4 inches o.c. and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.
- M. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing. Maximum spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- O. Gates: Install gates plumb, level, and secure for full opening without interference. Install groundset items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
 - 1. Provide 1-7/8" O.D. bottom rail gate frame at fence locations.

3.03 WARRANTY

- A. Provide two year warranty to insure materials against rusting or breakdown of finish. Provide adjustments as needed to assure continued smooth operation of gates.

3.04 TESTING

- A. At Owner's Representative's option, Contractor shall be required to cut any pipe column after installation to confirm requirements of this specification. If conformance is confirmed, replacement members shall be installed at Owner's cost. Components not meeting required standards shall be replaced.

END OF SECTION

SECTION 32 80 00
IRRIGATION – DESIGN-BUILD

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. For new and existing irrigation systems
- B. Products for Pipes, Fittings, Valves, Boxes, Controllers, Wiring, Compounds
- C. Products for Sleeves and Detection Tape
- D. Installation of all materials including location for Detection Tape
- E. Testing of System
- E. Guarantee

1.2 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Section 01300.
- B. Include the following:
 - 1. Materials List and Product Data
 - 2. Shop Drawing showing all proposed pipes and sizes, valves, boxes, heads, etc.
 - 3. Record Documents – Complete as-built documents showing location and dimensions of all pipes within 1 foot horizontally and 6 inches vertically.
 - 4. Guarantee
 - 5. Recommended Watering Schedule

1.3 DESIGN BUILD

- A. Contractor is to design/build system based on planting plan provided. Minimum coverage to have 65% distribution efficiency in all areas. Contractor must familiarize himself with the existing system before submitting bid. No extra services will be granted for relocation of control valves, wiring, or the need to add more valves. **SYSTEM DESIGN, IF PROVIDED ON PLANS, IS TO DESIGNATE SUGGESTED MINIMUM ZONING AND PROVIDE A SUGGESTED ACCEPTABLE LAYOUT. HEADS, SPRAY PATTERS, LINE SIZING, PRESSURE REQUIREMENTS, ETC. ARE ALL TO BE VERIFIED AND DESIGNED BY THE CONTRACTOR.**
- B. Where modifying existing irrigation system to accommodate the scope of work this specification is a guide. Contractor shall field verify existing conditions and proposed design solution to connect to existing system and utilize similar products so the modified system will be compatible with the existing system and functional.

PART 2 PRODUCTS

2.1 PIPE and FITTINGS

- A. PVC pipe: Polyvinyl chloride (Type 1) plastic pipe PVC 1120 and NSF approved as follows: (New materials only)
 - 1. Mainline to 2-1/2 inch: Schedule 40 solvent-weld
 - 2. Mainline 3 to 6 inch: Class 200 ring-tite
 - 3. Lateral lines: Schedule 40 solvent-weld
- B. PVC Fittings: Polyvinyl chloride (Type 1) plastic fittings 1120, Schedule 40
- C. PVC Nipples: Polyvinyl chloride (Type 1) plastic fittings 1120, Schedule 40
- D. Flex Vinyl Risers: ½ inch diameter Salco A/R PVC flex hose or equal.

2.2 Valves and Valve Boxes

- A. Valves: As specified on drawings or match existing if not specified.
- B. Valve Boxes: 10" Round shall be Carson 910-12B (green) or approved equal
- C. Valve Box: 14"x19" Rectangular Boxes shall be Carson 1419B-13B (green) or approved equal. Lids shall be marked "Irrigation Control Valve".
- D. Valve Box: 17"x20" Rectangular Boxes shall be Carson 1320-13B (green) or approved equal. Lids shall be marked "Irrigation Control Valve"

2.3 Automatic Controller

- A. Owner will provide a new controller for the site unless it is identified on the plans to connect to the existing controller. (controller will be Irritrol)
- B. Provide one (1) flow meter and one (1) normally closed master valve per controller and dedicated mainline.
- C. All controllers will be wall-mounted type.

2.4 Electrical Wiring and Service

- A. High Voltage: Electrical Service to the controller shall be provided in accordance with Division 16 Sections or NEC if no Division 16 is included. Provide electrical as required and final hookup to equipment as part of the work in this section.
- B. Low Voltage: Copper with U.L. approval for direct burial in ground, size #14-1. Common ground wire shall have white insulating jacket; control wire shall have insulating jacket of other color than white. Splices shall be made with 3M DBY connectors. Provide two spare wire of a different color. Spare wires to be routed through each valve box connected to the controller.

2.5 Connecting Compounds

- A. Primer: Weld-on P-70
- B. Cement: Weld-on product appropriate for particular application, 705 for Class 200 and Schedule 40 PVC, 711 for Schedule 80 PVC, 795 for flexible PVC to rigid PVC.

2.6 Sprinkler Heads

- A. As specified on drawings or to match existing manufacturer with spray pattern as recommended by Contractor.
 - 1. Turf: Hunter Rotors
 - 2. Shrub and Lawn: Rainbird 1800 series

2.7 Additional Material

- A. Pipe Detection Tape: 3" wide, detectable, "caution" tape indicating pressurized, non-potable water line below.
- B. Sleeving: PVC Schedule 40 pipe 6 inch minimum diameter unless noted otherwise
- C. Tree deep watering pipes: 3" diameter perforated pipe with grade cap minimum 24" long, as shown on drawings
- D. Teflon tape shall be used on all pressurized, threaded PVC connections and all threaded PVC to metal connections.

PART 3 EXECUTION**3.1 EXAMINATION**

- A. Test and Verify that water pressure levels prior to providing shop drawing and design.
- B. Pipe lines running parallel may be placed in a common trench, provided that a minimum horizontal distance of four inches (4") is maintained between buried lines.

3.2 PREPARATION

- A. Protect all work throughout construction. Protect plastic pipes and fittings from direct sunlight, and avoid undue bending and any concentrated external loading. Beds on which pipe is stored shall be full length of pipe.
- B. Damage to any and all existing utilities shall be the contractor's responsibility to repair. All repairs shall be approved by the Architect.

- C. Contractor shall take necessary precautions to protect all existing planting to remain. Should any damage occur, contractor shall repair damage to its original condition or furnish and install equal replacements. THIS INCLUDES MAINTAINING ADEQUATE IRRIGATION TO ALL EXISTING PLANTS AND LAWN AREAS, OR WATERING BY HAND UNTIL SUCH IRRIGATION CAN BE RE-CONNECTED.
- D. When the existing irrigation system is damaged by the contractor, the contractor shall provide immediate repair to the system, and shall remove all sprinkler heads so that the lines may be cleaned of all dirt and foreign matter.
- E. Lay-out: Coordinate lay-out of system with Architect. Flag all head locations for approval.

3.3 TRENCHES

- A. Conform to Section 02200.
- B. Excavate trenches with vertical sides and uniform bottom, free of deleterious materials, and wide enough for pipes to lay side by side, fully supported bottom.
 - 1. No pipes shall be installed parallel to and directly over another line.
 - 2. When lines must cross, the angle shall be forty-five to ninety degrees (45-90), and a minimum of 3" vertical clearance shall be maintained.
- C. Depth to provide minimum coverage as follows:
 - 1. Mainline: 24" in landscape areas, 36" under pavement unless noted otherwise.
 - 2. Lateral Lines: 18" in landscape areas. 36" under pavement unless noted otherwise.
 - 3. Control Wiring: 18" in landscape areas. 36" under pavement unless noted otherwise.

3.4 PIPE INSTALLATION

- A. Comply with Standard Provisions and manufacturer's instructions
- B. Solvent Welded Joints:
 - 1. Assemble above ground where possible
 - 2. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fitting of dirt, dust, and moisture.
 - 3. Dry-insert pipe into fitting. Pipe should enter fitting 1/3 to 2/3 depth of socket.
 - 4. Coat the inside socket surface of the fitting and the external surface of the make end of the pipe with primer. Then without delay, apply cement liberally to the make end of the pipe and also apply cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
 - 5. Insert pipe immediately into fitting and turn ¼ turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Pipe and fitting shall be aligned without strain to either.
 - 6. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
 - 7. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.
- C. Threaded Joints:
 - 1. Field threading of plastic pipe or fittings is not permitted. Factory-formed threads only will be permitted.
 - 2. Factory-made nipples shall be used wherever possible. Field-cut threads in metallic pipe will be permitted only where approved by the Architect. When field threading, cut threads accurately on axis with sharp dies.
 - 3. All threaded joints shall be made up with pipe joint compound. Apply compound to male threads only.

4. Where assembling metallic pipe to metallic pipe fitting or valve, take up joint no more than one full turn beyond hand tight.
5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.
6. Where assembling soft metal (brass or copper) or plastic pipe, use strap type friction wrench only; do not use metal jawed wrench.
- D. Snake pipe a minimum of one (1) additional foot per one hundred (100) feet of pipe to allow for expansion and contraction.
- E. Pipe shall be fully and evenly supported by bedding material
- F. Cap or plug openings as soon as lines have been installed to prevent intrusion of debris.
- G. Sleeves:
 1. Install pipe sleeves at all points where pipes pass through concrete or masonry, and also where indicated on drawings. In footings, allow one inch (1") clearance around pipe, and in other locations allow one-half (1/2") inch.
 2. Each end of sleeve shall extend 6" beyond end of paving or structure above. Provide removable non-decaying plug at each end of sleeve, to prevent earth from entering pipe.
- H. Install approved thrust blocks as shown on details
- I. Prior to backfilling trenching, irrigation mainline piping shall be installed with "Caution" detectable tape.
- J. Thoroughly flush system prior to installing valves and heads.

3.5 EQUIPMENT AND INSTALLATION

- A. Automatic Valves
 1. Install where shown on approved Drawings and group together where practical.
 2. Locate valve boxes 12" from and perpendicular to walk edges, buildings, and walls. Provide 12" between valve boxes where valves are grouped together.
 3. Locate all valve boxes near turf fields outside of playing areas, preferably in adjacent shrub/groundcover zones.
 4. Label control line wire at each valve with a 2-1/4" x 2-3/4" polyurethane I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.
- B. Controller:
 1. Install as shown on plans
 2. Verify final location with Architect.
 3. Label cabinet door interior with permanent, one (1) inch tall (minimum), letter designations corresponding to plan designation.
- C. Control Wire:
 1. Connect control wires to controller in sequential arrangement according to identification number in the approved shop drawings. Label each controller station with permanent non-fading labels indicating identification number of valve controlled.
 2. Install as shown in approved detail alongside mainline. When not possible, house wiring in PVC class 200 conduit in landscape areas.
 3. Bundle multiple wires with tape or ties at twenty (20) foot intervals maximum.
 4. Make splices in valve boxes using only specified connectors. Splices shall only be allowed in runs exceeding 2,500 l.f. in length. Indicate splice locations on as-built drawings.
 5. Provide thirty (30) inch wire coil at each valve and at pipe directional changes.
 6. Control wiring under concrete, asphalt, or other masonry shall be installed in schedule 40 PVC sleeve – six (6) inches in size unless noted otherwise.

3.6 FIELD QUALITY CONTROL

A. General

1. Notify Architect for the following reviews, with 72 hours minimum notice:
 - a. Pressure supply line installation and testing
 - b. System Layout
 - c. Automatic controller installation
 - d. Control wiring installation
 - e. Lateral line and sprinkler head installation
 - f. Coverage test prior to landscape planting
2. Provide 7 day notice for Final Review
3. Provide all equipment and personnel required to conduct tests.
4. Provide up-to-date Project Record Drawings at each review.
5. No reviews without preparing the system for inspections shall be made.

B. Pressure Tests:

1. Do not install remote control valves, quick couplers, or any other valve assembly until testing of pressure main lines is completed and approved by the Architect.
2. Center load pipe between fittings prior to test.
3. Do not backfill trenches more than necessary until system has been reviewed, tested, and approved by the Architect.
4. Test pressure supply lines under hydrostatic pressure of 125 psi, or line pressure, whichever is greater, for a period of twenty-four (24) consecutive hours and provide verification that the pressure has held.
5. Lateral line shall be tested under full line pressure for a period of (1) one hour prior to backfilling. Cap all heads and center load pipe between fittings prior to testing.
6. Correct all deficiencies revealed by tests.

C. System Flushing

1. After sprinkler pipelines and risers are in place and connected, and prior to installation of automatic valves, quick couplers, and sprinkler heads, thoroughly flush all lines with a full head of water.
2. Install sprinkler heads after lines have been flushed to the satisfaction of the Architect.

D. Coverage Tests

1. Perform coverage tests after all systems are completed and operational, after finish grading has been completed, but prior to any planting, in the presence of the Architect.
2. Coverage and Efficiency: The Contractor shall be responsible for complete coverage and 65% (overlap) distribution efficiency in all areas.

3.6 Automatic Controller

- A. Install in location shown on approved drawings. The exact location will be determined on site with Architect. Provide conduit and wire and connect to 120 volt switch accessible to controller for ease of maintenance.
- B. Connect control lines to controller in sequential arrangement according to assigned identification number of valve.
- C. Coordinate location of phone line adjacent to controller with Owner.

3.7 Backfilling

- A. Do not backfill trenches until all required tests are performed and passed. Carefully backfill trenches with approved excavation materials for backfilling, consisting of earth, loam, sandy clay, sand, or other acceptable materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscape areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

- B. Surround mainline pipe with sand with a 2" bed and 6" cover.
- 3.8. Guarantee
- A. Fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following completion and acceptance of the work.
 - B. Guarantee all materials, equipment and workmanship to be free of all defects of workmanship and materials. Agree to replace at Contractor's expense, at any time within one year after installation is accepted, any and all defective parts.
- 3.8 Clean-Up
- A. Clean-up shall be made weekly at a minimum. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.
 - B. When work of this section has been completed and such other times as may be directed, remove all trash, debris, surplus materials and equipment from site. At no time shall debris, surplus materials and equipment be placed on adjacent property unless said location is approved by the Architect and with written permission from the property owner.

END OF SECTION

SECTION 33 11 16

WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Civil Drawings including but not limited to C1.1 - C4.3
- B. General provisions of Contract Agreement form, including appendices and exhibits.
- C. 2019 California Plumbing code / CA code of registration, (Title 24, Part 5)
- D. California Health and Safety Code, (Title 22, Division 4, Chapter 3)
- E. California Water Code, (Title 17, Division 1, Chapter 5)
- F. Section 31 10 00 Site Clearing and Demolition – Existing water main demolition.
- G. Section 32 13 14 Civil Site Concrete – Mix Design

1.2 SUMMARY

- A. This section includes the following:
 - 1. Water systems piping for potable water service.
 - 2. Water system piping for fire suppression service.
 - 3. Water system products that will be furnished to the site and ready for installation.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for both water systems piping.
 - 1. Underground Potable and Fire Suppression Piping: 200 psig
 - 2. Underground Irrigation Piping: 200 psig

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:
 - 1. Valves.
 - 2. Identification materials and devices.
 - 3. Back Flow Preventer – Potable
 - 4. Back Flow Preventer - Irrigation
 - 5. Plastic piping, potable system.

6. Plastic piping, fire suppression system
 7. Plastic piping, irrigation system
 8. Copper Piping, potable service lateral.
 9. Saddle tap for potable service lateral
- C. Shop drawings for precast concrete valve boxes. Include frames and covers.
- D. Record drawings at Project closeout of installed water system piping and products.
- E. Maintenance data for:
1. Valves.
 2. Back Flow Preventers

1.5 QUALITY ASSURANCE

- A. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
1. Listing and labeling Agency Qualifications: "A Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
 2. NSF61 or AWWA.
 3. Comply with the Redwood City Fire Department regulations and requirements for fire protection systems. Including, but not limited to, materials, hose threads, installation and testing.
 4. Comply with NFPA 24 "Standards for in the Installation of Private Fire Services Mains and Their Appurtenances: for materials, installation, test and flushing.
- B. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equivalent performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as determined by District's representatives. The burden of proof of products or request to substitute product is on Contractor. Should the Contractor proceed with the allowed substitute product prior to receiving written approval of the substitute, Contractor shall do so at own risk and expense.
- C. Safety Standards: All excavation should be constructed in accordance with OSHA and CAL-OSHA Safety Standards. Safety in and around utility trench is the responsibility of the underground contractors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves for shipping as follows:
1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends, flange faces, mechanical joints, Victaulic grooves, and weld ends.
 3. Set valves in upright position for handling. Set valves closed to prevent rattling.
- B. Storage: Use the following precautions for valves, during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Deliver piping with factory-applied bracing, dust barriers, end-caps, or other protective devices or packaging. Maintain protective devices and packaging through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- E. Protect flanges, fittings, and piping specialties from moisture and dirt.
- F. Store plastic pipes (PVC) protected from direct sunlight. Support at midpoint and ends to prevent sagging and bending.

1.7 PROJECT CONDITIONS

- A. Verify that water system piping has been installed in compliance with original design and no underground conflicts exist that were not shown on the plans.
- B. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the District or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
1. Notify District's representatives not less than two working days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without receiving written permission from the District's representative.
- C. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings). District assumes no responsibility for interpretations or conclusions drawn from this information.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate pipe materials, sizes, entry locations, and pressure requirements of building water distribution systems piping.
- B. Before laterals are energized, pipeline shall be tested, cleaned and disinfected per part 3.09 Field Quality Control, in this Section.
- C. Coordinate with other utility work (storm, sanitary, gas, electric, telephone, cable and communication).

- D. Demolition of existing water system asbestos concrete piping shall be done in accordance with Section 31 10 00 - Site Clearing and Demolition, Section 3.03 – Disposal of Waste Materials – Part G.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Valves (Resilient Wedge):
 - a. American Flow Control
 - b. Clow Valve Co. Div., McWane, Inc
 - c. M & H Valve Co.
 - d. Mueller Co., Grinnell Corp
 - e. Kennedy
 - f. Waterous Co.
 - 2. Valve Boxes
 - a. Christy
 - b. Hanson
 - 3. Precast Concrete Box Structures
 - a. Christy Concrete Products
 - b. Hanson Concrete Products Company
 - c. Utility Vault Company.

2.2 PIPING

- A. Refer to Part 3 Article “Piping Applications” for identification of systems where pipe and tube materials specified below are used.
- B. Refer to Irrigation, Section 32 84 00, for irrigation piping.
- C. Copper Tubing: ASTM B88, Type K and AWWA C800.
- D. Polyethylene Tubing: AWWA C901 for pressure class 200 and dimension ratio 9.
- E. Polyvinyl Chloride (PVC) Irrigation Service Pipe: ASTM D1784 and D1785, and AWWA C800.
 - 1. Main Line 2-inches or smaller: Schedule 40 PVC with Solvent Weld Fittings:
 - 2. 2 ½ to 3-inch: Class 315 PVC
 - 3. 4-inch or larger: AWWA C900
- F. Polyvinyl Chloride (PVC) Transmission and Distribution Pipe: AWWA C900; Pressure Class 200; with bell end and elastometric gasket, with plain end for cast-iron or ductile-iron fittings.
 - 1. Pipe Markings: NSF 14, NSF 61, “NSF-PVC CTO only.”
 - 2. Gasket: ASTM F477, elastometric seal

2.3 PIPE FITTINGS

- A. Refer to Part 3.02 Article “Piping Applications” for identification of systems where pipe fitting materials specified below are used.
- B. Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110 or C153, ductile-iron or cast-iron, 250-psig (1725-kPa) minimum pressure rating;
 - 1. Lining: AWWA C104, cement mortar.
 - 2. Gaskets: AWWA C111, rubber.
- C. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110 or C153, 250-psig (1725-kPa) minimum pressure rating, with AWWA C104 cement-mortar lining.
- D. Fittings for Polyethylene Tubing: Ford C44 series, pack joint fittings with stainless steel insert.
- E. Copper Tubing Fittings: ASTM A865.
- F. Polyvinyl Chloride (PVC) Service Pipe Fittings: ASTM D2464, ASTM D2466, ASTM D2467, and ASTM F437. This are limited to connections to existing PVC piping.

2.4 JOINING MATERIALS

- A. Refer to paragraph 3.02, “Piping Applications” for identification of systems where joining materials specified below are used.
- B. PVC piping:
 - 1. Primer for PVC Piping Solvent-Cement Joints: ASTM F656
 - 2. Solvent Cement for PVC Solvent – Cement Joints: ASTM D2564
- C. PVC C900 Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
 - 1. Push-on Joints: AWWA C111 rubber restraining gaskets (Tyton with Field-Lok®) and lubricant.
 - 2. Mechanical Joints: Each mechanical joint shall be supplied with a vulcanized butadiene rubber (SBR) gasket in accordance with the provisions of AWWA C111. The retainer or follower gland shall be replaced with a thrust restraining follower gland.
 - a. The mechanical restraining follower gland shall be Megalug® Series 1100, Series 1100SD, Series 1100PV, or Series 2000PV as manufactured by EBAA IRON SALES, INC., or approved substitute. Each fitting shall be restrained in accordance with the recommendation of publication “Thrust Restraint Design for Ductile Iron Pipe” by the Ductile Iron Pipe Association (latest edition).
 - b. Bolt material shall be high-strength, low-alloy steel.
 - 3. Flanged Joints: Each flanged joint shall be supplied with a ring type, 1/8-inch-thick composite or neoprene rubber gasket conforming with the provisions of AWWA C110.

- a. Flange bolts and nuts shall be hex head in conformance with ASTM A307 and A563 in accordance with provision of AWWA C110.
- b. Bolts and nuts shall be fabricated of low carbon steel conforming to ASTM A307 galvanized after fabrication or stainless steel conforming with ASTM F593 and F594.

2.5 VALVES

- A. Non-rising Stem Gate Valves 4 Inches (DN 80) and Larger: AWWA C500, cast-iron, bronze mounted, resilient seat type with non-rising stem conforming to AWWA C509 and these provisions. Except as provided for in the Contract Documents, the Contractor shall only use the product of one manufacturer.
- B. Air Release Valves: Cla-Val Company Model 34AR-116.3 or approved substitute.
- C. Ball Valves: Worcester Series 44, Milwaukee Valve 20SSOR, BA-360, 22SSOR or approved substitute.
- D. Valve Boxes: Precast concrete with cast-iron lid having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel a minimum of 6 inches (150 mm) in diameter, and adjustable extension of length required for depth of bury of valve.
 - 1. Provide one steel tee-handle operating wrench for every 25 valve boxes supplied with a minimum of one and a maximum of five. The wrenches shall have tee handles with one pointed end, and socket-fitting valve-operating nut. The length of the wrench stems shall be sufficiently varied to allow at least one wrench to function on any valve supplied.
 - 2. Cast iron lids shall be vandal resistant with hold-down screws (Christy G5).

2.6 BEDDING AND BACKFILL

- A. Sand bedding: Bedding material shall be clean, washed, granular material derived from decomposed or crushed rock. Such material shall be free of organic material, mica, clay, silts, oils and other deleterious materials. Sand bedding shall have a maximum particle size of 1/4 - inch with gradation that allows 90 to 100 percent passing a No. 4 sieve and not more than 10 percent to pass a No. 200 sieve.
- B. Backfill:
 - 1. Pipe Zone Backfill: Backfill with sand conforming to the requirements of 2.7 A., referenced above. Backfill shall be placed to a minimum of 12 inches above the top of pipe and compacted to 95 % Relative Compaction. Compaction shall be monitored by District's Geotechnical Engineer.
 - 2. Backfill above Pipe Zone: Sand conforming to the specification above shall be used as backfill. Native material may be used as trench backfill if approved by the District's Geotechnical Engineer.
 - 3. Sand/Cement Slurry Backfill: Sand/cement slurry backfill shall consist of fluid, workable mixture of aggregate, cement, and water. Aggregate for sand/cement slurry shall be clean, washed fine aggregate conforming to section 2.6 A "Sand

Bedding” of these specifications. Alternatively, fine aggregate may be clean mortar sand conforming with provisions of ASTM C404.

- a. Cement shall be Type IP.
- b. Water shall be potable

2.7 ANCHORAGE

- A. Bolts: ASTM A307, steel.
- B. Cast-Iron Washers: ASTM A126, gray iron.
- C. Concrete Reaction Backing (Thrust Resistance): shall be used only on connections to existing pipelines or fire hydrants. All new construction thrust restraint shall be by mechanical thrust restraint fittings (MegaLug® Series, Mega Flange® or EBAA Iron Bell Restraints or approved substitute). When using Concrete Thrust Blocks the following shall be met:
 - 1. Portland Cement Concrete mix shall be Class “B”, 3,000 psi (Six Sack Minimum).
 - 2. Cement: See Section 02675 Concrete , Part 2.02, 3E , Part 2.2 “Concrete Mixes”
 - 3. Water: Potable

2.8 IDENTIFICATION

- A. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches (150 mm) wide by 4 mils (0.1 mm) thick, solid blue in color with continuously printed caption in black letters **“CAUTION - WATER LINE BURIED BELOW.”**

2.9 SEPARATION FROM SANITARY SEWER LINES

- A. Domestic water system pipelines and component shall be separated from sanitary sewer lines as required by the California Department of Health Services.
- B. Domestic water system pipelines and component shall be separated from recycled water lines as required by the California Department of Health Services

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 23 00 "Excavation and Fill."

3.02 PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, fittings, and joining methods according to the following applications.
- B. Trenching shall be in accordance with Part 2 of this Section.
- C. Comply with requirements of California Plumbing Code for materials and installation and reconnection of domestic water services after the meter.
- D. Unless specifically indicated otherwise on the plans, maintain a minimum cover of 36 inches (1000 mm) below finished grade for all water systems.

3.03 ANCHORAGE INSTALLATION AND THRUST RESTRAINTS

- A. Anchorages for New 3" and smaller Pipe: Install anchorages for all tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. PVC Piping: According to AWWA C600.
- B. Anchorage System for New 4" and larger pipeline: installations shall be thrust restrained by use of MegaLug® joint restraints. As a minimum, the Contractor shall install 40 linear feet of restrained pipe on each side of a restrained fitting or joint.
- C. Anchorage System for Existing 4" and larger pipeline: Installation of Concrete Thrust Blocks per Section 2.8 Anchorage.
 - 1. Concrete shall be in accordance with Section 02675, Portland Cement Concrete and Section 2.8 Anchorage
 - 2. Contractor shall surround thrust block in undisturbed native soil left in place.
 - 3. Restraining Rods and Ties-rods shall be coated with bitumastic type coating (Protecto Wrap 160/160H or approved substitute) prior to placement in excavation.

3.04 VALVE INSTALLATION

- A. General Application: Use mechanical-joint-end or flanged valves as indicated on the plans for 3 inch (80-mm) and larger buried installation.
- B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem plumbed vertically and with Christy G5 valve box. Valve Extension Stem: Valve stems located deeper than 48-inches shall be equipped with a valve extension stem assembly.

3.05 IDENTIFICATION INSTALLATION

- A. Contractor shall install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

- B. Locating wire associated with pipe labeling tapes shall be brought to the surface at each valve box with at least 2-feet of wire more than required to reach the surface. In bringing wire to the surface, the wire shall be routed outside the barrel of the valve box, and then led into the barrel at the top of the barrel and below the surface structure. The wire shall be protected during the backfilling operations to prevent displacement or continuity breaks. Any damage to the locator wire shall be immediately repaired.

3.06 FIELD QUALITY CONTROL

- A. Piping Tests: Contractor shall conduct piping tests in a manor that joints are exposed and can be inspected for leaks. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water. All work in hydrostatic testing shall conform to the requirements of AWWA C600 and these specifications.
- B. Hydrostatic Tests: Test pressure shall be a minimum 150-psi or 150 percent of the service pressure for the pipeline, whichever is greater, at the highest point in the distribution system to be tested. Test pressure shall be held for a minimum 2 hours.
1. Contractor shall supply all pumps (test pump capable of supplying 300-psi static pressure), fittings, gauges and meters to monitor pressure, labor, equipment, and materials and all assistance necessary, including but not limited to, temporary thrust restraints and connection to the water supply source for the hydrostatic testing of all pipelines and a means of replacing water during testing.
 2. Hydrostatic testing shall be performed in the presence of the District's representatives. Notify one working day prior to testing.
 3. Increase pressure in 50 psig (350 kPa) increments and inspect each joint between increments. Hold at test pressure for 2 hours; during the hydrostatic test the pressure shall not be allowed to vary more than 5-psi above or below the required test pressure. Test shall not be allowed against closed line valves without the prior written approval of the District's representative. Maximum allowable leakage is shown in following table:

Allowable Leakage per 1,000 lf of Pipeline (gph)							
Avg Test Pressure	Nominal Pipe Diameter (in.)						
	4	6	8	10	12	14	16
150-psi	0.37	0.55	0.74	0.92	1.10	1.29	1.47
175-psi	0.40	0.59	0.80	0.99	1.19	1.39	1.59
200-psi	0.43	0.64	0.85	1.06	1.28	1.48	1.70
225-psi	0.45	0.68	0.90	1.13	1.35	1.58	1.80
250-psi	0.47	0.71	0.95	1.19	1.42	1.66	1.90
275-psi	0.50	0.75	1.00	1.24	1.49	1.74	1.99
300-psi	0.52	0.78	1.04	1.30	1.56	1.82	2.08

4. Allowable Leakage Formula: $L_a = (LDP^{1/2})/133,200$
 Where: L_a = Allowable leakage
 L = Length of the pipe run
 D = Nominal diameter of pipe in inches
 $P^{1/2}$ = Square root of test pressure

5. All visible leaks shall be promptly repaired regardless of the actual leakage measured.
6. This test procedure shall be followed until an acceptable test is achieved.

3.07 CLEANING AND DISINFECTION

- A. Clean and disinfect water distribution piping as follows:
 1. Contractor shall perform disinfection. The Contractor shall provide access to the pipe to be tested, including service tap for chlorination. All disinfection shall be in accordance with AWWA C651 "Disinfecting Water Mains."
 2. Except as required by District's representatives, chlorination shall be accomplished after preliminary flushing at a minimum velocity of 2.5 ft/s in accordance with the provisions of AWWA C651, "Continuous Feed Method." Chlorinated water shall be brought to a minimum concentration of 25 mg/l as determined by testing a sample of water immediately after injecting chlorine. After 24 hours, a sample shall be tested for chlorine residual. Residual shall not be less than 10 mg/l.
 - a. Comply with NFPA 24 and C651 for flushing of piping.
 - b. Contractor shall assist the District's representatives in the flushing operation, including but not limited to, providing water trucks, hoses valves, neutralizing chemical, and directing the discharge to a safe disposable point.
 - c. Contractor shall allow a period of two working days from the time the sample is taken until the results are available.
 - 1) Upon completion of satisfactory test for chlorine residual, the main shall be flushed at a velocity of not less than 2.5 ft/s for a minimum period of 15 minutes until the chlorine residual drops to 0.05-mg/l. At this time, a sample shall be taken in accordance with AWWA C651, "Bacteriological Tests." Test results shall be in accordance with California State Department of Health Services.
 3. Contractor shall hire laboratory to perform the analysis. Such laboratory shall have the prior approval of the California Department of Health Services.

END OF SECTION

SECTION 33 11 19

FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Civil Drawings
- B. General provisions of Contract Agreement form, including appendices and exhibits.
- C. National Fire Protection Association, including but not limited to , NFPA 24 “ Standard for Installation of Private Fire Service Mains and Their Appurtenances” and NFPA 13.
- D. ASCE – Manuals and Reports for Engineering Practices No. 108 – *Pipeline Design for installation by Horizontal Direction Drilling*.

1.02 SUMMARY

- A. This section includes the following:
 - 1. Fire protection service outside the building.
 - 2. Water system products that will be furnished to the site and ready for installation.
 - 3. Fire suppression system will be installed by horizontal direction drilling methods.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping
- B.
 - 1. Underground Fire Suppression Piping, Downstream of Fire Department Connections: 200 psig (1380 kPa).

1.04 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:
 - 1. Fire Department Connection
 - 2. Post Indicator.
 - 3. Valves.
 - 4. Identification materials and devices.
 - 5. Plastic piping, fire suppression system.
- C. Shop drawings for precast concrete valve boxes. Include frames and covers.
- D. Record drawings at Project closeout of installed water system piping and products.
- E. Maintenance data for:
 - 1. Valves.

1.05 QUALITY ASSURANCE

- A. Comply with requirements San Jose Water Company which is the utility supplying water, and City of San Jose Fire Department.
- B. Comply with standards of City of San Jose Fire Department having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing.
- C. Safety Standards: All excavation shall be constructed in accordance with OSHA and CAL-OSHA Safety Standards and Industrial Safety Orders. Safety in and around utility trench is the responsibility of the underground contractors.
- D. Comply with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, and flushing.
- E. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
 - 1. Listing and labeling Agency Qualifications: "A Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
 - 2. NSF61 or AWWA.
- F. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equivalent performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as determined by Owner's representatives. The burden of proof of products or request to substitute product is on Contractor. Should the Contractor proceed with allowed substituted product prior to receiving written approval of the substitution, Contractor shall do so on his own risk and expense.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves and backflow preventer for shipping as follows:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends, flange faces, mechanical joints, Victaulic grooves, and weld ends.
 - 3. Set valves in upright position for handling. Set valves closed to prevent rattling.
- B. Storage: Use the following precautions for valves and backflow preventers, during storage:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use slings to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied bracing, dust barriers, end-caps, or other protective devices or packaging. Maintain protective devices and packaging through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

- F. Protect flanges, fittings, and piping specialties from moisture and dirt.
- G. Store plastic pipes (PVC) protected from direct sunlight. Support at midpoint and ends to prevent sagging and bending.

1.07 PROJECT CONDITIONS

- A. Notify Underground Service Alert (USA) at (800) 227-2600 for location and verification of existing utility locations.
- B. Verify that water system piping has been installed in compliance with original design and no underground conflicts exist that were not shown on the plans.
- C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
 - 1. Notify Owner's representatives and San Jose Water Company Utility Systems Manager not less than two working days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without receiving written permission from the Owner's representative.
- D. Site Information: See Section Site Clearing, Part 1.03 Project Conditions, for description of existing topographic and utility information.

1.08 SEQUENCING AND SCHEDULING

- A. Coordinate shut down and/or Hot Tap connection of water main with the District and San Jose Water Company Utilities System Manager (if needed).
- B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building water distribution systems piping.
- C. Coordinate horizontal boring pit and receiving pit with District representative.
- D. Coordinate with other utility work (storm, sanitary, gas, electric, telephone, cable and communication).
- E. Before Contractor energizes laterals and fire hydrants, pipelines shall be tested, cleaned and disinfected per part 3.09 Field Quality Control, in this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Gate Valves (Resilient Wedge & Weight and Lever):
 - a. American Flow Control
 - b. Clow Valve Co. Div., McWane, Inc
 - c. M & H Valve Co.
 - d. Mueller Co., Grinnell Corp
 - e. Kennedy
 - f. Waterous Co.
 - 2. Backflow Preventers:
 - a. Cla-Val Co. Div., Griswold Industries.
 - b. Febco
 - c. Watts

- d. Wilkins-Zurn
- 3. Grooved Couplings for AWWA Ductile-iron Piping:
 - a. Gustin-Bacon Div., Tyler Pipe Subsidiary., Tyler Corp.
 - b. Victaulic Co. of America.
- 4. Precast Concrete Structures:
 - a. Christy Concrete Products
 - b. Santa Rosa Cast Products Company
 - c. Hanson Concrete Products Company
 - d. Utility Vault Company

2.02 PIPING

- A. Refer to Part 3 Article "Piping Applications" for identification of systems where pipe and tube materials specified below are used.
- B. Ductile-Iron Pipe: AWWA C151, Class 50 (150 psi).
 - 1. Lining: AWWA C104, cement mortar, bituminous, seal coated.
 - 2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
 - 3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.
- C. Polyvinyl Chloride (PVC) Transmission and Distribution Pipe: AWWA C900; Pressure Class 200; with bell end and elastomeric gasket, with plain end for cast-iron or ductile-iron fittings.
- D. Polyvinyl Chloride (PVC) – CERTA-LOK DR-14; AWWA C900: pressure class 200, with restrained joint coupling (nylon splines) for directional drilling purposes.
- E. High Density Polyethylene Pipe (HDPE) DR-14; AWWA C900: pressure class 200, with electrofusion joints for direction drilling purposes.
- F. Copper Tubing: ASTM B88, Type K and AWWA C800.

2.03 PIPE FITTINGS

- A. Refer to Part 3.3 Article "Piping Applications" for identification of systems where pipe fitting materials specified below are used.
- B. Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110 or C153, ductile-iron or cast-iron, 250-psig (1725-kPa) minimum pressure rating;
 - 1. Lining: AWWA C104, cement mortar.
 - 2. Gaskets: AWWA C111, rubber.
- C. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110 or C153, 250-psig (1725-kPa) minimum pressure rating, with AWWA C104 cement-mortar lining.
- D. Copper Tubing Fittings: AWWA C800, Section 5.

2.04 JOINING MATERIALS

- A. Refer to paragraph 3.2, "Piping Applications" for identification of systems where joining materials specified below are used.
- B. PVC Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
 - 1. Push-On Joints: AWWA C111 rubber restraining gaskets (Tyton with Field-Lok®) and lubricant.

2. Mechanical Joints: Each mechanical joint shall be supplied with a vulcanized butadiene rubber (SBR) gasket in accordance with the provisions of AWWA C111. The retainer or follower gland shall be replaced with a thrust restraining follower gland.
 - a. The mechanical restraining follower gland shall be Megalug® Series 1100, Series 1100SD, Series 1100PV, or Series 2000PV as manufactured by EBAA IRON SALES, INC., or approved substitute. Each fitting shall be restrained in accordance with the recommendation of publication "Thrust Restraint Design for Ductile Iron Pipe" by the Ductile Iron Pipe Association (latest edition).
 - b. Bolt material shall be high-strength, low-alloy steel.
3. Flanged Joints: Each flanged joint shall be supplied with a ring type, 1/8-inch-thick composite or neoprene rubber gasket conforming with the provisions of AWWA C110.
 - a. Flange bolts and nuts shall be hex head in conformance with ASTM A307 and A563 in accordance with provision of AWWA C110.
 - b. Bolts and nuts shall be fabricated of low carbon steel conforming to ASTM A307 galvanized after fabrication or stainless steel conforming with ASTM F593 and F594.

2.05 VALVES

- A. Non-rising Stem Gate Valves 2 Inches (DN 80) and Larger: AWWA C500, cast-iron, bronze mounted, resilient seat type with non-rising stem conforming to AWWA C509 and these provisions. Except as provided for in the Contract Documents, the Contractor shall only use the product of one manufacturer, with the exception of backflow preventers, which shall be OS&Y gate valves and may be from a different manufacturer.
- B. Control Valves: The basic valve shall be hydraulically operated and diaphragm actuated. The body and cover shall be fabricated of material in accordance with the following table:

TABLE 3-09 MECHANICAL SCHEDULE - CONTROL VALVES		
Description	Material	Material Standard
Body and cover	Ductile iron	ASTM A536
Cover gasket	Buna N rubber	ASTM D2000
Bolts	Steel	ANSI B18.2(plated)
Stem	Stainless steel	Type 3-03
Diaphragm	Nylon bonded w/synthetic rubber	ASTM D2000
Seat ring	Rubber	ASTM D2000
Nozzle plugs	Malleable iron	ASTM A865
Retaining screw	Stainless steel	Type 3-04

1. Check Valves: Cla-Val Company Model 81-02 or 681-02.
 2. Pressure Relief Valves: Cla-Val Company Model 50-01 or 650-01.
 3. Surge Anticipator Valves: Cla-Val Company Model 52-03 or 652-03.
- C. Ball Valves: Worcester Series 44, Milwaukee Valve 20SSOR, BA-360, 22SSOR or approved substitute.
 - D. Valve Boxes: Precast concrete with cast-iron lid having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel a minimum of 6 inches (150 mm) in diameter, and adjustable extension of length required for depth of bury of valve.
 1. Provide one steel tee-handle operating wrench for every 25 valve boxes supplied with a minimum of one and a maximum of five. The wrenches shall have tee handles with one

pointed end, and socket-fitting valve-operating nut. The length of the wrench stems shall be sufficiently varied to allow at least one wrench to function on any valve supplied.

2. Cast iron lids shall be vandal resistant with hold-down screws (Christy G5).

2.06 ANCHORAGES

- A. Clamps, Straps, and Washers: ASTM A506, steel.
- B. Rods: ASTM A575, steel.
- C. Rod Couplings: ASTM A197, malleable iron.
- D. Bolts: ASTM A307, steel.
- E. Cast-Iron Washers: ASTM A126, gray iron.
- F. Concrete Reaction Backing (Thrust Resistance): Shall be used only on connections to existing pipelines. All new construction thrust restraint shall be by mechanical thrust restraint fittings (MegaLug® Series 1100 et al, MegaFlange® Series 2100, or approved substitute). Portland cement concrete mix, 3000 psi (20.7 MPa).
 1. Concrete: See Section 32 1314, Concrete, Part 2.02, "Concrete Design," Part B "Class B Concrete Thrust Blocks."
 2. Water: Potable.

2.7 IDENTIFICATION

- A. Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches (150 mm) wide by 4 mils (0.1 mm) thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

2.8 SEPARATION FROM SANITARY SEWER LINES

- A. All water system pipelines and component shall be separated from sanitary sewer lines as shown in Details sheet C.5.1, and as required by the California Department of Health Services.

2.9 TRENCHING

- A. See Section 31 23 00 Excavation for Pipeline and Utility Trenches for instructions.

PART 3 - EXECUTION

3.01 EXCAVATION FOR FIRE SUPPRESSION MAIN

- A. Excavation, trenching, and backfilling are specified in Section 31 23 00 Excavation & Fill.

3.02 PIPING APPLICATION

- A. Refer to Part 2 of this Section for detailed specifications for pipe and fittings products listed below. Use pipe, fittings, and joining methods according to the following applications.
- B. Use pipe, fittings, and joining methods according to following applications.
 1. 4 Inches to 12-inches: AWWA C900, Class 150 for potable mains, and Class 200 for fire suppression, polyvinyl chloride (PVC) plastic pipe, AWWA C110 or AWWA C153, ductile-iron or gray-iron fittings, and mechanical or push on joints.
- C. Trenching shall be in accordance with Part 2 of this Section.
- D. Comply with requirements of NFPA 24 for materials and installation.
- E. Install ductile-iron pipe and ductile-iron and cast-iron fittings according to AWWA C600.
- F. Unless specifically indicated otherwise on the plans, maintain a minimum cover of 36 inches (1000 mm) below finished grade for all water mains.

3.03 ANCHORAGE INSTALLATION AND THRUST RESTRAINTS

- A. Anchorages for Pipe: Install anchorages for all tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Ductile-Iron Piping: According to AWWA C600.
 - 2. Fire Service Piping: According to NFPA 24.
 - 3. PVC Piping: According to AWWA C900.
- B. Anchorage System: All pipeline installations shall be thrust restrained by use of MegaLug® joint restraints. As a minimum, the Contractor shall install 40 linear feet of restrained pipe on each side of a restrained fitting or joint. Tie-ins to existing pipelines shall be restrained by the use of Portland cement concrete thrust blocks in accordance with paragraph 3.3.D. Portland cement concrete thrust blocks may, at the Contractor's option, be used at the termination of pipelines intended for future extension (dead-end lines).
- C. Apply full coat of bitumastic protective wrap or approved substitute material to surfaces of installed ferrous anchorage devices.
- D. Portland Cement Concrete Thrust Blocks:
 - 1. Where thrust blocks are permitted or required for installation on existing facilities, they shall be in accordance with the details on the civil plans.
 - 2. All concrete thrust blocks shall be Class "B" concrete in accordance with Section 32 1314, Portland Cement Concrete.
 - 3. The Contractor shall hand excavate the soil surrounding the thrust block to undisturbed native soil left in place.
 - 4. Restraining rods and ties-rods shall be coated with bitumastic type coating (Protecto Wrap 160/160H, Tapecoat Brush-Applied Coating, or approved substitute) prior to placement in excavation. Coating shall extend a minimum 2-inches and a maximum 4-inches into the concrete.
 - 5. Heating shall not be used to bend restraining bars. Restraining rods shall be cold bent to a radius of not less than 6 times the bar diameter.

3.04 VALVE INSTALLATION

- A. General Application: Use mechanical-joint-end or flanged valves as indicated on the plans for 3 inch (80-mm) and larger buried installation. Use non-rising stem UL/FM gate valves for installation with indicator posts.
- B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem plumbed vertically and with Christy G5 valve box. All buried valves, bolts, and appurtenances shall be coated with bitumastic type coating (Protecto Wrap 160/160H, Tapecoat Brush-Applied Coating, or approved substitute) prior to placement in excavation.
- C. UL/FM-Type Gate Valves: Comply with NFPA 24.
 - 1. Install valves with stem plumbed vertically and with vertical cast-iron indicator post.

3.05 IDENTIFICATION INSTALLATION

- A. Contractor shall install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.
- B. Locating wire associated with pipe labeling tapes shall be brought to the surface at each valve box with at least 2-feet of wire more than required to reach the surface. In bringing

wire to the surface, the wire shall be routed outside the barrel of the valve box, then led into the barrel at the top of the barrel and below the surface structure. The wire shall be protected during the backfilling operations to prevent displacement or continuity breaks. Any damage to the locator wire shall be immediately repaired.

3.06 FIELD QUALITY CONTROL

- A. Piping Tests: Contractor shall conduct piping tests before joints are covered and after thrust blocks have cured for a minimum of 36 hours. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water. All work in hydrostatic testing shall conform to the requirements of AWWA C600 and these specifications.
- B. Hydrostatic Tests: Test pressure shall be a minimum 150-psi or 150 percent of the service pressure for the pipeline, whichever is greater, at the highest point in the distribution system to be tested. Test pressure shall be held for a minimum 2 hours.
 1. Contractor shall supply all pumps (test pump capable of supplying 300-psi static pressure), fittings, gauges and meters to monitor pressure, labor, equipment, and materials and all assistance necessary, including but not limited to, temporary thrust restraints and connection to the water supply source for the hydrostatic testing of all pipelines and a means of replacing water during testing.
 2. Hydrostatic testing shall be performed in the presence of the Owner's representatives. Notify one working day prior to testing.
 3. Increase pressure in 50 psig (350 kPa) increments and inspect each joint between increments. Hold at maximum test pressure for 2 hours; during the hydrostatic test the pressure shall not be allowed to vary more than 5-psi above or below the required test pressure. Test shall not be allowed against closed line valves without the prior written approval of the Owner's representative. Maximum allowable leakage is shown in following table:
 4. Allowable Leakage
 - a. Formula: $L_a = (LDP^{1/2})/133,200$

Where: L_a = Allowable leakage
 L = Length of the pipe run
 D = Nominal diameter of pipe in inches
 $P^{1/2}$ = Square root of test pressure
 5. All visible leaks shall be promptly repaired regardless of the actual leakage measured.
 6. This test procedure shall be followed until an acceptable test is achieved.

Allowable Leakage per 1,000 lf of Pipeline (gph)							
Avg Test Pressure	Nominal Pipe Diameter (in.)						
	4	6	8	10	12	14	16
150-psi	0.37	0.55	0.74	0.92	1.10	1.29	1.47
175-psi	0.40	0.59	0.80	0.99	1.19	1.39	1.59
200-psi	0.43	0.64	0.85	1.06	1.28	1.48	1.70
225-psi	0.45	0.68	0.90	1.13	1.35	1.58	1.80
250-psi	0.47	0.71	0.95	1.19	1.42	1.66	1.90
275-psi	0.50	0.75	1.00	1.24	1.49	1.74	1.99
300-psi	0.52	0.78	1.04	1.30	1.56	1.82	2.08

3.7 CLEANING AND DISINFECTION

A. Clean and disinfect water distribution piping as follows:

1. Contractor shall perform disinfection. The
2. Contractor shall provide access to the pipe to be tested, including service tap for chlorination. All disinfection shall be in accordance with AWWA C651 "Disinfecting Water Mains."
3. Except as required by Owner's representatives, chlorination shall be accomplished after preliminary flushing at a minimum velocity of 2.5 ft/s in accordance with the provisions of AWWA C651, "Continuous Feed Method." Chlorinated water shall be brought to a minimum concentration of 25 mg/l as determined by testing a sample of water immediately after injecting chlorine. After 24 hours, a sample shall be tested for chlorine residual. Residual shall not be less than 10 mg/l.
 - a. Comply with NFPA 24 and AWWA C651 for flushing of piping.
 - b. Contractor shall provide water trucks, hoses valves, neutralizing chemical, and directing the discharge to a safe disposable point.
 - c. Contractor shall allow a period of two working days from the time the sample is taken until the results are available.
 - 1) Upon completion of satisfactory test for chlorine residual, the main shall be flushed at a velocity of not less than 2.5 ft/s for a minimum period of 15 minutes until the chlorine residual drops to 0.05-mg/l. At this time, a sample shall be taken in accordance with AWWA C651, "Bacteriological Tests." Test results shall be in accordance with California State Department of Health Services.
 - 2) Contractor shall hire a laboratory to perform the analysis. Such laboratory shall have the prior approval of the California Department of Health Services.

END OF SECTION

SECTION 33 31 00

SANITARY SEWER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Civil Drawings including but not limited to C1.1 & C4.1
- B. Drawings, general provisions of Contract Agreement Form including Appendices and Exhibits, Division 1 Specification Sections, and California Building Code, Title 24, Part 2 and appropriate sections for educational facilities apply to this Section.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Sanitary sewerage.

1.3 DEFINITIONS

- A. Sewerage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of sanitary sewage.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Polymer-concrete, channel drainage systems.
 - 2. Plastic, channel drainage systems.
 - 3. Identification materials and devices.
 - 4. Steel casing pipe and welder certification in accordance with AWWA C206
- C. Shop drawings for precast concrete manholes and other structures. Include frames and covers.
- D. Shop drawings for cast-in-place concrete or field-erected masonry manholes and other structures. Include frames and covers.
- E. Reports and calculations for design mixes for each class of cast-in-place concrete.
- F. Coordination drawings showing manholes and other structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.

- G. Coordination profile drawings showing systems piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500 metric ratio) and vertical scale of not less than 1 inch equals 5 feet (1:50 metric ratio). Indicate underground structures and pipe. Show types, sizes, materials, and elevations of other utility crossing system piping. Include drawings for the following piping systems:
 - 1. Sanitary sewerage.

- H. Inspection and test reports specified in the "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.
- B. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.
- C. Safety Standards: All excavation should be constructed in accordance with OSHA and CAL-OSHA Safety Standards. Safety in and around utility trench is the responsibility of the underground contractors.
- D. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Product Substitutions."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures in direct sunlight.
- B. Do not store plastic pipe or fittings in direct sunlight.
- C. Protect pipe, pipe fittings, and seals from dirt and damage.
- D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.8 PROJECT CONDITIONS

- A. Notify Underground Service Alert (USA) at (800) 642-2444 for location and verification of existing utility locations.
- B. Locate existing structures and piping before starting construction. Verify that sanitary system piping may be installed in compliance with design and no underground conflicts exist that were not shown on the plans.
- C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
 - 1. Notify Construction Manager not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Construction Manager's written permission.
 3. Protect existing tennis courts and existing grease trap, grease trap piping with protective shoring while trench sanitary main to existing lift station.
- D. Site Information: See Section Site Clearing, Part 1.03 Project Conditions, for description of existing topographic and utility information.
- E. Sanitary piping along existing pool to be encased with steel casing.
- 1.9 SEQUENCING AND SCHEDULING
- A. Coordinate with building sewer drainage laterals and connect piping within 5-feet from the outside of the building wall or as otherwise indicated on the plans.
- B. Coordinate with other utility work (storm, water, gas, electric and data).
- C. Demolition of existing sanitary main system shall be in accordance with Section 31 1000 – Site Clearing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Manholes:
 - a. Hanson, Inc.
 2. Cleanouts, and Drains:
 - a. Ancon, Inc
 - b. Christy, Inc.
 - c. Jones Manufacturing Co., Inc.
 - d. Josam Co.
 - e. Rockford Sanitary Systems, Inc.
 - f. Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
 - g. Wade Div., Tyler Corp.
 - h. Zurn Industries, Inc., Hydromechanics Div.
- B.
- C.

2.2 PIPES AND FITTINGS

- A. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints.
1. Gaskets: ASTM F 477, elastomeric seal.
- B. Polyvinyl Chloride (PVC), Profile, Gravity Sewer Pipe and Fittings: ASTM F 794, open and closed profile, bell and spigot for gasketed joints.
1. Gaskets: ASTM F 477, elastomeric seal to form watertight joints.

- C. Polyvinyl Chloride (PVC), Ribbed Drain Pipe: AASHTO M 304M, bell and spigot, with smooth waterway for bell-gasketed joints.
 - 1. Fittings: AASHTO M 304M or ASTM F 794 for bell-gasketed joints.
 - 2. Gaskets: ASTM F 477, elastomeric seal to form soiltight joints.
- D. Polyvinyl Chloride (PVC), Ribbed Drain Pipe: AASHTO M 304M, bell and spigot, with smooth waterway for bell-gasketed joints.
 - 1. Fittings: AASHTO M 304M or ASTM F 794 for bell-gasketed joints.
 - 2. Gaskets: ASTM F 477, elastomeric seal to form soiltight joints.

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Sleeve-Type Pipe Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for nonpressure joints.
 - 1. Gaskets for Concrete Pipe: ASTM C443 (ASTM C443M), rubber.
 - 2. Gaskets for Cast-iron Soil Pipe: ASTM C564, rubber.
 - 3. Gaskets for Plastic Pipe: ASTM F 477, elastomeric seal.
 - 4. Gaskets for Dissimilar Pipes: Compatible with pipe materials being joined.
- B. Gasket-Type Pipe Couplings: Rubber or elastomeric compression gasket, made to match outside diameter of smaller pipe and inside diameter or hub of adjoining larger pipe, for non-pressure joints.
 - 1. Gaskets for Concrete Pipe: ASTM C443 (ASTM C443M), rubber.
 - 2. Gaskets for Cast-iron Soil Pipe: ASTM C564, rubber.
 - 3. Gaskets for Plastic Pipe: ASTM F 477, elastomeric seal.
 - 4. Gaskets for Dissimilar Pipes: Compatible with pipe materials being joined.
- C. Internal, Expansion-Type Pipe Couplings: Stainless-steel expansion band with ethylenepropylene-diene-monomer (EPDM), rubber-compound sealing sleeve, made to match inside diameter of pipes for non-pressure joints. Use nitrile rubber-compound sealing sleeve for fluids containing oil or gasoline.

2.4 MANHOLES

- A. Sanitary Sewer Manholes: Manholes for the sanitary sewer system shall be in conformance with Sheet C4.1 the project plans.
- B. Manhole Frames and Covers: Cast iron manhole frames and covers shall be in accordance with sheet C4.1 the project plans. The top design shall include lettering, equivalent to the following, cast into cover:
 - 1. Sanitary Sewerage Piping Systems: SANITARY SEWER.

2.5 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C150, Type 11.
 - 2. Fine Aggregate: ASTM C33, sand.
 - 3. Coarse Aggregate: ASTM C33, crushed gravel.
 - 4. Water: Potable.
- B. Structures: Portland-cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cement ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 4000 psi (27.6 MPa) minimum. with 0.45 maximum water-cement ratio.
 1. Include channels and benches in manholes.
 2. Include channels and benches in sanitary sewerage manholes.
 3. Include channels and benches in sanitary sewerage and combined sanitary sewerage and storm drainage manholes.
 - a. Manhole Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 1) Invert Slope: 1.2 inches (30 mm) through manhole.
 - 2) Invert Slope: 2.5 percent (1:40) through manhole.
 - 3) Invert Slope: None.

2.6 CLEANOUTS

- A. Description: ASME A12.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 1. Light Duty: In earth or grass, foot-traffic areas.
 2. Medium Duty: In paved, foot-traffic areas.
 3. Heavy Duty: In vehicle-traffic service areas.
 4. Extra Heavy Duty: In roads.
- B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, service class, cast-iron soil pipe and fittings.

2.7 TRENCHING

- C. A. See Section 31 23 00 - Excavation and Fill, for Pipeline and Utility Trenches for instructions.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 23 00 – “Excavation and Fill.”

3.2 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 23 00 – “Excavation and Fill.” Arrange for installation of green warning tapes directly over piping and at outside edges of underground structures.
 1. Use warning tapes or detectable warning tape over Sanitary Pipe from building to grease trap.

3.3 ON-SITE SEWERAGE PIPING APPLICATIONS

- A. General: Include watertight joints.

- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.
- C. Pipe Sizes 4 and 6 Inches (100 and 150 mm): ASTM D3034, polyvinyl chloride (PVC) sewer pipe and fittings; solvent-cemented joints; or with gaskets and gasketed joints.

3.4 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.
- F. Extend sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Connect piping 5-feet from the outside of the building wall or as otherwise indicated on the plans.
- G. Install sewerage piping pitched down in direction of flow, at minimum slope of 2 percent (1:50) and 36 inch (915 mm) minimum cover, except where otherwise indicated.

3.5 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to the following.
- B. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: As follows:
 - 1. Join solvent-cement-joint pipe and fittings with solvent cement according to ASTM D2855 and ASTM F 402.
 - 2. Join pipe and gasketed fittings with elastomeric seals according to ASTM D2321.
 - 3. Join profile sewer pipe and gasketed fittings with elastomeric seals according to ASTM D2321 and manufacturer's written instruction. Install according to ASTM D2321.
- C. System Piping Joints: Make joints using system manufacturer's couplings, except where otherwise specified.
- D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems' materials and dimensions.

3.6 MANHOLE INSTALLATION

- A. Form continuous concrete channels and benches between inlets and outlet, where indicated.
- B. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere, except where otherwise indicated.
- C. Place precast concrete manhole sections as indicated, and install according to ASTM C891.
 - 1. Provide rubber joint gasket complying with ASTM C443 (ASTM C443M), at joints of sections.
 - 2. Apply bituminous mastic coating at joints of sections.
- D. Construct cast-in-place manholes as indicated.

3.7 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318, ACI 350R, and as indicated.

3.8 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth in a cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding earth grade.
- C. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.
- D. Set drain frames and covers with tops flush with surface of paving.

3.9 CASING PIPE

- A. Weld steel casing pipe to required length.
- B. All welded steel pipe shall be fusion bonded epoxy coated inside and out after fabrication in accordance with AWWA C213. The Contractor shall take precaution including but not limited to, the use of fabric hoisting slings and protective wrappings, to protect coating from damage during installation. Any damage shall be immediately repaired in accordance with AWWA C213, Section 3.4 and 3.5.
- C. Protect existing piping and structures while installing casing pipe.

3.10 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plug in end of incomplete piping at end of day and whenever work stops.
 - 3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of the Project.
1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new on-site piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to authorities having jurisdiction.
 3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
 4. Submit separate reports for each test.
 5. Where authorities having jurisdiction do not have published procedures, perform tests as follows:
 - a. Sanitary Sewerage: Perform hydrostatic test.
 - 1) Allowable leakage is a maximum of 50 gallons per inch (4.6 L per mm dimension) nominal pipe size, for every mile (km) of pipe, during a 24-hour period.
 - 2) Close openings in system and fill with water.
 - 3) Purge air and refill with water.
 - 4) Disconnect water supply.
 - 5) Test and inspect joints for leaks.
 - a) Option: Test ductile-iron piping according to AWWA C600, Section 4 "Hydrostatic Testing." Use test pressure of at least 10 psig (69.0 kPa).
 - 6) Manholes: Perform hydraulic test according to ASTM C969 (ASTM C969M).
 - 7) Leaks and loss in test pressure constitute defects that must be repaired.
 - 8) Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.
 - 9)
 - 10)

END OF SECTION

SECTION 33 41 00

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Civil drawings, including but not limited to C3.1-C4.1
- B. General provisions of Contract Agreement form, including appendices and exhibits.
- C. Section 31 23 00 – “Excavation and Fill”.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Storm drainage.

1.3 DEFINITIONS

- A. Drainage Piping: System of pipe, fittings, and appurtenances for gravity flow of storm water.
 - 1. Storm Drains: The primary drainage conduit system conveying storm water runoff from catch basins to storm water ponds or other points of release.
 - 2. Area Drains: A secondary system of drainage conduits conveying storm water collected from building roof drains and local area drain basins to the primary storm drain system.
- B. Sewerage Piping: System of sewer pipe, fittings, and appurtenances for collection of wastewater and for its conveyance by gravity flow to public sanitary sewage systems.
- C. Bedding: Shall be the material placed to a minimum depth of 4-inches (102-mm) below and 12-inches above all storm and sewer piping and structures.
- D. Backfill: Shall be that material used to fill trenches and excavated areas above the depth of the bedding.
- E. Softscape: Landscape areas planted with vegetation (pervious).
- F. Hardscape: Areas paved or intended for foot travel (impervious).

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

- B. Product data for the following:
 - 1. Drop inlets, area drain boxes and in-line drain boxes.
- C. Shop drawings for precast concrete manholes and other structures. Include frames, covers, and grates.
- D. Shop drawings for cast-in-place concrete manholes and other cast-in-place structures.
 - 1. Shop drawings for area drains, including frames, covers, and grate.
 - 2. Certificate of compliance for utility bedding (sewer, area drains, and storm drains).
 - 3. Certificate of compliance for backfill bedding (sewer, area drains, and storm drains).

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with similar performance characteristics may be considered.
- B. Safety Standards: All excavation should be constructed in accordance with OSHA and CAL-OSHA Safety Standards. Safety in and around utility trench is the responsibility of the underground contractors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures in direct sunlight.
- B. Do not store plastic pipe or fittings in direct sunlight.
- C. Protect pipe, pipe fittings, and seals from dirt and damage.
- D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.
- E. Properly support pipe during transport, handling, and storage. Maintain bracing and chocking in place until pipe is ready for installation.

1.7 PROJECT CONDITIONS

- A. Notify Underground Service Alert (USA) at (800) 227-2600 for location and verification of existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned. Verify that storm drain system piping may be installed in compliance with design and no underground conflicts exist that were not shown on the plans.

- C. Existing Utility System: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
 - 1. Notify Owner not less than 48 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without receiving Owner's written permission.
- D. Site Information: See Section 31 1000 Site Clearing, Part 1.03 Project Conditions, for description of existing topographic and utility information.

1.8 SEQUENCING AND SCHEDULING

- A. Notify Owner's representatives a minimum of two working days in advance of proposed storm sewer interruptions.
- B. Coordinate with other pipeline and utility work (gas, electric conduits, water, fire suppression, communications conduits, etc.)

PART 2 - PRODUCTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following for the entire project or approved substitute:
 - 1. Drop Inlets, Trench Drains and Drain Boxes:
 - a. Christy Concrete Products Inc.
 - b. Hanson Concrete Products Inc.
 - c. Santa Rosa Products Inc.
 - 2. Area Drain (Inline and Drain Basins)
 - a. Nyloplast® Advanced Drainage Systems, Inc. (ADS).
 - b. Christy Concrete products
 - 3. Manholes:
 - a. Santa Rosa Products, Inc.
 - b. Hanson Concrete Products, Inc.
 - 4. Slot Drains
 - a. NDS

2.2 PIPES AND FITTINGS

- A. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal.

- B. Polyvinyl Chloride (PVC), Profile, Gravity Sewer Pipe and Fittings: ASTM F 794, open and closed profile, bell and spigot for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal to form watertight joints.
- C. Polyvinyl Chloride (PVC), Ribbed Drain Pipe: AASHTO M 304M, bell and spigot, with smooth waterway for bell-gasketed joints.
 - 1. Fittings: AASHTO M 304M or ASTM F 794 for bell-gasketed joints.
 - 2. Gaskets: ASTM F 477, elastomeric seal to form soiltight joints.
- D. Polyvinyl Chloride (PVC), Ribbed Drain Pipe: AASHTO M 304M, bell and spigot, with smooth waterway for bell-gasketed joints.
 - 1. Fittings: AASHTO M 304M or ASTM F 794 for bell-gasketed joints.
 - 2. Gaskets: ASTM F 477, elastomeric seal to form soiltight joints.

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Gasket-Type Pipe Couplings: Rubber or elastomeric compression gasket, made to match outside diameter of smaller pipe and inside diameter of bell of adjoining larger pipe, for non-pressure joints.
 - 1. Gaskets for Plastic Pipe: ASTM F477, elastomeric seal.
 - 2. Gaskets for Dissimilar Pipes: Compatible with pipe materials being joined.
 - 3.

2.4 DRAIN BOXES

- A. On-Site Precast drain boxes: All precast drain boxes shown on, but not limited to the civil plans. Inlets shall be precast, reinforced concrete of depth indicated.
 - 1. Christy 22"x22" V64

2.5 AREA DRAINS

- A. Onsite Area Drains: All area drains as shown on, but not limited to the Civil Drawings. shall be in accordance with the following;
 - 1. ADS Form # 1074/94 "ADS Surface Drainage Products".
 - 2. Grate:
 - a. Hardscape Areas:
 - 1) 10" Bronze ADS standard light duty with locking device.

2.6 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C150, Type II.
 - 2. Fine Aggregate: ASTM C33, sand.
 - 3. Coarse Aggregate: ASTM C33, crushed gravel.
 - 4. Water: Potable.

- B. Structures: Portland-cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cement ratio.
 - 1. Reinforcement Fabric: ASTM A185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A615, Grade 60 (ASTM A615M, Grade 400), deformed steel.
- C. Structure Channels and Benches: Field formed from concrete. Portland-cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cement ratio.
 - 1. Include channels and benches in storm manholes.
 - 2. Include channels and benches in sanitary sewerage manholes.
 - 3. Include channels and benches in storm drop inlets.
 - a. Manhole Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope. The radius shall be not less than 40 percent of the manhole diameter.
 - 1) Invert Slope: 2.5 percent (1:40) through manhole.
 - b. Manhole Benches: Concrete, sloped to drain into channel; coarse broom finish.
 - 1) Slope: 0.5 inch per foot (1:24).
 - 2) Include channels and benches in storm drainage catch basins.
 - c. Catch Basin Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope. The radius shall be not less than 40 percent of the manhole diameter.
 - 1) Invert Slope: match proposed slope through catch basin.
 - d. Catch Basin Benches: Concrete, sloped to drain into channel
 - 1) Slope: 0.5 inch per foot (1:24).

2.7 BEDDING, AND BACKFILL

- A. Sand bedding: Bedding material shall be clean, washed, granular material derived from decomposed or crushed rock. Such material shall be free of organic material, mica, clay, silts, oils and other deleterious materials. Sand bedding shall have a maximum particle size of 1/4 - inch with gradation that allows 90 to 100 percent passing a No. 4 sieve and not more than 10 percent to pass a No. 200 sieve.
- B. Backfill:
 - 1. Pipe Zone Backfill: Backfill with sand conforming to the requirements of 2.07 A., referenced above. Backfill shall be placed 12 inches above the top of pipe and compact in accordance to 95 % Relative Compaction. Compaction shall be monitored by Owner's Geotechnical Engineer.
 - 2. Backfill above pipe zone: Sand conforming to the specification above shall be used as backfill. Native material may be used as trench backfill if approved by the Owner's Geotechnical Engineer.
 - 3. Sand/Cement Slurry Backfill: Sand/cement slurry backfill shall consist of fluid, workable mixture of aggregate, cement, and water. Aggregate for sand/cement slurry shall be clean, washed fine aggregate conforming with Section of this

section. Alternatively, fine aggregate may be clean mortar sand conforming with provisions of ASTM C404.

- a. Cement shall be Type IP.
- b. Water shall be potable.

2.8 EXCAVATION FOR SEWER AND DRAINAGE PIPE TRENCHES

- A. Excavate trenches to indicated slopes, lines, depths, and invert elevations. See Section 31 23 00 – “Excavation and Fill.”.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe, unless otherwise indicated.
 - 1. Clearance: A minimum of 4 inches (100 mm) and a maximum of 9 inches (230 mm) on each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes or conduit less than 4 inches (100 mm) in nominal diameter, hand-excavate trench bottoms and support pipe bells and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 4 inches (100 mm) or larger in nominal diameter, place and compact sand bedding as shown on the plans, shape bedding to provide support to a minimum of 180 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Where rock or other unyielding bearing surface is encountered, extend trench excavation a minimum of 6 inches (150 mm) below pipe barrel and bell to receive bedding course.

2.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavations per Section 3.08 “Unauthorized Excavations” of Section 31 2300 – “Excavation and Fill.”
- B. Where indicated widths of utility trenches are exceeded, provide remedial measures in accordance with the recommendations of the pipe manufacturer and such other measures as may be required by the Owner’s representative.

2.10 COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil shall be in compliance with the plans and details.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. Materials and their installation are specified under Section 31 2300 – “Excavation and Fill.” part 2.02 “Accessories.” Arrange for installation of green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Locate warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.2 ON-SITE DRAINAGE PIPE APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.
- C. Refer to Part 2 of this Section for detailed specifications for pipe trenching.
- D. Drainage Pipe Sizes 4 to 12 Inches (100 to 300 mm): AASHTO M252 Interim, corrugated, high density polyethylene (HDPE) drainage pipe and fittings; high density polyethylene (HDPE) sleeve, silt-tight couplings; and silt-tight, coupled joints in sizes 8 and 10 inches (200 and 250 mm). AASHTO M 294 Interim, corrugated, high density polyethylene (HDPE) plastic pipe and fittings; high density polyethylene (HDPE) sleeve, silt-tight couplings; and silt-tight, coupled joints in sizes 12 and 15 inches (300 and 375 mm).
- E. Drainage Pipe Sizes 12 to 48 Inches (300 to 1200 mm): AASHTO M294M corrugated, high density polyethylene (HDPE) drainage pipe; high density polyethylene (HDPE) sleeve, silt-tight couplings; and silt-tight, coupled joints in sizes 8 and 10 inches (200 and 250 mm). AASHTO M 294 Interim, corrugated, high density polyethylene (HDPE) plastic pipe and fittings; high density polyethylene (HDPE) sleeve, silt-tight couplings; and silt-tight, coupled joints in sizes 12 and 48 inches.

- F. Drainage Pipe Size 4 Inch HDPE (Perforated): Refer to Part 2.2 “Pipes and Fitting” Under item D “Perforated Pipe” this section.

3.3 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Civil drawings (plans and details) indicate the location and arrangement of underground drainage systems piping.
- B. Install piping beginning at low point of systems, true to pipe laser grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer’s recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.
- E. Install gravity-flow-systems piping at constant slope between points and elevations indicated using a pipe laser. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.
- F. Install sewerage piping pitched down in direction of flow, at the lines and slopes indicated on the plans. Use a pipe laser to maintain grades.
- G. Extend drainage piping and connect to building’s storm drains, of sizes and in locations indicated. Terminate piping as indicated.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to the following.
- B. Polyethylene (PE) Plastic Pipe and Fittings: As follows:
 - 1. Join pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO “Standard Specifications for Highway Bridges,” Division 11, Section 26.4.2.4 “Joint Properties” and manufacturer’s written instructions.
 - 2. Join pipe, tubing, and gasketed fittings with elastomeric seals for watertight joints according to ASTM D2321 and manufacturer’s written instructions.
 - 3. Install according to ASTM D2321 and manufacturer’s written instructions.
- C. System Piping Joints: Make joints using system manufacturer’s couplings, except where otherwise specified.

3.5 TRENCH DRAIN INSTALLATION

- A. Materials: The Trench (Slot) Drain system bodies shall be manufactured from polymer concrete with minimum properties as follows:

Compressive strength: 14,000 psi

Flexural strength: 4,000 psi

Water absorption 0.07%

Frost proof

Salt proof

Dilute acid and alkali resistant

The nominal clear opening shall be 4.00" (100mm) with overall width of 6.3" (160mm). Pre-cast units shall be manufactured with an invert slope of 0.6% and have a wall thickness of at least 0.67" (16mm). Each unit will feature a full radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring features on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The ductile iron edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 1/4" (6mm) thick.

- C. Installation: The Slot Drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

3.6 AREA DRAIN INSTALLATION

- A. Installation per manufacturer's instructions.
- B. Set frames and grates to elevations indicated on civil plans. Set frames in concrete per manufacturer's recommendations in areas subject to traffic loading.
- C. Fasten pour ring to drains prior to backfill or pouring of Portland cement concrete.
- D. Set drain frames and covers with tops flush with surface of paving prior to pouring concrete pavement.

3.7 STORM DRAINAGE DROP INLET/ INSTALLATION

- A. Form continuous concrete channels and benches between inlets and outlet, where indicated.
- B. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere, except where otherwise indicated.
- C. Place precast concrete sections as indicated, and install according to ASTM C891.

- D. The upper 18 inches (45 cm) of the inlet (immediately below finished surface) shall be poured-in-place.

3.8 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318, ACI 350R, and as indicated.

3.9 DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions and as indicated.
- B. Install with top surfaces of components, except piping, flush with final finished surface.

3.10 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. Place plug in end of incomplete piping at end of day and whenever work stops.
 - 2. Flush piping between manholes and other structures to remove collected debris.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of the Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Re-inspect and repeat procedure until results are satisfactory.

END OF SECTION