

**ZONE 7 WATER AGENCY
CWS 5 TURNOUT REPLACEMENT PROJECT
275-18
ADDENDUM NO. 1
March 19, 2019**

This Addendum No. 1 (“Addendum”) is dated the date set forth above and modifies certain Bidding Documents issued by the Alameda County Flood Control and Water Conservation District, acting by and through its Zone 7 Water Agency (“District”) in connection with the District’s project: *CWS 5 TURNOUT REPLACEMENT PROJECT- Project # 275-18*.

All capitalized terms not otherwise defined herein shall have the meanings provided in the Bidding Documents. There are no other amendments to the Bidding Documents other than expressly contained in this Addendum No. 1.

The following clarifications and/or modifications shall be incorporated into plans and specifications for the above-referenced project and shall become part of the Contract Documents. All other provisions and requirements shall remain unchanged.		
CONTRACT DOCUMENTS AND SPECIFICATIONS		
Addendum Item	Document/Section	Location and Description of Change
1	00450	<p>Section 00450 Page 5 - Statement of Qualifications Please replace Part B 5 (a) with List Bidder’s Interstate Experience Modification Rate for the last five years.</p>
2	01100	<p>Section 01100 – Summary: Please replace Section 1.2.A Paragraph 2 – Mobilization and demobilization of all equipment, labor, and materials including bonds and insurance. Due to the project being located in a City sidewalk, coordination and encroachment permit approval from the City of Livermore is essential. Items the City will require include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • Sidewalk Restoration. • Street Sweeping other SWPPP BMP’s as required. • Notifications to Nearby Residents. • Contractor Parking Restrictions. • Hours of Operation (typically 9:00 am to 3:00 pm as an Elementary School is across the street). • Detouring Foot, Bicycle, and Auto Traffic. • Approved Traffic Plan with Restrictions (see Exhibits B.1 & B.2 for past examples. Past Examples do not represent nor guarantee an actual Approved Traffic Plan for this Work. <p>With Mobilization and demobilization of all equipment, labor, and materials including bonds and insurance. Due to the project being located in a City sidewalk, the CONTRACTOR SHALL OBTAIN an ENCROACHMENT PERMIT AND APPROVAL from the City of Livermore is required. Items the City will require include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • Sidewalk Restoration.

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		<ul style="list-style-type: none"> • Street Sweeping other SWPPP BMP's as required. • Notifications to Nearby Residents. • Contractor Parking Restrictions. • Hours of Operation (typically 9:00 am to 3:00 pm as an Elementary School is across the street). • Detouring Foot, Bicycle, and Auto Traffic. • Approved Traffic Plan with Restrictions (see Exhibits B.1 & B.2 for past examples. Past Examples do not represent nor guarantee an actual Approved Traffic Plan for this Work. • Coordination of any tree trimming with the City of Livermore as necessary to prosecute the Work.
3	01100	<p>Section 01100 – Summary: Please <i>replace</i> Section 1.3.D.1-</p> <p>1. Mobilization and Demobilization (Bid Item 1). The lump sum price paid for this item shall be full payment for mobilization and demobilization. . Mobilization at Project commencement (50% to be paid then or as agreed in the Schedule of Values), full payment for providing Bonds and Insurance required by Document 00700 (General Conditions), the Safety Plan, applicable permits, as required by Document 00550 (Notice to Proceed), Document 00700 (General Conditions), SQPP preparation and implementation as required by Section 001570 (Stormwater Management and Erosion Control).</p> <p>Due to the project being located in a City sidewalk, coordination and encroachment permit approval from the City of Livermore is required. Items the City require include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • Sidewalk Restoration. • Street Sweeping and other SWPPP BMP's as required. • Notifications to Nearby Residents. • Contractor Parking Restrictions. • Hours of Operation (typically 9:00 am to 3:00 pm as an Elementary School is across the street). • Detouring Foot, Bicycle, and Auto Traffic. • Approved Traffic Plan with Restrictions (see Exhibits B.1 & B.2 for past examples. Past Examples do not represent nor guarantee an actual Approved Traffic Plan for this Work. <p>Receipt of all records and documents as required in the contract documents, site restoration and clean up at Final Completion of Work constitutes demobilization (50% to be paid then or as agreed in the Schedule of Values).</p> <p>With</p> <p>1. Mobilization and Demobilization (Bid Item 1). The lump sum price paid for this item shall be full payment for mobilization and demobilization. . Mobilization at Project commencement (50% to be paid then or as agreed in the Schedule of Values), full payment for providing Bonds and Insurance required by Document 00700 (General Conditions), the Safety Plan,</p>

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		<p>applicable permits, as required by Document 00550 (Notice to Proceed), Document 00700 (General Conditions), SQPP preparation and implementation as required by Section 001570 (Stormwater Management and Erosion Control).</p> <p>Due to the project being located in a City sidewalk, the CONTRACTOR SHALL OBTAIN an ENCROACHMENT PERMIT AND APPROVAL from the City of Livermore is required. Items the City require include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • Sidewalk Restoration. • Street Sweeping and other SWPPP BMP's as required. • Notifications to Nearby Residents. • Contractor Parking Restrictions. • Hours of Operation (typically 9:00 am to 3:00 pm as an Elementary School is across the street). • Detouring Foot, Bicycle, and Auto Traffic. • Approved Traffic Plan with Restrictions (see Exhibits B.1 & B.2 for past examples. Past Examples do not represent nor guarantee an actual Approved Traffic Plan for this Work. • Coordination of any tree trimming with the City of Livermore as necessary to prosecute the Work. <p>Receipt of all records and documents as required in the contract documents, site restoration and clean up at Final Completion of Work constitutes demobilization (50% to be paid then or as agreed in the Schedule of Values).</p>
4	15202	Please add the attached Contract Specification Section 15202 – Butterfly Valves to the Contract Specifications.
5	16000	Please add the attached Contract Specification Section 16000 – Electrical to the Contract Specifications.
6	17000	Please add the attached Contract Specification Section 17000 – Instrumentation to the Contract Specifications.
7	Exhibit A - Contract Drawings	Please replace Contract Drawings S-01 with the attached drawing S-01A, to reflect Vault and Bilco Lid field adjustment approvals between existing West Electrical Cabinet and East Piping 90 degree Elbow clearances.
8	Exhibit A - Contract Drawings	Please add the attached Exhibit A.1 to Exhibit A – Contract Drawings to reflect a sampling station detail.

Please be reminded that all bidders shall acknowledge receipt of this Addendum No. 1 in Document 00400A (Bid Form) and failure to acknowledge addendum in the Bid Form shall render the bid non-responsive and shall be cause for its rejection.

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Acknowledgement of receipt of Addendum No. 1 for the CWS 5 Turnout Replacement Project, Livermore, California, Project No. 275-18.

Please also sign and email a copy of this page to John Koltz, Zone 7 Water Agency, at jkoltz@zone7water.com to acknowledge receipt of Addendum No. 1 for this project.

Signature and Print Name

Date

Company

SECTION 15202

BUTTERFLY VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 15200 - Valves, General apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 15200.
- B. Shop Drawings
 - 1. Complete Shop Drawings of butterfly valves and actuators.
 - 2. Drawings showing valve port diameter complete with dimensions, part numbers, and materials of construction.
 - 3. Certified statement of proof-of-design tests from the valve manufacturer. Valve manufacturer shall state that the valves proposed for this project will be manufactured with identical basic type of seat design and materials of construction to the prototype evaluated under the proof of design testing.
 - 4. Manufacturer's certification that the valve complies with applicable provisions of AWWA C504 – Rubber-Seated Butterfly Valves.

1.3 QUALITY ASSURANCE

- A. Valves shall be subjected to performance, leakage, and hydrostatic tests in accordance with procedures and acceptance criteria established by AWWA C504.

PART 2 -- PRODUCTS

2.1 EPDM SEATED BUTTERFLY VALVES 25 TO 150 PSI (AWWA)

- A. **General:** Butterfly valves for steady-state water working pressures and steady-state differential pressure up to 150 psi and for fresh water service having a pH range from 6 to 10 and temperature range from 33 to 125 degrees F shall conform to AWWA C504 and be as indicated. Valves subjected to steady state working pressures and steady state differential pressures from 25 to 150 psi in sizes 3-inches through 24-inches shall be rated for Class 150B with actuator sized for Class 150B. Valves 30 inches through 72-inches shall be of the class indicated. Valves larger than 72-inches shall be of the class indicated, designed in accordance with the intent of AWWA C504. If the operating conditions such as flow, velocity, and differential pressures are not indicated, the valve body and shaft shall be sized for the pressure class rating of the valve.

- B. Valves shall be of the body type, pressure class, end joint, and actuator indicated.
- C. **Construction:** Unless otherwise indicated, materials of construction shall be in accordance with AWWA C504, suitable for the service. Seats shall be positively clamped or bonded into the disc or body of the valve, but cartridge-type seats that rely on a high coefficient of friction for retention shall not be acceptable. Seat material shall be guaranteed to last for at least 75 percent of the number of cycles in the AWWA C504 proof-of-design test without premature damage.

Description	Material Standards
Valve bodies	Gray iron, ASTM A 48, Class 40 or Gray iron, ASTM A 126, Class B, or Ductile iron, ASTM A 536, grade 65-45-12 or 70-50-05
End flanges	Same material as valve bodies
Valve shafts	Stainless steel ASTM A 240 or A 276, Type 316
Valve discs	Same material as valve bodies.
Seats	EPDM
Seat mating surfaces	Stainless steel, ASTM A 240 or A 276, Type 316
Clamps and retaining rings	Type 316 retaining rings and cap screws.
Valve bearings	Self lubricating materials per AWWA C504
Shaft seals	Resilient non-metallic materials suitable for service
Painting and coating	Refer to Section 09800 – Protective Coating

- D. **Manual Actuators:** Unless otherwise indicated, manually-actuated butterfly valves shall be equipped with a handwheel and 2-inch square actuating nut and position indicator. Screw-type (traveling nut) actuators will not be permitted for valves 30 inches in diameter and larger.
- E. **Worm Gear Actuators:** Valves 30 inches and larger, as well as submerged and buried valves, shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing.
- F. **Electric Actuators:** Electric actuators shall meet the requirements of AWWA C540. Electric actuators in open and close service shall be rated to produce output torque of at least 1.5 times the required valve maximum seating or maximum dynamic torque, whichever is greater. For valves in modulating service with dynamic torque exceeding the seating torque, the rated output torque of the actuator shall be twice the dynamic torque required by the valve. Actuator rated torque is defined as pullout torque rated at

10 percent below the rated voltage of the motor. The torque switch shall be field set at no greater than 60 percent and 50 percent of the maximum actuator rated torque for open/close service and modulating service, respectively. After plant startup, the manufacturer shall prepare a certification including a torque curve to demonstrate that the torque requirements have been met.

G. Manufacturers, or Equal

1. **De Zurik Corporation**
2. **Henry Pratt Company**

2.2 BUTTERFLY VALVES FOR AIR SERVICE

- A. **General:** Butterfly valves for air systems shall be specifically designed for this service and meet or exceed the design, strength, performance, and testing standards of AWWA C504. Valves shall be suitable for pressures from vacuum to 125 psi and temperatures from minus 40 degrees F to 250 degrees F.
- B. **Body:** The valve body shall be of cast iron conforming to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings, Class B, with either wafer, lug, or flanged design as indicated, drilled to ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800, Class 125.
- C. **Disc:** The disc shall be of ductile iron conforming to ASTM A 536 - Ductile Iron Castings, or cast iron conforming to ASTM A 48 - Gray Iron Castings, or ASTM A 126 with an edge of monel, Type 316 stainless steel, or nickel. The disc shall be designed with the air-profile or other suitable shape. Sprayed or plated disc edges are not acceptable.
- D. **Seat:** The elastomer seat shall be in the body. It shall be field-replaceable without special tools. Except for use with petroleum-base fluids, the seat material shall be Ethylene-Propylene-Diene Monomer (EPDM), or other suitable material, to provide a tight shut-off at the temperatures above.
- E. **Shaft:** The valve shaft shall be of Type 316 or 304 stainless steel with sufficient strength to allow for the increased torque for air service.
- F. **Bearings:** Shaft bearings shall be of the self-lubricating corrosion-resistant sleeve type.
- G. **Packing:** The packing shall be of the adjustable or self-adjustable (O-ring) type, suitable for the temperature and service conditions.
- H. **Manual Actuators:** Unless otherwise indicated, manually-actuated butterfly valves shall be equipped with a handwheel and 2-inch square actuating nut and position indicator. Screw-type (traveling nut) actuators will not be permitted for valves 30-inches and larger.
- I. **Worm Gear Actuators:** Valves 30-inches and larger shall be equipped with worm-gear actuators, lubricated and sealed to prevent entry of dirt or water into the housing.

- J. **Electric Actuators:** Electric actuators shall meet the requirements of AWWA C540 and be in accordance with Section 15201. Electric actuators in open/close service shall be rated to produce output torque of at least 1.5 times the required valve maximum seating or maximum dynamic torque whichever is greater. For valves in modulating service with dynamic torque exceeding the seating torque, the rated output torque of the actuator shall be twice the dynamic torque required by the valve. Actuator rated torque is defined as pullout torque rated at 10 percent below the rated voltage of the motor. The torque switch shall be field set at no greater than 60 percent and 50 percent of the maximum actuator rated torque for open/close service and modulating service, respectively. After plant startup, the manufacturer shall prepare a certification including a torque curve to demonstrate that the torque requirements have been met.
- K. **Testing:** Valves shall be factory leak tested in accordance with AWWA C504.
- L. Manufacturers, or Equal
 - 1. **De Zurik Corporation**
 - 2. **Rodney Hunt Company** (24-inches and larger)

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator. Installation shall be in accordance with Section 15200.

- END OF SECTION -

DIVISION 16 – ELECTRICAL

SECTION 16000

SECTION 16010

GENERAL REQUIREMENTS, ELECTRICAL

PART 1 GENERAL

1.01 DESCRIPTION

- A. All general provisions of the Contract Documents apply to all work specified in this Division 16 Electrical.
- B. Furnish all necessary labor, materials, equipment and incidentals required to install a complete and operational electrical system according to the intent of this specification and the accompanying drawings, whether itemized or not.
- C. Examine the specification and drawings for mechanical equipment and provide all starters, circuit breakers, switches, pushbuttons and appurtenances which are not specified to be with the mechanical equipment. Erect all electrical equipment not definitely stated to be erected by others, furnish and install conduit, wire and cable and make connections required to place all equipment in complete operation.
- D. The general extent of the electrical work includes, among others, the furnishing and installing of the following items:
 - 1. Complete circuiting and connections for all flowmeters, including their remote control and indicating devices, pressure transmitters, float switch, intrusion alarm sensors, and all lighting and receptacles.
 - 2. All supports, bases, anchors, sleeves, hangers, conduit seals, and the like, all electrical work shown and/or specified, not particularly mentioned above.
 - 3. Complete grounding system.
 - 4. Significant documentation, including submittal, instruction, operations and maintenance manuals.
 - 5. Significant field services including pre-start-up check-out, testing, calibration, start-up, radio testing and training.
 - 6. Conduit, fittings, conductors and pullboxes.
 - 7. Seismic calculations for all electrical equipment anchors.
 - 8. Pedestals and all components.
 - 9. Antenna mast.
 - 10. Power, control, alarm, and instrumentation wiring for all equipment specified in Divisions 11000, 15000, 16000 and 17000.
- E. Throughout this Contract, provide protection for materials and equipment against loss or damage in accordance with provisions elsewhere in these Contract Documents. Throughout

this Contract, follow manufacturer's recommendations for storage. Protect everything from the effects of weather. Prior to installation, store items in clean, dry, indoor locations. Store in clean, dry, indoor, heated locations items subject to corrosion under damp conditions, and items containing electrical insulation, such as transformers, conductors, motors, and controls. Energize all space heaters furnished with equipment. Provide temporary heating, sufficient to prevent condensation, in transformers, motors, and pedestals which do not bare space heaters.

- F. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. When equipment intended for indoor installation is installed at the Contractor's convenience in areas where it is subject to dampness, moisture, dirt, or other adverse atmosphere until completion of construction; ensure that adequate protection from these atmospheres is provided that is acceptable to the Construction Manager. Cap conduit runs during construction. Energize all space heaters furnished with equipment.
- G. All temporary wiring for the pumps shall have disconnect means, overcurrent protection, and conduit or metal wireways as required by the National Electrical Code, except that jacketed flexible cables may be exposed on equipment.
- H. Provide an experienced field supervisor to monitor work progress and to attend regular project meetings. Reference the General Conditions for specific requirements.
- I. Removal of Salvaged Material: Use reasonable care in removing salvaged electrical material to avoid all unnecessary damage. Handle equipment to be removed and salvaged with special care to avoid damage of any nature. Repair any unnecessary damage to salvaged equipment at the Contractor's expense. Deliver all such material to the Zone 7's storage area or the District's storage area, and neatly stockpile, as directed.

1.02 CODES AND STANDARDS

- A. All Work shall conform to the following codes:
 - 1. NFPA 70 - National Electrical Code - 2002 Edition
 - 2. NFPA 101 - Life Safety Code - Latest Edition
 - 3. Uniform Building Code - Latest Edition
 - 4. District Electrical Code
 - 5. Any additional codes effective at the job site
- B. The Contractor shall furnish without extra charge any additional material and labor which may be required for compliance with these laws, rules, and regulations, even though the work is not mentioned in these particular specifications or shown on the drawings.

- C. The Contractor shall apply and pay for all permits required by any of the legally constituted public authorities for the installation or construction of the work included under this Division. The Contractor shall arrange and pay for any inspections or examinations so required and deliver certificates of all such inspections to the Engineer. When these specifications call for materials or construction of a better quality or larger sizes than required by the above mentioned rules and regulations, the provisions of the specifications shall take precedence.

1.03 INTERPRETATION OF DRAWINGS

- A. Any error or omissions of detail in either the drawings or the specifications shall not relieve the Contractor from correctly installing all materials necessary for complete and operating electrical system.
- B. The Contractor shall inspect the site and verify all measurements and conditions and shall be responsible for the correctness of same. No extra compensation will be allowed because of differences between work shown on the drawings and measurements at the site.
- C. The electrical drawings are diagrammatic, but shall be followed as closely as existing conditions and work of other contractors will permit. All deviations from the drawings required to make the work conform to structures as constructed, and to the work of others, shall be made at the Contractor's expense.
- D. The Contractor shall examine the civil, structural, mechanical, architectural and manufacturer's drawings for the various equipment in order to determine exact routing and final terminations for all conduits and cables. Conduits shall be stubbed up as near as possible to equipment enclosure.

1.04 LOCATIONS AND ENCLOSURES

- A. Provide equipment, materials, and wiring methods suitable for the type of locations in which they are located.
- B. Definitions of types of locations and types of enclosures to be provided:
 - 1. Dry locations: All indoor areas that do not fall within the definitions below for wet, damp, hazardous, nor corrosive locations and which are not otherwise designated on the drawings. Provide NEMA 1A or NEMA 12 enclosures.
 - 2. Wet locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the drawings. Provide NEMA 3R enclosures.
 - 3. Damp locations: All indoor [or outdoor] spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, over or near water areas,

or any area subject to water spray, unless otherwise designated on the drawings.
Provide NEMA 4 enclosures.

4. Corrosive location: Areas where chlorine or sulfur dioxide gas under pressure, sulfuric acid or liquid polymer are stored or processed. Provide NEMA 4X (non-metal) enclosures.

1.05 MATERIAL AND EQUIPMENT INSTALLATION

- A. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The District reserves the right to require minor changes in location of outlets or equipment, prior to roughing in, without incurring any additional costs or charges.
- B. All electrical equipment and appurtenance facilities which are separately mounted or anchored shall be so installed as to be in conformance to all requirements of the Uniform Building Code, latest edition, both for vertical and seismic loading. Provide housekeeping pads for floor or pad mounted equipment.
- C. Follow the manufacturer's installation recommendations unless otherwise indicated. Keep copy of the manufacturer's installation instructions available on the job site for review at all times.

1.06 SEISMIC REQUIREMENTS

- A. All pieces of electrical, mechanical, and instrumentation equipment and appurtenant facilities which are separately mounted or anchored shall be so installed as to be in conformance to all requirements of the Uniform Building Code, both for vertical and seismic loading. This requirement applies, but is not limited to, such items as light fixtures, electrical and instrumentation panels, tanks, pumps, piping, pipe supports and hangers, generator, motors, fans, ventilating ducts and equipment, and other similar equipment or facilities in excess of 400 pounds.
- B. All components of this facility shall be considered essential for the purpose of determining seismic force values. The seismic force shall be taken as $F = 0.34W$, where "W" is the weight of the equipment or pipe contents. A similar force of two-thirds (2/3) of the horizontal force shall be assumed to act in a vertical upward direction. The seismic zone shall be considered Zone 4 for this project.
- C. Prepare and submit seismic calculations, per Zone 7 standards, for all electrical equipment anchors. Calculations shall be signed by a registered professional engineer.

1.07 CUTTING AND PATCHING

- A. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of materials and equipment. Following such work, restore surfaces neatly to new condition using skilled craftsmen of the trades involved, at no additional cost to the District.

1.08 UTILITY COORDINATION

- A. Coordinate new electrical service.
 - 1. The Contractor shall pay all costs for utility work shown on the Plans and described in the Specifications. The District will pay all fees charged by PG&E for the upgraded service. The Contractor shall coordinate the completion of forms, even where the Owner is filling out the majority of the form. The Contractor is responsible for providing trenching, conduit, concrete encasement, risers, transformer pads, pull ropes, poles, pull sections and meter sections per PG&E requirements. The Contractor is responsible for coordinating inspections, site visits and all paperwork to completion. See additional requirements in section 16400.

1.09 INSPECTION

- A. The Contractor shall cooperate with the Engineer and shall provide assistance at all times for the inspection of the electrical work. Remove covers, operate machinery, or perform any reasonable work which, in the opinion of the Engineer, will be necessary to determine the quality or adequacy of the work.
- B. If any material does not conform with these specifications the Contractor shall, within three days after being notified by the Engineer, remove the materials from the premises.
- C. Work shall not be closed in or covered before inspection and approval by the Engineer. Cost of uncovering and making repairs where uninspected work has been closed in shall be borne by the Contractor.

1.10 SUPERVISION AND WORKMANSHIP

- A. The Contractor shall employ a competent electrical foreman on the job throughout the entire period of construction to see that his work is carried on without delay and completed as rapidly as possible.

- B. Before the start of construction and in conjunction with the schedule of other Contractors, the Electrical Sub-Contractor shall furnish to the Engineer a tentative construction schedule showing the order of the work, the pedestal component shop drawings submittal dates, scheduled manufacturing dates, and the anticipated delivery dates.

1.11 COOPERATIVE WORK WITH OTHERS

- A. The Contractor shall cooperate with others, with due regard to their work, towards promotion of rapid completion of project. If any cooperative work must be altered due to lack of proper supervision of such, or failure to make proper provision in time by Contractor, then he shall bear expense of such changes as necessary to be made in work of others.
- B. Labor and materials, including templates, sleeves, anchors, concrete inserts and the like shall be furnished in ample quantities at such times as necessary to ensure uninterrupted progress of work.
- C. Contractor shall cease work at any particular point temporarily and transfer his operations to such points or execute such portions of work as directed, when in the judgment of the Engineer it is necessary to do so.

1.12 QUALITY OF MATERIALS

- A. All electrical materials used on this project shall be new and free from defects.
- B. All electrical materials used on this project shall conform where applicable, to the following standards, unless otherwise noted:
 - 1. NEMA - National Electrical Manufacturers Association
 - 2. ANSI - American National Standards Institute
 - 3. UL - Underwriters Laboratories, Inc.
- C. Each type of material shall be of the same manufacturer and quality throughout the work.

1.13 SUBSTITUTIONS

- A. Specific brand names and catalog numbers are used to describe materials in order to establish standards of performance and quality or to match existing equipment.
- B. The decision of the Engineer shall govern as to what is equal to the item specified. Equality will be judged on the basis of the following:
 - 1. Conformance with description or performance required.
 - 2. Equal in quality.

3. Comparable in appearance and artistic effect where these are considerations.
 4. Comparable operation, maintenance and performance.
 5. Equal in longevity and service under conditions of climate and usage.
 6. Conformance with space allocations and requirements for operations from mechanical or electrical services provided without necessitating changes in details and construction or related work.
 7. Compatible with existing equipment.
- C. If the Engineer considers it necessary, tests to determine the quality of the proposed materials shall be made, at the expense of the Contractor, by an unbiased laboratory, satisfactory to the Engineer.
- D. Any material, article, or method judged by the Engineer equal to that specified will be approved, provided the Contractor submits a single written request, in triplicate, to the Engineer, within 45 days after contract award, with the following information for each item:
1. Name of manufacturer or supplier
 2. Trade or brand name
 3. Type, model, style, and/or catalog number
 4. Size or capacity rating
- E. The Contractor assumes full responsibility for including complete, correct data in this one request and shall also attach completely referenced diagrams descriptive and technical data sheets for the Engineer's determination of equality or suitability of appearance of any substitution item. Only one such request may be submitted. The Engineer's rejection of any substitute shall automatically require the Contractor to furnish the specified item without further discussion or delay.

1.14 MATERIAL, EQUIPMENT AND SHOP DRAWING SUBMITTALS:

- A. Submittals shall be prepared in accordance with *General Conditions, Section 1340, Submittals and Division 15 Mechanical*.
- B. The following information shall be clearly marked on each shop drawing, catalog cut, specification sheet, etc. submitted:
1. Project Title
 2. Date
 3. Submitted By
 4. Identification of item represented
- C. Shop drawings shall be drawn to scale or completely dimensioned and shall give all information required to completely describe the item. Shop drawings of speed control

switchboards, panels, and pedestals shall all be submitted on 11" x 17" or 24" x 36" size sheets at one time. 8-1/2" x 11" sheets will not be accepted. Drawings shall show front views, plan views, elementary wiring diagrams and numbered terminal blocks. Drawings shall be submitted for existing equipment requiring modifications as called for on drawings.

- D. The Contractor shall carefully check all his shop drawings for compliance with this Specification and the Plans.
- E. In the event that certain shop drawings are rejected by the Engineer, they will be so noted and returned to the Contractor for resubmittal. Resubmittals are to be made within 14 days.
- F. If the shop drawings show variation from the contract requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in order that if acceptable, suitable action may be taken for proper adjustment of the Contract. The Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract, even though the shop drawings have been reviewed.
- G. The Engineer's review of shop drawings will be for general design and arrangement only, and shall not relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules. The Contractor shall verify all dimensions and job site conditions affecting the work, and shall be responsible for furnishing and installing the proper materials required by the Contract, whether or not indicated on the shop drawings.
- H. Work requiring shop drawings shall not be started before receipt of the Engineer's written approval.
- I. Provide complete interconnection wiring diagrams. Interconnections drawings shall show for each piece of equipment and all wiring between all devices, panels, cabinets, terminal boxes, control equipment, pedestals and any other devices and equipment including equipment provided in other Divisions of the Specifications as well as equipment provided by the District. Each interconnection diagram shall show the following as a minimum: each conduit number, wire label, wire color code and terminal number, as actually installed; each motor, starter, cubicle, disconnect, switch, panel, cabinet, instrument, device, and all other equipment; and grounding points.
- J. Commercial Warranties: Pursuant to the General Provision of the contract, prior to final payment, the Contractor shall furnish to the Engineer a listing of all manufacturers of their materials and equipment. The list of these warranties must include the time period of each warranty, i.e. 6 months, 1 year, and the like. One copy each of those warranties whose time period exceeds 1 year shall be submitted with the listing.
- K. Submit calculations for the anchor systems for each item specified herein which weighs in excess of 400 pounds (wet, or operating weight). Calculations shall include seismic

horizontal and vertical forces as well as dead load or live load calculations, as applicable. Calculations shall include details which show size and material of anchor bolts, spacing requirements, grout and filler specifications, strap material, spacing and fastening requirements, and any miscellaneous information required to properly secure the item of equipment. Calculations shall be stamped by a civil or structural engineer registered in the state of California.

- L. The submittal documents (submittals and manuals) for the Zone 7 equipment shall conform to Zone 7 panel documentation requirements. See Wunderlich-Malec drawings [standard Zone 7 requirements] GI001 and GI002 for additional requirements. The drawing documents shall be combination schematic, loop drawing and interconnection drawing. other requirements include All loop related drawings shall start at drawing number XXX-100 (XXX denotes the site number) and All wires shall be labeled. All wires shall have a unique label unless it is used as part of an AC or DC bus. All wires shall be shown terminating on a terminal block unless it is used as part of a bus. All terminal blocks shall have labels. All terminal blocks shall have unique labels unless it is used as a bus. The first two digits of the terminal number shall be the last two digits of the drawing number. The last two digits of the label shall be sequentially assigned from the top of the drawing to the bottom of the drawing starting at 00. Provide terminal junction boxes (TJB), for maintenance purposes, for the flowmeter and pressure transmitters. The TJB shall include knife disconnect terminal blocks, for all analog transmitters, for calibration purposes. All conduits shall be numbered per the District's standards.
- M. Submit a single complete package for all products on the following list:
1. Pedestal including metering equipment, breakers and controls with all internal components.
 2. Zone 7 RTU and communication equipment.
 3. Conduit, fittings, supports, conductors, vaults and boxes.
 4. Disconnects, receptacles and switches.
 5. Light Fixtures and Accessories.
 6. Instrumentation - Complete.
 7. Interconnection drawings.
 8. Seismic Calculations.
 9. Testing schedule and forms.
 10. Completed testing forms.

1.15 OPERATION AND MAINTENANCE MANUALS:

- A. The CONTRACTOR shall provide six (6) copies of an Operation and Maintenance manual prior to completion of the Work. The manual shall be bound and covered and be 9 inch by 12 inch in size. Provide a table of contents and one section for each item of equipment specified herein. All pages shall be nearly assembled and fit within the manual cover.

- B. For each section provide the following information, as applicable:
1. An itemized list of all data provided.
 2. Name and location of the manufacturer, the manufacturer's local representative, the nearest suppliers, and spare parts warehouse.
 3. Recommended installation, adjustment, start up, calibration, and troubleshooting procedures.
 4. Recommended lubrication, lubrication intervals, and an estimate of yearly quantity needed.
 5. Recommended step-by-step procedures for all modes of operation.
 6. Complete internal and connection wiring diagrams.
 7. Recommended preventive maintenance procedures and schedule.
 8. Complete parts lists, by generic title and identification number, with exploded views of each assembly.
 9. Recommended spare parts and special tools.
 10. Disassembly, overhaul, and reassembly instructions.
 11. All approved shop drawing information pertinent to facility operation and maintenance.
 - XII. Equipment calibration data, calibration sheets including equipment/instrument description.
 - XIII. Approved submittal information.
- C. Record (as-built) submittal information covering all Contractor supplied equipment.
- D. As-built drawings containing complete wiring diagrams shall be submitted with the Operation and Maintenance manuals described above.
- E. As built [Contract Document] Drawings shall be marked with red pencil to show electrical work revisions and actual routes of embedded or buried conduit which may differ from the Drawings. Refer to the General Conditions for additional requirements.

- F. Test results/reports shall be contained within the Operation & Maintenance manual and shall be placed under each respective equipment item tested.

1.16 AS BUILT RECORD DRAWINGS:

- A. The Contractor shall keep an accurate legible record of all changes and conduit relocations made during construction and shall make up a separate legible record copy of Contract Drawings at completion of the project. A working copy of as-built drawings shall be maintained on site at all times during construction.

1.17 EQUIPMENT IDENTIFICATION

- A. Pedestal components, starters, control panels, internal control panel components, all disconnect switches and circuit breakers, transformers, push buttons, controls, instruments, boxes, etc. shall be properly identified with a descriptive nameplate. Nameplates shall be made of 1/6 inch laminated plastic with black background and white letters. Size of letters shall be 1/4 inch high, minimum. Letters shall be machine engraved. All nameplates shall be screw mounted with oval head machine screws tapped into metal. Adhesive material shall not be used.

1.18 CLEANING

- A. After all other work has been accomplished pedestals, starters, panelboards, and all other electrical equipment shall be cleaned of all dust, dirt, grease, plaster, paint or other marks, by the Contractor. All pedestals shall be "touch-up" painted to match original colors.

1.19 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. The contractor shall supply all spare parts prior to functional acceptance test. All parts shall be sealed in plastic bags and delivered to the site in a heavy duty plastic storage box.
 - 1. Fuses. Provide 20 percent of each size and type used rounded to the next whole number, but no less than three of each size and type.
 - 2. Indicating Light Bulbs. Provide 20 percent of each size and type used rounded to the next whole number, but no less than 10 of each type.

1.20 TESTING, GENERAL

- A. Testing, test plans, and test reports shall be provided by the Contractor as specified herein. The Contractor shall perform tests as required to demonstrate that the equipment and systems covered in this Specification operate safely and meet the requirements of these Specifications: reference the General Conditions, Specification Section 1010, Division 16

and Division 17. The Contractor shall provide labor, instruments, and other material to complete the tests.

1. Perform the Operational Readiness Test and Functional Acceptance Test.
2. Perform independent testing services for the electrical system prior to Functional Acceptance Test.
3. Perform other specific test required by Specification Sections in Divisions 16 and 17.
4. Perform support activities for the final lift station, described throughout the Specifications.

B. Independent Testing Services

1. The Contractor shall provide the services of an independent testing services. The independent testing service shall certify the electrical equipment and installation.
2. Testing methods shall be in accordance with NETA standards for "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
3. As a minimum, the main switchboard, main service disconnect, ground fault detection equipment, solid state breakers, transformers and ground system shall be tested.
4. Certified test results shall be submitted for review.

C. Operational Readiness Test (ORT)

1. Point-to-Point Wire Check. After installation, termination, and identification of conductors, perform a point-to-point wire check to verify that all wiring has been properly installed and identified, and that there are no shorts between wires, shields, and ground. Lift wires from terminals as required to perform this test.
2. Insulation Test. Perform a 1000 volt megger test on all 600 Volt class control and power wiring. The Engineer shall be notified at least 1 week prior to the insulation test so that the testing maybe witnessed.
3. Motor Test. Submit test data showing (for every motor): Perform a winding resistance check of each phase. Amperes in each phase with motor loaded; motor nameplate amperes; Thermal overload element rating and catalog number. At time of test record voltage at switchboard for all three phases. Check for correct rotation of mechanical equipment.

4. Control System Test. Test the PLC hardware, terminations and control strategy and enter all setpoints. Refer to Section 16997, Programmable Logic Controller for additional specific testing requirements.

5. Communication System Test. Test the communication systems and align antennas.

C. Functional Acceptance Test (FAT)

1. The Contractor shall perform the FAT after he has delivered written notice to the Engineer that the ORT has been completed.

2. The Contractor shall inform the Engineer at least 2 weeks prior to the FAT so that the Engineer may witness the test.

3. The FAT shall operate all equipment and systems over the full operating range, shall demonstrate proper operation of alarms and indicators, and, in general, shall demonstrate that the equipment and systems meet the requirements of the Drawings and Specifications.

4. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.

5. The FAT shall be performed in the presence of the Engineer.

D. Final System Testing

1. Provide resources and personnel, on site, as necessary, to support the effort required to complete testing of the lift station in a timely manner.

a. Resources include testing equipment, two way radios and tools.

b. Personnel include an electrician and a control system start-up technician.

1.21 TRAINING

A. The Contractor shall provide a eight man-hour for training of the operation of the electrical and control systems to District personnel.

B. Instructions shall consist of the functional description of each piece of equipment, including calibration and setting of set points. Demonstration of the operation of each system shall be included.

C. The Contractor shall provide all manuals and study materials required for the training of District personnel.

1.22 WARRANTY

- A. The Contractor shall leave the entire electrical system in proper working order and shall, at his own expense, replace any work, material, or equipment furnished by him which develops defects within one year from the date of acceptance.
- B. The PLC supplier shall have a staff of experienced personnel available to provide service on 2 working days notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing the hardware and software delivered; and of implementing corrective measures.
- C. If the PLC supplier fails to respond in 2 working days, the District at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor or supplier from fulfilling the remainder of the warranty requirements.
- D. Prior to "final acceptance", the Contractor shall furnish to the Engineer a listing of warranty information for all manufacturers of materials and equipment used on the project. The listing shall include the following:
 - 1. Manufacturer's name, service contact person, phone number, and address.
 - 2. Material and equipment description, equipment number, part number, serial number, and model number.
 - 3. Manufacturers warranty expiration date.
 - 4. Completed test forms.

END OF SECTION

SECTION 16110
RACEWAY SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. The work under this section includes all equipment, labor and material necessary to furnish and install a complete raceway system including fittings, boxes and supports.

- B. Raceway shown in the schedule with multiple conduits shall be used for installing different types of conductors; for example power (120, 208, 240 and 480 VAC) conductors in the first conduit, control (discrete 24 and 120 VAC) conductors in the second and signal (analog 4-20 mA, 24 VDC and other instrumentation) conductors in the third.

1.02 QUALITY ASSURANCE

- A. All raceway shall comply with applicable standards of the Underwriter's Laboratories, Inc.

- B. Conduits, entering the bottom of pad mounted equipment under enclosure structural members design to be flush with the pad, shall be removed, reworked and reinstalled properly, so the conduit enters the manufacturer's recommended conduit area, unobstructed. These modifications to conduit and pad shall be at the Contractor's expense. Do not cut, bend or deform, pedestal, control panel or equipment enclosure steel to accommodate conduits.

1.03 SUBMITTALS

- A. Submit complete description and catalog data of all conduit and fitting types to be provided on this project.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable with Site Engineer, secure from weather or accidental damage.

PART 2 PRODUCTS

2.01 CONDUIT

A. Rigid Steel Conduit (RSC)

1. Rigid steel conduit shall be hot dip galvanized on the exterior and may be zinc or enamel on the interior.
2. Couplings, locknuts, and all other fittings shall be hot dip galvanized. All couplings and locknuts shall be of the threaded type only.
3. Bushings for standard weight rigid steel conduit shall be non-metallic for 1 inch and smaller. For conduits larger than 1 inch, insulated metallic bushings shall be used.

B. Plastic Coated Rigid Steel Conduit (PCRSC)

1. Plastic coated rigid steel conduit and fittings shall be hot dip galvanized prior to the plastic coating. The galvanized surfaces shall be coated with an epoxy-acrylic primer before plastic coating. The plastic coating shall be applied by the dip method. Minimum thickness of the exterior coating shall be 40 mils. The interior of conduit and fittings and all male threads shall be coated with 2 mils of urethane. PCRSC shall be manufactured by Rob Roy, Ocal or equal.
2. Couplings, locknuts, and all other fittings shall be hot dip galvanized and plastic coated. All couplings and locknuts shall be of the threaded type only. All couplings shall have longitudinal ribs 40 mils in thickness. Condulets shall be supplied with stainless steel screws. All screws shall be encapsulated in plastic.
3. Sealing hubs shall be similarly coated and be manufactured by Meyers type or equal.
4. Bushings for standard weight rigid steel conduit shall be non-metallic for 1 inch and smaller. For conduits larger than 1 inch, insulated plastic coated metallic bushings with grounding connection, where required, shall be used.
5. All damaged coatings shall be repaired according to the manufacturer's instructions.

C. Flexible Metallic Conduit (Flex)

1. Flexible metallic conduit shall be hot dipped galvanized steel.

2. Neoprene jacketed flexible metallic conduit shall be used in all damp or weatherproof locations where flexible conduit is required.
3. Fittings for flexible metallic conduit shall be hot dipped galvanized or sheradized, squeeze type. Fittings which use a screw to bind against tubing will not be accepted. Fittings for neoprene jacketed flexible conduit shall be of the screw in type.

D. Flexible Non-Metallic Conduit (NMFlex)

1. Flexible non-metallic conduit and fittings shall be heavy duty PVC. Conduit shall consist of PVC spiral surrounded by flexible PVC.
2. Flexible non-metallic conduit shall be liquid tight and fittings shall be corrosion resistant with stainless steel retaining rings. Provide sealing gaskets at all threaded connections. NMFlex shall be manufactured by Thomas and Betts or equal.

E. Polyvinylchloride Conduit (PVC)

1. PVC Conduit shall be rigid heavy weight type, Schedule 40 when encased in concrete or schedule 80 when exposed or not encased in concrete. PVC conduit shall be supplied complete with PVC fittings. PVC conduit shall be manufactured by Carlon or equal.

2.02 CONDUIT SUPPORTS

- A. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be spring-able wrought steel. Rings shall be bolted to or interlocked with the suspension rod socket.
- B. Pipe racks for groups of parallel conduits shall be constructed of galvanized structural steel preformed channels of length as required. Racks or channel shall be suspended on threaded rods and secured with nuts above and below the cross bar or bolted to concrete walls with stainless steel anchors.
- C. Pipe straps shall be the two piece bolted type. Pipe straps shall be coated to be compatible with the conduit (and coating) installed. .
 1. Similar support components in the wet well shall be stainless steel or coated galvanized steel as shown on the Drawings.

2. Conduit support components shall be manufactured by Unistrut, B-line or equal

2.03 FS BOXES

A. Cast boxes shall be galvanized, threaded, cast malleable iron. Cast boxes shall be manufactured by Appleton, Feraloy, Crouse-Hinds, or equal. Hub arrangements on threaded fittings shall be the most appropriate for the conduit arrangement required in each case to avoid unnecessary conduit bends and fittings. Use plastic coated FS boxes with plastic coated conduit.

2.04 VAULTS, PULLBOXES AND CABINETS

A. Cast boxes shall be galvanized malleable ferrous metal, gasketed and watertight, with threaded hubs and mounting lugs. Use plastic coated boxes with plastic coated conduit.

B. Provide underground vaults and pullboxes, where shown on drawings or required by length of conduit runs. Underground vaults and pullboxes shall be pre-fabricated concrete type shall be manufactured by Christy Concrete Products, Brooks or equal. All pullboxes shall have standard brass holddown bolts and hardware. Vaults and boxes located in paved areas or other areas over which vehicles normally may travel shall have traffic covers. All covers shall be labeled appropriately, i.e. ELECTRICAL, SIGNAL, TELEPHONE, etc... Provide cable supports in vaults and large boxes. Cable supports, saddles, arms, and racks mounted in pullboxes shall be manufactured by Underground Devices or equal.

C. Wire gutters shall be NEMA 4 with neoprene gaskets on the hinged doors or removable covers. Box and gutter sizes, metal thickness, and installation details shall comply with the National Electrical Code. Wire gutter shall be manufactured by Hoffman or equal.

2.05 CONDUIT IDENTIFICATION

A. The design documents (submittals and manuals) shall conform to Zone 7 documentation requirements. See Wunderlich-Malec drawings [standard Zone 7 requirements] GI001 and GI002 for additional requirements. All conduits shall be numbered per the District's standards.

2.06 DUCT SEAL

A. Duct seal shall be non-hardening compound designed for sealing between conduit and electrical cable. Duct seal shall be manufactured by O.Z., Gedney DUX or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General. Unless otherwise specified or indicated, wiring shall consist of insulated conductors installed in raceways of the types indicated. Provide pullboxes or conduit bodies in addition to those shown on the Drawings to limit the number of bends as required by the NEC.
1. Minimum size conduit installed on this project shall be 3/4 inch.
 2. Use the following types of conduit for the locations listed, unless indicated otherwise:
 - a. Use galvanized rigid steel conduit (GRS) for all exposed, dry locations.
 - b. Use plastic-coated steel conduit (PCRSC) outdoors in wet and damp locations, and below grade for direct-buried conduit where sand encased.
 - c. Use rigid polyvinyl chloride (PVC) conduit for concealed locations, for embedded conduit and conduit installed below grade in concrete duct banks, except use plastic coated steel conduit (PCRSC) at least 5 feet on both sides of penetrations through footings and outside walls, under equipment mounting pads, where embedded in exterior light pole foundations, and where conduit changes from underground to exposed or from embedded to exposed.
 - d. Use liquidtight flexible metal conduit (flex) with steel fittings for the last 18 to 36 inches of conduit run to a piece of equipment where required to isolate vibration or to facilitate maintenance or adjustment.
 - e. Electrical metallic tubing (EMT) shall not be used on this project.
- B. Conduit Installation
1. Conduit system installation shall meet or exceed the requirements of the NEC. Raceways shall be concealed or exposed, as indicated, and shall be at least 6 inches away from parallel runs of flues and steam or hot water pipes. Group raceways in same area together. Raceways shall be supported at intervals required by the NEC and shall have exposed runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Avoid field-made bends and offsets where possible, but where necessary make with an approved hickey or conduit bending machine. Heating of conduit to facilitate bending shall not be acceptable, except as noted hereinafter. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. Do not install crushed or deformed raceways. Avoid traps in raceways where possible. Take care to prevent the lodging of plaster, dirt, or trash in raceways,

boxes, fittings, and equipment during the course of construction. Raceways shall be entirely free of obstructions or shall be replaced. All conduit shall be reamed, deburred, and cleaned for proper introduction of wires and cables. Immediately after installation, plug or cap all conduit ends with watertight and dust tight conduit seals until the time for pulling wires. In block walls, do not run conduit in the same horizontal course with reinforcing steel.

2. Install insulated bushings on the ends of all conduits, except where conduits terminate in threaded hubs on cast boxes or cabinets. Provide plastic inserts where conduits terminate in threaded holes in cast boxes. Provide suitable expansion fittings for raceways crossing expansion joints in structures or concrete slabs, or provide other suitable means to compensate for expansion and contraction.
3. Wooden plugs inserted in concrete or masonry are not acceptable as a base for raceway fastenings, nor shall raceways or pipe straps be welded to steel structures. Support multiple raceways adjacent to each other by ceiling trapeze. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze fastened by toggle bolts or expansion shields on hollow masonry units, expansion shields on concrete or brick, and clamp-type fasteners approved for the type of installation on steelwork. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Use plastic coated fasteners and supports in plastic coated conduit systems. All metallic conduit supports, fasteners, and accessories shall be galvanized steel.
4. Conduit shall be of the greatest practicable single length between joints. Joints shall be made up with approved jointing compound. Do not use red lead as a joint compound. Do not use nails to fasten conduit. Do not use wire in lieu of straps or hangers, and do not notch structural members for the passage of raceways except with prior approval of the Engineer.
5. Install and equip conduit, boxes, and fittings installed outdoors or in other wet or damp locations so as to prevent water from entering the conduit. Provide sealing hubs. Do not run conduit in equipment foundation pads.
6. Provide a suitable seal inside each conduit or raceway entering buildings and structures, raceways entering boxes and enclosures in wet or hazardous locations.
7. Empty ducts and conduits shall be identified at both ends and shall be capped and provided with a 1/8-inch-minimum nylon cord, unless noted otherwise.

8. The Contractor shall run a mandrel through all unexposed conduits immediately prior to wire or pullstring installation to ensure conduits are clear of debris and foreign objects.
9. For PVC conduit, use factory-made ells where applicable. Use approved heating methods for forming all other bends. Provide expansion joints as required or as recommended by the manufacturer. When joining PVC conduit to metallic fittings, use approved PVC terminal adapters. When joining PVC conduit to rigid steel conduit, use an approved PVC female adapter. PVC conduit joints shall be solvent-welded with solvent recommended by the conduit manufacturer. Where PVC conduit is used, a separate grounding conductor shall be run with the conductors.
10. Concealed, embedded, and buried conduits shall emerge at right angles and shall have none of the curved portion of a bend exposed, unless otherwise approved by the Engineer. Where slabs are on grade, install conduit beneath the slab and not in the slab. Where ells are required to penetrate floor slabs, the ells shall be galvanized rigid steel conduit.
11. Where conduit size is 4 inches or less, final connection to motors, motor heaters, wall- or ceiling-mounted fans and unit heaters, dry transformers, and to other equipment where flexible connection is desired or required to minimize vibration or to facilitate maintenance or removal of equipment, shall be made with flexible conduit. Length shall be 18 to 36 inches, unless otherwise approved by the Engineer.
12. Flexible conduit shall never be used as a ground. Flexible conduit shall be secured with conduit clamps or equivalent means except where the flexible conduit is fished and where sections less than 4 feet in length are used in concealed areas for lighting fixtures.
13. Exposed conduit shall be neatly installed parallel to or at right angles to the structural members.
14. Exposed conduit stubbing up through the floor into the bottom of exposed panels, cabinets or equipment shall be lined up, properly spaced and shall be straight and plumb. Conduits shall be installed at sufficient depth below the floor to eliminate any part of the bend above.
15. Maintain at least 12 inches of separation between conduits carrying power and instrumentation cables.

16. Where flexible equipment chords are utilized for final connection to equipment use a compression type seal fitting. Crouse-Hinds CGB or equal.

C. Underground and Embedded Conduit

1. In general, trenches with two or more underground conduits shall be red concrete-encased PVC conduits (duct bank). In general, a single underground conduit in trench shall be sand encased PVC coated rigid steel conduit (PCRSC). Conduit under concrete slabs and foundations may be PVC conduit with PVC coated rigid steel conduit transitions and risers. Underground conduits provided for utility company cabling shall meet the requirements of the serving utility
2. Except as otherwise indicated, underground and embedded conduit shall be 24 inches deep, except conduit under building slabs may be just below the slab. Do not embed conduit in slabs. Conduit installation shall meet the requirements of the 1999 NEC.
3. Separate parallel runs of four or more conduits in a single trench or embedded duct bank with preformed, nonmetallic spacers designed for the purpose. Install spacers at 6 feet or at intervals not greater than that specified in the NEC for support of the type of conduit used. Support conduits installed in fill areas suitably to prevent accidental bending until backfilling is complete.
4. Groups of conduit shall be arranged substantially as shown on the Drawings, but minor changes in location or cross sectional arrangement shall be made as necessary to avoid obstructions, etc. Where conduit runs cannot be installed substantially as shown because of conditions not discoverable prior to digging of trenches, the condition shall be referred to the Engineer for instructions before further work is done. Underground conduit work shall be coordinated with other construction work.
5. All underground conduit shall be mandrelled prior to pulling wires/cables

D. Trenching and Backfill

1. Unless otherwise noted, conduit shall have a minimum cover of 24 inches. Trench bottoms shall be free of rocks and other hard objects. For direct buried cable and when rocks that cannot be removed are encountered at the trench bottoms, sand bedding material shall be used for a depth of 3 inches below the conduit. In any case, bedding material shall be used for the zone 6 inches above the direct burial conduit.

2. Bedding material shall contain no rocks larger than 3/4 inch in diameter and shall be free from roots and debris.
3. Where conduit trenches are located in roads or in structural backfill, the compaction requirements shall be as required by the agency that has jurisdiction for those areas. Where conduit trenches are located in an area where backfill material specifications are more rigid than those of this Section, the trench backfill shall meet the more rigid specification. In any event, trench backfill compaction shall be as required by the Specifications.
4. Conduits shall be placed parallel in the bottom of the trench. Where conduits are required to cross, they shall be separated by a minimum of 3 inches of bedding material. Where more than one level of conduit are placed in the same trench, they shall be separated by a minimum of 3 inches of bedding material.
5. Conduit trenches in paved or improved areas shall be installed and backfilled before the area is paved or improved.
6. For trenches through existing paving, the paving shall be saw cut in order to obtain a neat vertical edge for repaving. Saw cuts shall be parallel and shall be a minimum of 6 inches outside of the trench area. Unless covered by other sections of the Specifications, paving shall be replaced in accordance with the original paving Specifications.
7. All existing improvements damaged as a result of the Contractor's operation shall be reconstructed by the Contractor at no cost to the Owner.

E. Penetrations

1. Penetrations may be cast in place or run through blockouts or holes, except where waterproof penetrations are required. Dry pack with nonshrink grout around conduits run through blockouts or holes.
2. Where a waterproof penetration through a concrete structure is shown on the Drawings or called out elsewhere in the Specifications, an approved malleable-iron watertight entrance sealing device shall be provided. Each end of the device shall have a gland-type sealing assembly with pressure bushings which may be tightened at any time, except where a concrete envelope is specified or shown on the Drawings. Where there is a concrete envelope specified or shown on the Drawings, a sealing gland assembly may be on the more accessible side only. The device shall be securely anchored into the concrete with one or more integral flanges. The sealing device shall be OZ/Gedney Type WSK, or equal.

F. Existing Conduit

1. The contractor shall submit a formal request for clarification or proposal to reuse any existing conduit(s) and or conductors when new conduit and/or conductors are called for on the Drawings.

G. Boxes

1. Provide each outlet in the wiring or raceway systems with an outlet box to suit the conditions encountered. Each box shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of the NEC. Provide flush or recessed fixtures with separate junction boxes when required by the fixture terminal temperature requirements. Boxes used with concealed conduits shall be flush mounted, unless otherwise indicated. Boxes must be accurately placed for finish, independently and securely supported by manufactured box hangers. Fixture outlets shall be located symmetrically.
 - a. Install cast boxes outdoors, in wet or damp locations, with exposed conduit and with embedded and buried conduit. Cast boxes installed with threaded conduit shall have threaded hubs. Cast boxes installed with PVC or plastic coated conduit shall be similarly coated.
 - b. Boxes in concealed conduit systems, other than in cast-in-place concrete and exterior faces of walls or where weatherproof devices are required, shall be galvanized or cadmium plated steel.
2. Underground pullboxes shall be sized by contractor in accordance with NEC Article 370. Underground pullboxes shall be precast concrete type as shown on the Drawings complete with steel traffic covers, extension rings and concrete bases. Entire box shall be sealed to prevent entrance of mud and rainwater. Conduits shall enter box horizontally, not vertically. Conduit entry shall be grouted in place with approved insulated bushings. Seals shall be installed in conduits around conductors to prevent water from entering the conduit system.
3. Unless otherwise shown on the Drawings, install boxes in a rigid and satisfactory manner, and support boxes independently of the conduit. For frame construction, use bar hangers; on concrete or brick, fasten directly to the surface using bolts or expansion shields; on hollow masonry units, use toggle bolts or expansion shields; and on steelwork, use machine screws. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Where boxes are flush mounted in walls, if not embedded in concrete, the hole shall be no larger than required to receive the box. Set flush-mounted sheet steel boxes flush with the finished surface, providing them with

suitable extension rings or plaster covers as required. Mounting hardware in industrial areas shall be galvanized.

3.02 ELECTRICAL CONTINUITY

- A. The entire electrical raceway system shall form a continuous metallic electrical conductor from service point to every outlet and shall be grounded by connection to the main service ground.
- B. Rigid steel conduit shall have threads filled with conductive sealant before screwing into fittings.
- C. A ground wire shall be installed in all PVC and flexible conduit, as required by code.

3.03 TRENCH SETTLING:

- A. If at any time during a period of one year dating from the date of final acceptance of the project, there shall be any settlement of conduit trenches, the Engineer may notify the Contractor to immediately provide additional fill and to make such repairs or replacements in paving, planting, or structures, as may be deemed necessary at the Contractor's expense.

3.04 TRENCHING:

- A. Verify the location of all existing cables, conduits, piping, and other equipment in or near the areas to be trenched, prior to starting trenching. Repair any equipment damaged during trenching. Trenches shall not be left unattended unless the area is fenced or barricaded to restrict entry to the area. Call an Underground Service firm before trenching.

3.05 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.

END OF SECTION

SECTION 16120

WIRE AND CABLE

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment and incidentals required to install wire and cable for a complete operable electrical system as shown on Drawings.

1.02 QUALITY ASSURANCE

- A. All raceway, wire and cable shall comply with applicable standards of the Underwriter's Laboratories, Inc.

1.03 SUBMITTAL

- A. Submit complete description of all power, signal, communication and instrumentation cables including name of the manufacturer, type of insulation, type of conductor, and size and catalog number of control, instrument signal cables.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable to the District, secure from weather or accidental damage

PART 2 PRODUCTS

2.01 MANUFACTURER'S LABELING

- A. Electrical conductors shall be delivered to the job site plainly marked or tagged on 24 inch centers as follows:
 - 1. Underwriter's Laboratories Label
 - 2. Gauge
 - 3. Voltage
 - 4. Kind of Insulation
 - 5. Name of Manufacturer
 - 6. Trade Name

- B. Conductor labels shall be white PVC tubing with machine printed black marking. Tubing shall be sized to fit conductor insulation. Adhesive strips are not acceptable. Machine printed markings, directly on conductors, will be accepted. Panduit, Thomas & Betts, or equal.

2.02 INSULATION

- A. All conductors shall be rated at 600 Volts.
- B. All wiring shall be type THWN/THHN unless shown otherwise.
- C. All conductors shall be sized for operation at 75 degrees C maximum operating temperature.

2.03 CONDUCTORS

- A. Unless specifically noted otherwise herein, all conductors for general wiring shall be a minimum of 98% conductivity, stranded, soft drawn copper. Aluminum or aluminum alloys are not acceptable. Conductors, including insulation, cabling, jacket, filler, shielding, covering, and testing, shall meet applicable requirements of IPCEA S-19-81 and S-61-402, the NEC, and UL. Unless noted otherwise, conductors shall have 600-volt type THWN insulation.
- B. 120 Volt control, indicator, signal and metering conductors may be #14 AWG, and shall be stranded.

2.04 SPECIALTY CABLES

- A. Instrumentation signal cables shall be of the type used for process control with twisted shielded pairs of triads with PVC jacket an overall shield over the multiple pairs or triads. Two conductor (pair) cable shall have black-clear insulation, three conductor cable shall have black-red-clear insulation. The instrumentation cable shall be rated 600 Volts at 60 degrees C or better. The size of the instrumentation cable shall be AWG No. 16 with seven strands minimum. All instrumentation cables shall be UL listed. Shield shall be an aluminum-backed synthetic material providing 100-percent shielding, with a copper drain wire. The cable shall be rated 90 degrees C minimum. Twisted shielded pair (TSP) cable shall be manufactured by Belden series 8719 or equal.
- B. Telephone Cable (TIC) shall consist of 2 to 12 pairs with 24 AWG conductors of soft bare copper. Conductors shall have thermoplastic compound insulation and shall be color coded per the telephone industry standards. The entire cable assembly shall have an outer jacket of black polyethylene that is resistant to abrasion, moisture, weather and

environmental cracking. Cable shall be suitable for installation in conduit or direct burial and shall be manufactured by Alpha, Belden or equal.

- C. Coaxial Cable (Coax) shall be heavy duty and sized for the length of run and communication equipment requirements. Coax shall be provided and submitted with the communication equipment.
- D. Ethernet Cable (Ethernet) shall be heavy duty with a UV resistant outer jacket, shielded, gel type with power conductors rated for 100 Mbits/second transmission minimum.
- E. Other specialty cables shall be provided by the manufacturer of the equipment or instrument they connect to.

2.05 PULLING LUBRICANT AND ROPES

- A. Wire pulling lubricant shall be "Flax-soap", "minerallac" or equal.
- B. Pullropes shall be 3/16" stranded nylon rated for 800 lbs.

2.06 CONNECTION

- A. Wire nuts for joints, splices and taps for conductors #8 and smaller shall consist of a cone shaped expandable coil spring insert, insulated with a teflon or plastic shell. Threaded or crimp types will not be accepted. All wire nuts shall be taped. Use "Skotchlock", "Hydent", or equal.
- B. Terminals for stranded conductors #8 and smaller shall be a pre-insulated crimp type.
- C. Lugs and connectors for conductors #6 and larger shall be compression types of one piece tubular construction with flat rectangular tongues. Two hole lugs shall be used for sizes 4/0 and larger. Fittings for copper conductors shall be tin-plated copper.
- D. Electrical tape shall be UL approved plastic.
- E. Splices shall not be installed in raceway. Splice wires in approved boxes or condulets only.

2.07 GROUNDING WIRE

- A. Ground wires, number 1/0 AWG or larger shall be tinned stranded bare copper cable. All smaller ground wires shall be insulated with green color insulation.

PART 3 EXECUTION

3.01 CLEANING

- A. All debris and moisture shall be removed from both new and existing raceways, boxes, and cabinets before installing wire or cable.

3.02 PULLING

- A. No oil, grease or similar substances shall be used to facilitate the pulling in of conductors. Use a specifically approved wire pulling compound.
- B. No wire or cable shall be pulled in until all construction which might damage insulation or fill conduit with foreign material is completed.
- C. Wire shall be pulled into conduits with care to prevent damage to insulation, using basket pulling grips to avoid slipping of insulation on conductors. Nylon rope or other "soft" surfaced cable must be used for pulling in conduits other than steel.

3.03 CONNECTIONS

- A. Stranded conductors #8 and smaller shall be terminated with terminals of appropriate size where connected to screw type lugs.
- B. Joints, splices and taps in dry locations for conductors #8 and smaller shall be made with twist-on connectors suitably sized for the number and gauge of the conductors.
- C. Furnish and install proper lugs in all panelboards, pedestals and gutters as required to properly terminate every cable. Where paralleled conductors, or conductors of large size are to terminate on a breaker, a short length of copper cable (of capacity of the breaker) shall be connected to the breaker, and the proper compression type lug installed to connect this cable to the feeder cable. The cutting of cable strands to fit the breaker will not be permitted.
- D. Only crimping tools approved by the manufacturer of the terminals or lugs shall be used.
- E. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire. Wire in pedestals, panels, cabinets, pullboxes and wiring gutters shall be neatly grouped together with cable ties or other methods acceptable to the Engineer.
- F. In underground location, joints, splices and taps shall be insulated by the "Skotchcast" epoxy-resin method. In-line splices may be insulated by approved waterproof "shrink

tube" method. Splices shall be made if specifically approved by the District (on a case by case basis).

- G. In panels, pullboxes, gutter, etc. conductor shall be neatly fanned out and tagged with wire markers. Conductors installed as part of this project but for connection to equipment to be installed in the future shall be 50% longer than the estimated final connection length, neatly coiled and sealed for storage in the equipment's respective pullbox.
- H. At outlets, junction boxes, pullboxes, fittings, etc., conductors shall be looped or pigtailed to extend at least six inches without splice beyond such wiring enclosures, and where used, pigtails added to loops for connection to fixtures or devices shall be at least six inches long.
- I. Conduit shall be capped during construction by means of manufactured conduit seals or caps to prevent entrance of water or debris, and shall remain closed until ready for use
- J. Splices shall not be installed in raceway. Splice wires in approved boxes or condulets only.
- K. In general, avoid splices on all cables run into the wet well. All terminations shall be on terminal blocks in an appropriate enclosure.

3.04 COLOR CODING AND LABELING

- A. All conductors shall color coded per the District's standards (note that internal panel wire colors are different in some cases from external wire colors).
 - 1. 120 VAC; Hot - Power Distribution - Panelboard to device or control panel- Black.
 - 2. 120 VAC; Neutral - Power Distribution - Panelboard to device or control panel - White.
 - 3. Ground - Any type - Green.
 - 4. 120 VAC; Hot - Internal - Control Panel - Red, 120 VAC Neutral - Internal - Control Panel - White.
 - 5. 24 VDC Positive - Internal - Control Panel - Blue.
 - 6. 24 VDC Common - Internal - Control Panel - White with Blue Stripe.
 - 7. Externally Supplied Voltage - Voltage from another panel - Internal inside Control Panel - Yellow.
 - 8. AC Hot less than 120 VAC - Internal - Control Panel - Orange AC Neutral less than 120 VAC - Internal - Control Panel - Brown.
 - 9. Intrinsically Safe Wiring - Light Blue.

10. Instrument Cable (i.e. 4-20 mA) external - twisted shielded pair - red positive, black negative.
11. Three Phase Power Distribution - External - Phase A - Black with Brown phasing tape
Three Phase Power Distribution - Phase B - Black with Orange phasing tape
Three Phase Power Distribution - Phase C - Black with Yellow phasing tape.

B. In addition to color coding, all power, control, and alarm wiring shall be numbered and identified by means of wire markers at all pedestals, panelboards, auxiliary gutters, junction boxes, pull boxes, receptacle outlets, light outlets, manholes, disconnect switches, and circuit breakers. These markers shall correspond to numbers on shop drawings and wiring diagrams. Wire markers shall consist of machine engraved numbers applied by an approved marking device. Provide Brady heat shrink labels or equal.

1. Not used.
2. For Zone 7 wire labeling, the submittal documents (submittals and manuals) for the equipment shall conform to Zone 7 panel documentation requirements. See Wunderlich-Malec drawings [standard Zone 7 requirements] GI001 and GI002 for additional requirements. The drawing documents shall be combination schematic, loop drawing and interconnection drawing. other requirements include All loop related drawings shall start at drawing number XXX-100 (XXX denotes the site number) and All wires shall be labeled. All wires shall have a unique label unless it is used as part of an AC or DC bus. All wires shall be shown terminating on a terminal block unless it is used as part of a bus. All terminal blocks shall have labels. All terminal blocks shall have unique labels unless it is used as a bus. The first two digits of the terminal number shall be the last two digits of the drawing number. The last two digits of the label shall be sequentially assigned from the top of the drawing to the bottom of the drawing starting at 00. Provide terminal junction boxes (tjb), for maintenance purposes, for the flowmeter and pressure transmitters. The TJB shall include knife disconnect terminal blocks, for all analog transmitters, for calibration purposes. All conduits shall be numbered per the District's standards.

3.05 SEALING CONDUCTORS IN CONDUITS

- A. All conduits containing conductors shall be sealed as the conduit enters pull boxes and vaults. Power conductor, control conductors, and instrumentation conductors shall be bundled and supported separately and independently in pullboxes.

3.06 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical. Contractor shall furnish necessary instruments and personnel required for testing.

END OF SECTION

SECTION 16150

MISCELLANEOUS ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment and incidentals required, and install, complete ready for operation, and field test the miscellaneous electrical equipment as shown on the Drawings and/or specified herein.

1.02 QUALITY ASSURANCE

- B. All equipment and components shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- C. Provide enclosures suitable for the type of location in which they are located per Specification Section 16010, General Requirements, Electrical

1.03 SUBMITTAL

- A. Submit catalog data on all equipment covered by this section as set forth in Section 16010, General Requirements, Electrical.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable with Site Engineer, secure from weather or accidental damage

PART 2 PRODUCTS

2.01 PILOT DEVICES

- A. Pilot devices shall be heavy-duty oil tight and shall perform the functions indicated. Pushbuttons, selector switches, and indicating lights shall be heavy-duty, oil tight, 30mm type, and manufactured to the requirements of NEMA ICS. Provide suitable NEMA- rated enclosures or mount in panels as indicated. Pilot devices shall be manufactured by Square D, Allen-Bradley, Cutler-Hammer or approved equal.

2.02 RELAYS

- A. Control relays shall be plug-in type with hold-down clamps and led indicators, unless noted otherwise. Plug-in relays shall be UL listed, enclosed, with contacts rated 10 amps at 120-volts-60 Hz, and 28 volts DC. Enclosures shall be clear plastic. Relays shall operate reliably at 80 percent of rated coil voltage. Coil burdens shall be not greater than 1.5 watts for DC coils or 2.6 VA for 60-Hz coils. The relays shall be IDEC RR Series, or equal.
- B. Machine tool type relays shall be rated B300. Machine tool relays shall be manufactured by Allen-Bradley, Cutler-Hammer, Square D or equal.
- C. Time delay relays with required ranges up to 180 seconds shall be enclosed and shall operate properly at any voltage within plus or minus 15 percent of the nominal voltage rating, and shall have a time delay on energization or deenergization, as required, which is knob-adjustable over the range 2 to 180 seconds. They shall have double-pole double-throw contacts rated 10 amps at 120 volts, 60 Hz. Time delay relays shall be manufactured by Idec RTE series, or equal.
- D. Phase Failure Relays shall detect phase over voltage and under voltage conditions. Provide an adjustable drop out setting and an adjustable time delay on drop out. Phase failure relays shall be manufactured by Diversified, Timemark or equal.

2.03 WIRING DEVICES

- A. Light switches shall be specification grade and shall be manufactured in accordance with UL 20. Switches shall be single pole, rated for 20 amps at 277 VAC. Switches shall be Hubbell 1221, Leviton 1201-2, or equal..
- B. Receptacles shall be duplex and rated 20 amps at 120 VAC, 2 pole, 3 wire, NEMA type 5-20R and specification grade. Receptacles shall be Hubbell, Leviton or equal, GFI type where shown on the Plans.
- C. Device cover plates shall be suitable for the environment in which they are installed. Stainless steel cover plates inside and weatherproof covers outside. Where weather protection is required with a plug in the receptacle, clear plastic bubble covers shall be provided.

2.04 UTILITY SERVICE EQUIPMENT

- A. The electric service meter compartment shall be arranged as shown to meet the electric utility company requirements. Provide neutral bar for grounding 120/240 volt, 1 phase 3 wire service. Provide wire and lugs for service entrance as required by utility company.

The pull section and utility compartments shall be accessible only by the utility company. Provide a meter base, test perch with test by-pass and other materials, as required by the electric utility which will provide service to the facility, for installation of metering equipment and attachment of service conductors.

- B. Provide circuit breaker, lightning arrestor, power distribution blocks and other components as shown on the Drawings. A ground bus shall be provided. It shall be connected to the service ground. Screw type lugs shall be provided for connection of equipment grounding conductors. Provide a receptacle in each enclosure section. All external and dead front receptacles shall be installed on ground fault interrupter circuits "GFCI".
- C. Furnish and install a U.L. listed weatherproof, vandal resistant, NEMA 3R, pedestal style meter/main enclosure. The enclosure shall be manufactured by TESCO, Class 27-000 and include dead front interior and hinged gasketed exterior doors. Outer enclosure shall be constructed of 12 gauge hot dipped galvanized steel. Doors shall be equipped with 316 stainless steel handles with 3-point roller bearing latches and hasps for owner padlocks. Concrete base with anchor bolts to meet applicable seismic requirements shall be provided.

2.05 POWER DISTRIBUTION BLOCKS

- A. Power distribution blocks shall be rated for the conductor size, conductor material, current and voltage of the system, with the number of poles required. Power distribution blocks shall be IlSCO PDB Series or equal.

2.06 MOTOR STARTERS

- A. Size per applicable Electrical Codes. Accept the minimum NEMA size shall be size 1. Where a combination starter is required, use a type with circuit breaker disconnecting device unless shown otherwise.
- B. Running Overload Protection: An overload relay shall be installed in each ungrounded motor circuit leg. They shall be sensitive to motor current only, have inverse time characteristics, and be of the manual reset type with a reset button operable from the outside of the starter enclosure. They shall be temperature compensated type. Select the overload relay heaters as required by the applicable Electrical Code only after the actual nameplate data for the motor has been determined.
- C. Provide and install all control devices not otherwise provided for. This includes specifically: control transformers, pilot devices, push buttons and selector switches, auxiliary contacts, etc., which are required to be mounted on or within the starter

enclosure. Each starter contactor shall be provided with at least one extra N.O. auxiliary contact..

- D. All motor starters shall be installed in enclosures suitable to the conditions and provided with a nameplate identifying the equipment controlled.
- E. Provide and install any specialty relays required by the various pump manufacturers at no extra cost to the District.
- F. Starters shall be manufactured by Cutler-Hammer AN16, Square D, Allen-Bradley or approved equal.

2.07 PANELBOARDS

- A. Panelboards shall be of a type and rating as shown on the Drawings. They shall be dead front with hardware for accepting molded case bolt-on circuit breakers of the maximum size allowable in each space. The entire assembly including circuit breakers shall be rated for not less than the available short circuit current shown on the Drawings (22,000 Amps symmetrical when not otherwise indicated). Circuit breakers shall meet the requirements of Specification Section 16180, Overcurrent Protective Devices.
- B. Circuit breakers for motors shall be pad-lockable open.
- D. Panelboards installed in metering pedestals shall utilize the pedestal manufacturer's standard enclosure design.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Follow the manufacturer's installation recommendations unless otherwise indicated. Keep copy of the manufacturer's installation instructions available on the job site for review at all times.
- B. Install freestanding equipment in accordance with the manufacturer's recommendations. Secure freestanding equipment rigidly to floors or mounting pads with anchor bolts, expansion shields, or other approved means.
- C. Equipment installation, including supports, anchors, and restrainers, shall meet the requirements specified in Section 16010, General Requirements, Electrical.

3.02 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.

END OF SECTION

SECTION 16180

OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment and incidentals required, and install overcurrent protective devices as shown on the Drawings and as required to protect all circuits in strict accordance with applicable Electrical Codes. Overcurrent protective devices may be required as a component of disconnect switches, transformers, motor starters, switchboards, motor control centers, panelboards or mechanical equipment.

1.02 QUALITY ASSURANCE

- A. All overcurrent protective devices shall comply with applicable standards of the Underwriter's Laboratories. Circuit breakers and other devices shall be UL labeled.

1.03 SUBMITTALS

- A. Submit material or equipment data in accordance with the Specification Section 16010, General Requirements, Electrical. Submit name and qualifications of testing service when applicable.

PART 2 PRODUCTS

2.01 CIRCUIT BREAKERS AND MOTOR CIRCUIT PROTECTORS

- A. Switchboard and motor control center mounted molded case circuit breakers shall be of the proper type and rating for each application. They shall be molded case, thermal-magnetic, with inverse time characteristic response - temperature compensated. Motor circuit protectors shall be similar to circuit breakers except with adjustable magnetic trip and no thermal trip. The fault current interrupting rating shall not be less than that shown on the Drawings (25,000 ASYM minimum). Provide auxiliary contacts were shown on the Drawings.
- B. Panelboard circuit breakers shall be bolt on type unless noted otherwise. Multiple pole breaker must be manufactured as a single unit. Use of "tandem" circuit breakers or "two in the space normally occupied by one" will not be acceptable. The fault current interrupting rating shall not be less than that shown on the Drawings (10,000 ASYM minimum).

- C. Circuit Breakers shall be manufactured by Cutler-Hammer, Square D or equal.
- D. Enclosed circuit breakers shall be as indicated on the Drawings and as required by applicable Electrical Code. The enclosures shall have been manufactured specifically for the type of circuit breaker provided and shall be UL listed.

2.02 FUSES

- A. Fuses shall be provided for all fuse holders as shown on the Drawings and specified herein. They shall be current-limiting, non-renewable as indicated on the Drawings - Fusetron or Limitron type manufactured by Bussman or equal. Provide at least 3 spare fuses for each size and class of fuse used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Circuit breakers and fuses are to be installed in accordance with manufacturers' instructions. Fuses must seat solidly with all contact surfaces bearing evenly. Replace warped, weak, or broken fuse clamp terminals. Do not attempt to repair or bend back into position.
- B. Enclosed circuit breakers are to be installed plumb and rigidly secured to structure or equipment with wood screws, bolts and expansion anchors, or machine bolts and locknuts as applicable. Nameplates shall be installed as indicated in Section 16010, General Requirements, Electrical.

3.02 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.
- B. In addition, test all circuit breakers required to be tested by code. Provide the services of a qualified testing service.

END OF SECTION

SECTION 16400

UTILITY EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide modifications to utility power service as described in the Specifications and shown on the Drawings. Provide and install all service entrance equipment, cabinets, vaults, pads, pull boxes, raceways, risers , supporting structures, conduit, concrete encasement, pullropes and conductors as required by the serving utilities.
- B. Make the "application for service" and coordinate all service requirements with the utility companies (PG&E) in accordance with their rules and requirements. Obtain Drawings of actual service equipment installation requirements from the utilities prior to construction. Submit equipment and devices to the utility companies in compliance with their requirements.
- C. Provide temporary power during construction. Pay for equipment rental, fuel, power, etc. Remove temporary facilities after completion of construction.

1.02 QUALITY ASSURANCE

- A. All work and material provided shall be in strict accordance with each utility company's rules, requirements, and standards, but in no case less than the requirements of this Specification. Coordinate all work, outages, etc., with the various utility companies, the District and others to prevent unnecessary delays in the progress of construction.

1.03 SUBMITTALS

- A. Submit material or equipment data in accordance with the Specification Sections 01300, Submittals and 16010, General Requirements, Electrical.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials shall be as specified by the utilities, but in no case less than the requirements of this Specification.
- B. Where specifically required by the utility companies, provide concrete encasement or sand bed with geotextile grid envelope in utility trenches per their standards.

- C. The metering equipment and pull section shall be provided as shown on the Drawings and shall be rated for 120/240 volts, 1 phase, 3 wire with current rating as shown on the Drawings and 25,000 Amps RMS symmetrical, unless shown otherwise. The metering equipment shall be UL listed and shall be equipped with a metering socket and provision for utility transformers and shall meet the requirements of the serving utility company. Metering equipment shall be manufactured by Tesco or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of all structures and equipment shall be in strict accordance with utility company standards.
- B. Brady "Identoline" identification tape shall be laid in Utility trenches. At a depth of 12" below finished grade and at least 6" above installed equipment, lay a 6" wide yellow warning tape on the compacted backfill for the full length of the trench. Do not stretch the tape. Use Brady "Identoline" stating: "CAUTION BURIED ELECTRICAL LINE". Installation of identification tape under building slabs is not required.
- C. Trenching and backfill shall be accomplished in accordance with utility requirements and the requirements of this specification. Coordinate raceway placement, use of conduit spacers, installation of sand bed, geotextile grid envelope and backfill, electronic markers, etc. with applicable utility.

3.02 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical..

END OF SECTION

SECTION 16410

GROUNDING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide a complete grounding system such that the entire raceway system including all equipment enclosures, fixtures and convenience outlets are solidly connected to ground.
- B. Provide an electrode ground (ufer) in the equipment pad and a ground rod for the new service.
- C. Ground all fences and gates to the switchboard ground.

1.02 QUALITY ASSURANCE

- A. Grounding shall be executed in accordance with all applicable codes and regulations.
- B. Ground testing shall be verified using NETA acceptance testing standards.

PART 2 MATERIALS

2.01 GENERAL

- A. Use materials made by Burndy, Erico (Cadweld), or equal.
- B. Ground conductors shall be sized according to the NEC.

PART 3 EXECUTION

3.01 GENERAL

- A. Unless otherwise indicated, ground all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in accordance with the NEC, State, and other applicable laws and regulations.
- B. Provide grounding points (foundation ground points) at each pedestal and enclosure. Grounding electrode conductor shall be copper, No. 3/0 minimum size, connected to a 20-foot-minimum-length piece of reinforcing steel located near the bottom of the concrete foundation. Attach the ground wires to the reinforcing steel by thermite welding.

- C. Where ground rods are indicated or used, they shall be copper clad, not less than 3/4 inch in diameter, 8 feet long, driven full length into the earth.
- D. Make ground connections by brazing, thermite welding, or with approved pressure terminals or mechanical grounding devices, except inaccessible connections shall be made by thermite welding.
- E. The point of contact of each thermite weld shall be wire brushed or filed to a bare metal surface. Thermite welding cartridges and molds shall be used in accordance with the manufacturer's recommendations. After the welds have been made and cooled, slag shall be brushed from the welded area and the joint thoroughly cleaned.

3.02 EQUIPMENT GROUNDING

- A. All exposed noncurrent-carrying metal parts of fixed equipment shall be grounded.

3.03 CONDUIT

- A. All PVC, non-metallic raceways and all flexible raceway shall be provided with grounding conductors to maintain continuity of raceway ground system.
- B. The Contractor shall exercise care to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.04 GROUND BUS

- A. Each control panel, panelboard, starter, motor control center, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall be equal to panelboard neutral bus and shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

3.05 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.
- B. In addition, test the ground using a NETA acceptance testing method.

END OF SECTION

DIVISION 17 – INSTRUMENTATION

SECTION 17000

SECTION 17010

INSTRUMENTATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provide and install all instruments, devices, wiring, terminal blocks, accessories, and enclosures as specified herein and as shown on Contract Drawings for the instrumentation system. The Contract Documents are intended as an outline for the work and are descriptive of the type of hardware and software configuration to be provided. Any error or omission of detail shall not relieve the Contractor from the obligations thereunder to provide and install in correct detail any and all materials necessary for a complete operational instrumentation system, at no additional cost to the District.
- B. Work includes that specified in Division 16, Electrical.
1. The contract documents are not intended to cover every detail of materials, configuration, or construction. The Contractor shall furnish all tools, temporary utilities, materials, setup, parts, labor, and other incidentals necessary to fully complete the entire work, whether or not said details are particularly shown or specified, all at no additional cost to the District.
 2. Coordinate the installation of instruments and accessories in the pedestal and RTU panel as shown on the Drawings.
- C. The major components for in the instrumentation scope of work which includes both the furnishing and installation are:
1. Flow Meter.
 2. Pressure Indicator/Transmitters.
 3. Vault Flood Level Switch
 4. Accessories
 5. Intrusion Alarm Sensor

1.02 RELATED WORK

- A. Installation of primary elements which require placement into or taps off of a process flow line is included under Division 15000 Mechanical. Electrical equipment interface, control panels, conduit and cable for instrumentation is covered in Division 16000 Electrical.

1.03 QUALITY ASSURANCE

- A. All equipment shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- B. Provide enclosures suitable for the type of location in which they are located per Specification Section 16010, General Requirements, Electrical.

1.04 SUBMITTALS

- A. Provide submittals and drawings as specified in Section 16010, Electrical, General Requirements.
- B. All drawings shall be submitted in 11" x 17" format.

1.05 OPERATION AND MAINTENANCE MANUALS

- A. Provide operating instructions as specified in Section 16010, Electrical, General Requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. It is the intent of the Contract Specifications and Drawings to secure the highest quality in all materials and equipment in order to facilitate operation and maintenance of the plant. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product.
- B. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced and anchored; and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile and competitive grade devices of doubtful durability shall not be used.
- C. 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 approved by the Engineer prior to installation.

- D. The equipment specifications have been prepared on the basis of the equipment first named in the Specifications. The Contractor shall note that the second named equipment, if given, is considered acceptable and equal equipment, but in some cases additional design, options, or modifications may be required, at no additional cost to the , to meet Specifications.
- E. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting or operator interaction when power is restored.
- F. Signal transmission from remote or field electric and electronic devices shall be 4-20 mA, powered by a 24 VDC loop supply from the panel that is to receive the signal. Nonstandard transmission methods such as impulse duration, pulse rate, and voltage regulated will not be permitted except where specifically noted.
- G. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission.
- H. The submittal documents (submittals and manuals) for the Zone 7 equipment shall conform to Zone 7 panel documentation requirements. See Wunderlich-Malec drawings [standard Zone 7 requirements] GI001 and GI002 for additional requirements. The drawing documents shall be combination schematic, loop drawing and interconnection drawing. other requirements include All loop related drawings shall start at drawing number XXX-100 (XXX denotes the site number) and All wires shall be labeled. All wires shall have a unique label unless it is used as part of an AC or DC bus. All wires shall be shown terminating on a terminal block unless it is used as part of a bus. All terminal blocks shall have labels. All terminal blocks shall have unique labels unless it is used as a bus. The first two digits of the terminal number shall be the last two digits of the drawing number. The last two digits of the label shall be sequentially assigned from the top of the drawing to the bottom of the drawing starting at 00. Provide terminal junction boxes (TJB), for maintenance purposes, for the flowmeter and pressure transmitters. The TJB shall include knife disconnect terminal blocks, for all analog transmitters, for calibration purposes. All conduits shall be numbered per the District's standards.

2.02 PRESSURE INDICATOR/TRANSMITTERS

- A. The pressure transmitters shall be of the bourdon tube, gauge type suitable for mounting on a pipe or wall. The pressure transmitters shall include a 4.5 inch gauge indicator. The gauge shall indicate in units of PSIG. Unless otherwise specified, wetted parts shall be Type 316 stainless steel. Internal (non-mechanical) components shall be hermetically sealed. Over-range capaDistrict shall not be less than 130 percent of maximum range. Span shall be adjustable over a 4:1 or greater range. Zero s

- B. uppression capability shall be provided. External zero adjustment shall be provided. Accuracy shall be 0.5 percent and repeatability of 0.1 percent of span. The unit shall be Factory Mutual Listed.
- C. Pressure transmitter shall be manufactured by Ashcroft part number 45-2279-SSH-04L-XFM-160 psi or preapproved equal. The range of the pressure transmitter shall be calibrated for 0-160 PSIG input and two wire 4-20 mA output.

2.03 Not Used

2.05 VAULT FLOOD LEVEL SWITCH

- A. The float level switches shall use the movement of a float, the weight of whose moving parts is less than that of the displaced process liquid, to actuate switches as the level rises and falls. The switches shall be integrally mounted within the float and connected to a terminal box by a waterproof electric cable.
- B. The switch covering shall be made of indestructible polypropylene material. The cable shall be PVC coated. The switches shall be reversible such that the switching action operates on rising or falling level. The switch contacts shall be rated for 250 volts ac or dc and 5 amperes minimum, and shall be terminated with 14 AWG wires in a NEMA 4X terminal box.
- C. Float level switches shall be as manufactured by Flygt Corporation ENM-10 with cable lengths as required to complete the installation, or approved equal.

2.06 ACCESSORIES AND MISCELLANEOUS COMPONENTS

- A. Isolators. The current/current (I/I) and voltage/current (V/I) isolators shall have all solid state circuitry mounted in plug-in modules. Each isolator shall provide complete isolation and amplification of the 4-20 mA output signal from the 4-20 mA or 1-5 VDC input signal and the isolator power supply. The output signal shall be capable of driving a 600 ohm load. Accuracy shall be +/- 0.25% of span. The isolators shall be powered from a 120 VAC source. Isolators shall be intrinsically safe where shown on drawings. Each isolator shall have a seven year warranty. The isolators shall be as manufactured by AGM Electronics, Action Instruments, or equal.
- B. Intrusion switches shall be Square D, Class 9007, model ZCKJ2 with roller arms and other accessories required to complete the installation, or equal.
- C. DC Power Supplies:
 - 1. Each DC power supply shall use a "linear" type power conversion. "Switching" type power supplies are not acceptable. Each power supply shall be capable of providing

the current and voltage rating shown under continuous operation while maintaining all parameters within the limits specified. The AC input voltage step-down transformer shall have separate and isolated primary and secondary windings. This transformer shall provide a minimum of 3,000 V RMS isolation between the input & ground and input & output. The output of the power supply shall be floating; either output terminal may be grounded or floated up to 300 VDC above ground. Short circuit and overload protection shall be provided by electronic current limiting and foldback with automatic recovery. Automatic remote voltage sensing and adjustment shall be a standard off the shelf part of the power supply. A manual output voltage adjustment potentiometer shall be provided on each power supply.

- 2. All power supplies shall be U.L. recognized. Power supply shall be Power-One "International Series Linear" or equal.

DC POWER SUPPLY SPECIFICATIONS

AC Input Voltage Range	120 VAC 1 Phase +/-10%
AC Input Frequency Range :	60Hz +/- 5%
DC Output Voltage	as shown on Drawings
DC Output Current	sized for total loop loads X 2
DC Output Regulation	+/- .05 %
DC Output Ripple Voltage	8 mV peak to peak max
DC Output Stability	+/- 0.3 %
Operating Temp. Range	0 to 50 Deg. C
Temperature Coefficient	0.03 % / Deg. C max
EMI / RFI requirements	FCC for class B equipment

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. All instrumentation work in this contract shall conform to the codes and standards outlined herein.
- B. The Contractor shall employ personnel who are skilled and experienced in the installation and connection of all elements, equipment, devices, instruments, accessories, and assemblies. All installation labor shall be performed by qualified personnel who have had experience on similar projects. Provide first class workmanship for all installations.
- C. Ensure that all equipment and materials fit properly in their installations.
- D. Perform any required work to correct improper installations at no additional expense to the District.

- E. The District reserves the right to halt any work that is found to be substandard or being installed by unqualified personnel.
- F. Rejected equipment or equipment without approved submittals shall be immediately removed from the delivery or job site by the Contractor.

3.02 INSTALLATION

- A. Install and supply all products necessary, at no additional cost to the District, to provide an operational system. This shall include the following:
 - B. Contract Drawings are intended to show the basic functional requirements of the instrumentation system and do not relieve the Contractor from the responsibility to provide a complete and functioning system.
 - C. Provide relays, signal converters, isolators, boosters, power conditioners, circuit cards, and other miscellaneous devices as required for the proper interface.
 - D. Provide analog loop isolators where required to eliminate "ground loops."
 - E. All wires shall be identified with machine printed labels. Plastic wire gutters shall be used for routing of wire bundles. Wiring shall be neat and laced with plastic tie wraps.
 - F. The instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions and located as shown on the Drawings. When manufacturer's installation literature specifies a particular location or orientation in a process line due to measurement accuracy considerations, the installation shall be in conformance with the manufacturer's instructions.
 - G. Engineering scales and charts for all instruments shall be provided that match the range of instruments that monitor the process.
 - H. Instrument installation methods.
 - 1. Install instruments at the location shown on the Plans or approved by the District. Instruments shall be NEMA rated for the installed location.
 - 2. Install level and plumb.
 - 3. All instruments shall be provided with floor stands or wall brackets as shown or required.
 - 4. Mounting hardware, stands, channels, and spacers shall be either galvanized steel, stainless steel, or non metallic to match the NEMA rated location.

5. All screws and bolts shall be stainless steel.
6. Provide nameplates or tags for all instruments. All nameplates and tags shall include both tag names and process description (i.e. "UP-STREAM PRESSURE INDICATOR - PIT-231").
7. Provide isolation and drain/calibration valves for each pressure sensor (Reference Mechanical Specifications and Details). Provide a compression fitting for each drain/calibration valve.

I. Wiring and Raceway installation methods.

1. Instrumentation wiring shall be carried in conduits provided in compliance with the Division 16, electrical. Labeling and color coding shall be per Specification Section 16120, Wire and Cable. All analog circuits shall be run as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required. Triads are not to be formed by using two pairs. Terminal blocks shall be provided at all instrument cable junctions and all wires shall be identified at such junctions. Instrumentation wiring shall be run without splices between instruments, terminal boxes, or panels.
2. The number of signal wires listed on the Drawings is approximate only, and the Contractor shall determine the required number of signal pairs or triads to properly connect the system furnished, especially when substituting equipment.

J. Wiring, grounding, and shielding methods.

1. It is important to observe good grounding and shielding practices in the generally noisy environment in this application. The following practices shall be observed unless modified by manufacturer's standards:
2. Each electronic equipment chassis shall be grounded to power ground.
3. All analog signals shall be transferred over shielded twisted pair cables.
4. All communication signals shall be transferred over shielded cables.
5. All shields of analog inputs and outputs of the PLC shall be connected at the PLC unit only. They shall not contact ground at any other point including the transmitters or receiving devices. All shielded cables shall be terminated using green shrink tube coverings.
6. Status and alarm signals routed through noisy environment shall be transferred over shielded twisted pair cables.

7. Each shield which is not connected to ground shall be covered with a heat shrink insulating boot. Shields shall be connected together at each transition from one cable to another for a continuous effective shield circuit. All shields shall be connected on terminal blocks.

K. Mechanical Installation

1. Install new instruments and transmitters at locations as shown on Drawings.
2. Install and calibrate indicators/transmitter and connect to elements per manufacturer's recommendations.
3. Ground transmitters/elements per manufacturer's recommendations.

3.03 TESTING

- A. The Contractor shall use the services of qualified testing personnel for the purpose of performing inspections and tests as herein specified and indicated on the Drawings. The procedures stated herein are guidelines for the intended tests, the Contractor shall be responsible to modify these tests to fit the particular application and insure personnel safety. It is the intent of these tests to assure that the instrumentation system is operational and is installed in accordance with design Documents.
- B. Test plans and test reports shall be treated as formal submittal. Tests and test plans shall be in the cause and effect format. The person conducting the test shall initiate an action (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
- C. The Contractor shall be responsible for each supplier of equipment to provide the following minimum services for each type of instrument supplied. The supplier shall use a qualified instrumentation field technician (sales representatives are not acceptable) to perform services listed herein.
 1. Advise and instruct Contractor on installation requirements.
 2. Check, calibrate, and place equipment in operation.
 3. All programmable devices shall be programmed and tested prior to startup. Programming shall be adjusted or changed as directed by the District or Engineer, at no additional cost.
 4. Coordinate with the District and setup all alarm, process, and operation setpoints.

5. Perform the acceptance tests.
6. Visit the job as often as required and spend as much time as necessary to ensure an operational instrumentation system.
7. Be readily available by telephone to answer all questions on supplied equipment.
8. Provide training as specified in subsection labeled Training.
9. The Contractor shall insure each supplier of instrumentation assumes the responsibility for providing primary elements in a timely manner, for insertion into the process line, coordinating size and material type when applicable, overseeing the actual installation, calibration, and acceptance testing.

D. Operational Readiness Test (ORT)

1. Prior to startup, the complete instrumentation system shall be inspected, tested, and documented to show that it is ready for operation.
2. The Contractor shall prepare a test plan for the ORT and shall submit it for review at least 30 days before the ORT is performed.
3. The ORT shall demonstrate that the instrumentation system meets the requirements of the Specification which are nonloop-specific. Following are examples of nonloop-specific functions.
 - a. CapaDistrict. Demonstrate that all components and subsystems have the specified capaDistrict, including spare capaDistrict.
 - b. Timing. Include tests to demonstrate all specified timing requirements.
 - c. Diagnostics. Include tests to demonstrate specified diagnostic capabilities and procedures.
4. If any component or subsystem fails the ORT, the Contractor shall correct the problem and repeat the test until it is successful.
5. After completion of the ORT, the Contractor shall prepare a test report and shall submit it for review. The ORT shall be successfully completed and the test report submitted to and reviewed by the Engineer before the FAT (functional acceptance test) is performed.

E. Functional Acceptance Test (FAT)

1. Once the facility has been started up and is operating, a witnessed FAT shall be performed on the complete instrumentation system to demonstrate that it is operating

as specified and meets the requirements of the Specifications.

2. The Contractor shall prepare a test plan for the FAT and shall submit it for review at least 30 days before the FAT is performed.
3. The FAT shall operate all equipment and systems over the full operating range, shall demonstrate proper operation of alarms and indicators, and, in general, shall demonstrate that the equipment and systems meet the requirements of the Drawings and Specifications.
4. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.
5. The FAT shall be performed in the presence of the Engineer.
6. After completion of the FAT, the Contractor shall prepare a test report and shall submit it for review. The instrumentation system will not be accepted before the FAT is successfully completed and the test report submitted to and reviewed by the Engineer.

3.04 TRAINING

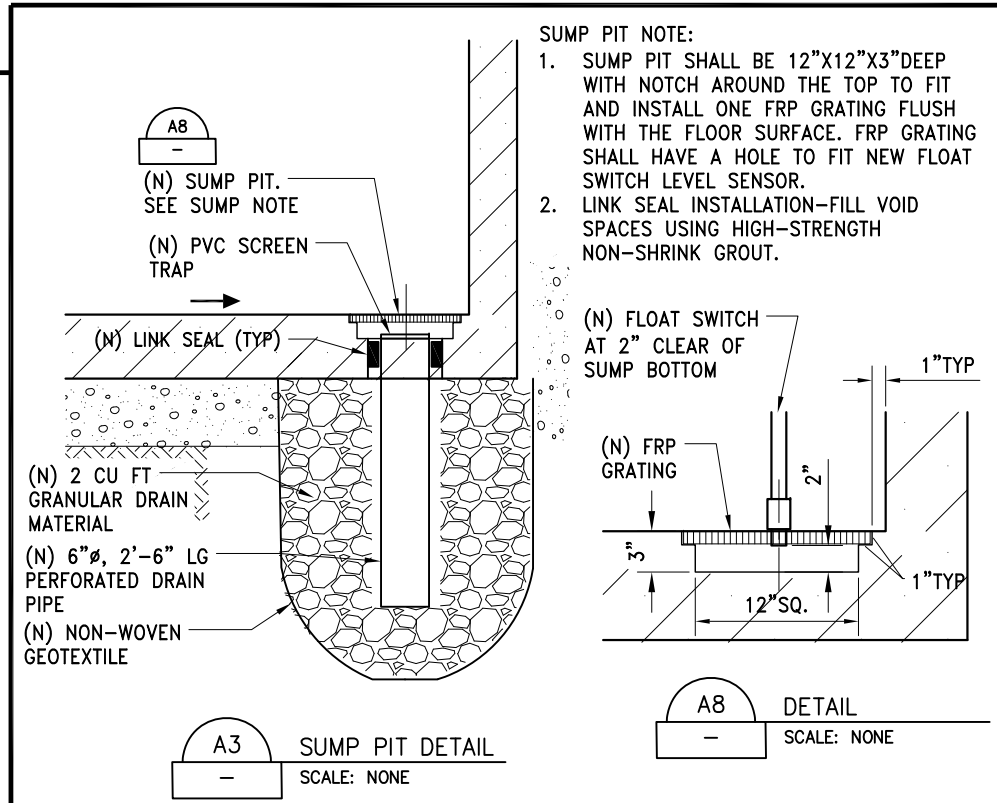
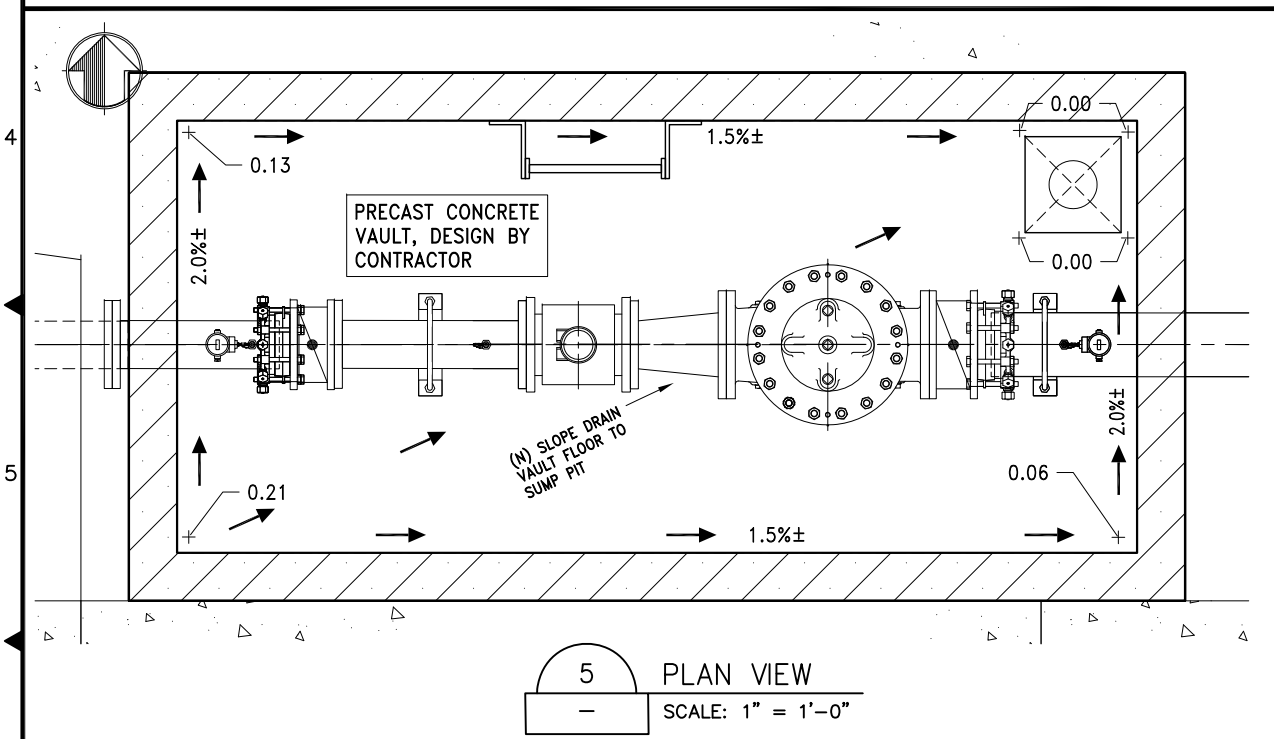
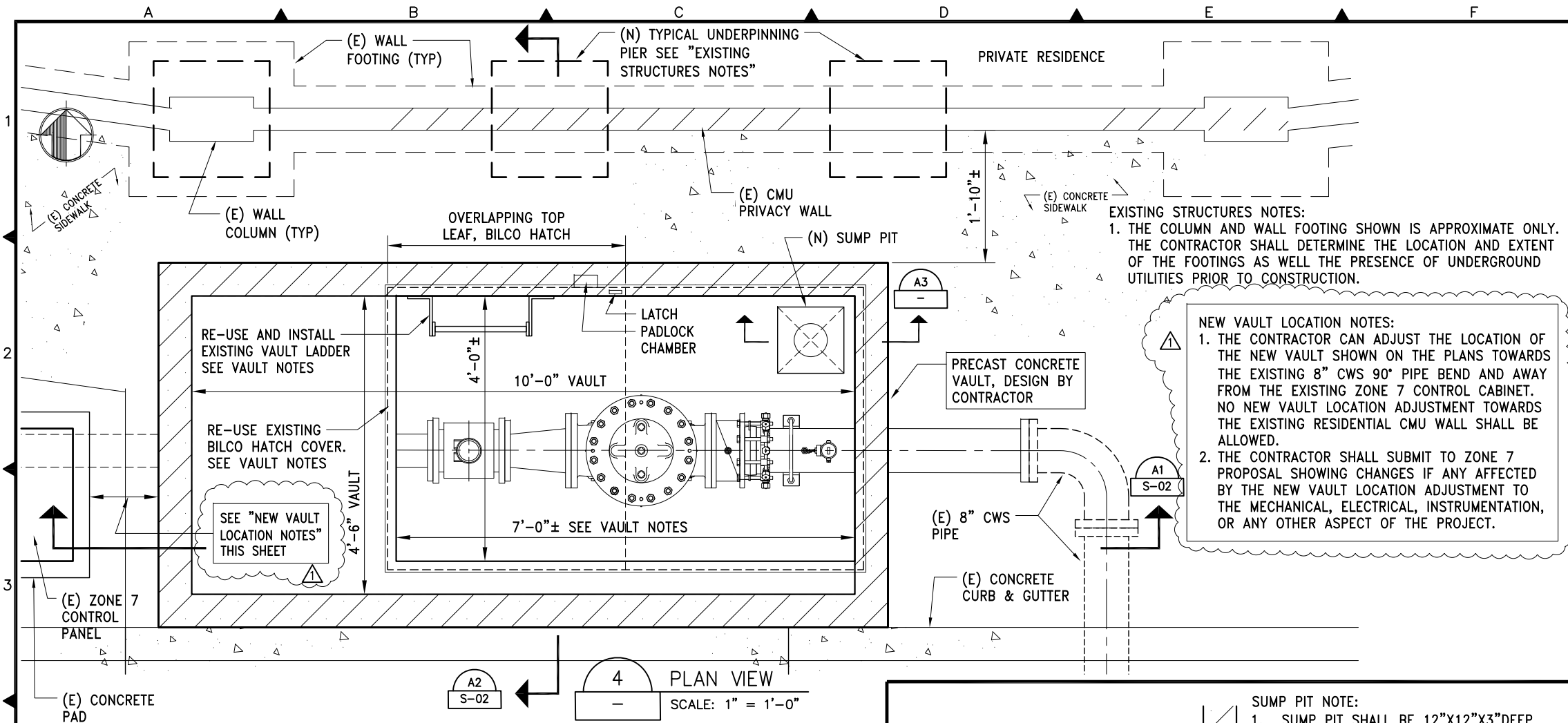
- A. The Contractor shall provide a eight man-hour (total for both sites) for training of the operation of the instrumentation system to District personnel.
- B. Instructions shall consist of the functional description of each piece of equipment, including calibration and setting of set points. Demonstration of the operation of each system shall be included.
- C. The Contractor shall provide all manuals and study materials required for the training of District personnel.

3.05 WARRANTY

- A. The instrumentation supplier shall have a staff of experienced personnel available to provide service on 2 working days' notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing the hardware and software delivered; and of implementing corrective measures.
- B. If the instrumentation supplier fails to respond in 2 working days, the District at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor or supplier from fulfilling the remainder of the warranty requirements.

1. Emergency repairs (hardware or software) performed by the District (or third parties directed by the District) shall not affect the warranty. The Contractor shall be advised of any modifications within 3 days of performing the work.
- C. Prior to "final acceptance", the Contractor shall furnish to the Engineer a listing of warranty information for all manufacturers of materials and equipment used on the project. The listing shall include the following:
1. Manufacturer's name, service contact person, phone number, and address.
 2. Material and equipment description, equipment number, part number, serial number, and model number.
 3. Manufacturers warranty expiration date.
 4. Completed test forms.

END OF SECTION



GENERAL STRUCTURAL NOTES:

- DRAWINGS REPRESENT FINISHED STRUCTURE. CONTRACTOR SHALL BE RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION, INCLUDING BUT NOT LIMITED TO SHORING AND TEMPORARY BRACING. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES TO INSURE SAFETY OF ALL PERSONS AND STRUCTURES AT THE SITE AND ADJACENT TO THE SITE. OBSERVATION VISITS TO THE SITE BY THE ENGINEER SHALL NOT RELIEVE THE CONTRACTOR OF SUCH RESPONSIBILITIES.1
- CONTRACTOR SHALL VERIFY ALL DIMENSIONS AT JOB SITE BEFORE COMMENCING WORK AND SHALL REPORT ANY DISCREPANCIES TO ZONE 7.
- OMISSIONS OR CONFLICTS BETWEEN VARIOUS ELEMENTS OF THE DRAWINGS, NOTES AND DETAILS SHALL BE BROUGHT TO THE ATTENTION OF ZONE 7 AND RESOLVED BEFORE PROCEEDING WITH THE WORK.
- DO NOT USE SCALED DIMENSIONS, USE WRITTEN DIMENSIONS. WHERE NO DIMENSION IS PROVIDED, CONSULT ZONE 7 FOR CLARIFICATION PRIOR TO PROCEEDING WITH THE WORK.

DESIGN BASIS

- APPLICABLE CODE: CALIFORNIA BUILDING CODE (CBC), 2016 EDITION
- LIVE LOAD:
 - PEDESTRIAN: 100 PSF
 - VEHICULAR: AASHTO HS 20-44
- SOILS:
 - ALLOWABLE SOIL BEARING PRESSURE: 1,500 PSF
 - ACTIVE PRESSURE: 45 PCF (EFP)
 - LIVE LOAD SURCHARGE ON BELOW GRADE WALLS: 240 PSF HORIZONTAL

MATERIALS

- CONCRETE: CONSTRUCTED IN ACCORDANCE WITH ACI 301 AND ACI 318, CURRENT EDITION. CONCRETE SHALL BE READY-MIXED NORMAL WEIGHT CONCRETE IN ACCORDANCE WITH ASTM C94.
 - REINFORCING STEEL:
 - BARS: ASTM A615, GRADE 60
 - WELDED BARS: ASTM A706, GRADE 60
 - CEMENTITIOUS GROUT:
 - MASTERFLOW 928 BY DEGUSSA BUILDING SYSTEMS OR W.R. MEADOWS 588 BY W.R. MEADOWS, INC.
 - MIX AND PLACE GROUT IN ACCORDANCE WITH MANUFACTURER'S DIRECTIONS.
 - EPOXY ANCHORS:
 - SIMPSON STRONG-TIE SET-XP EPOXY, OR HILTI HIT RE500-SD EPOXY WITH STAINLESS STEEL FASTENERS.
 - INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND LATEST ICC-ES REPORT
 - EXPANSION ANCHORS:
 - SIMPSON STRONG-TIE STRONG BOLT 2 OR HILTI KWIK BOLT 3, STAINLESS STEEL FASTENERS.
 - INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND LATEST ICC-ES REPORT.
 - STEEL:
 - FABRICATE STRUCTURAL STEEL IN ACCORDANCE WITH AISC MANUAL OF STEEL CONSTRUCTION, LATEST EDITION.
 - PLATES: ASTM A304
 - WELDING
 - ELECTRODES: E-70XX
 - PERFORM IN ACCORDANCE WITH AWS D1.1

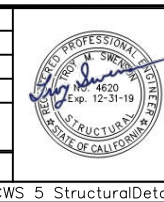
SUBMITTALS

- REINFORCING STEEL SHOP DRAWINGS
- SHOP DRAWINGS AND DESIGN CALCULATIONS FOR PRECAST VAULT
- EQUIPMENT CUT SHEETS AND SHOP DRAWINGS SHOWING ATTACHMENT TO CONCRETE
- MEANS AND METHODS OF PROTECTING SURROUNDING STRUCTURES AND UTILITIES.

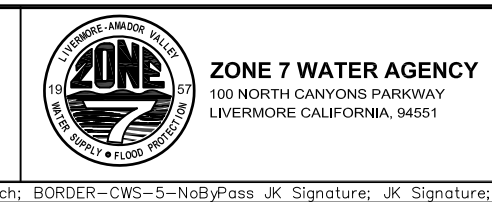
VAULT NOTES:

- RE-USE AND INSTALL EXISTING 2-LEAF BILCO HATCH COVER PER MANUFACTURER'S REQUIREMENTS. VAULT HATCH OPENING TO MATCH EXISTING BILCO HATCH COVER INSTALLATION REQUIREMENTS. LOCATE THE HATCH PADLOCK CHAMBER TO THE SIDEWALK SIDE OF VAULT AWAY FROM THE CURB & GUTTER.
- CONTRACTOR TO INSTALL LADDER CLEAR OF THE BILCO HATCH BODY AND MECHANISMS TO ALLOW FOR FUTURE EASY ACCESS AND REPAIR.

REV	DATE	BY	Description
1	03/XX/17	ESB	ADDENDUM NO. 1-ALLOW LOCATION ADJUSTMENT FOR THE NEW VAULT.



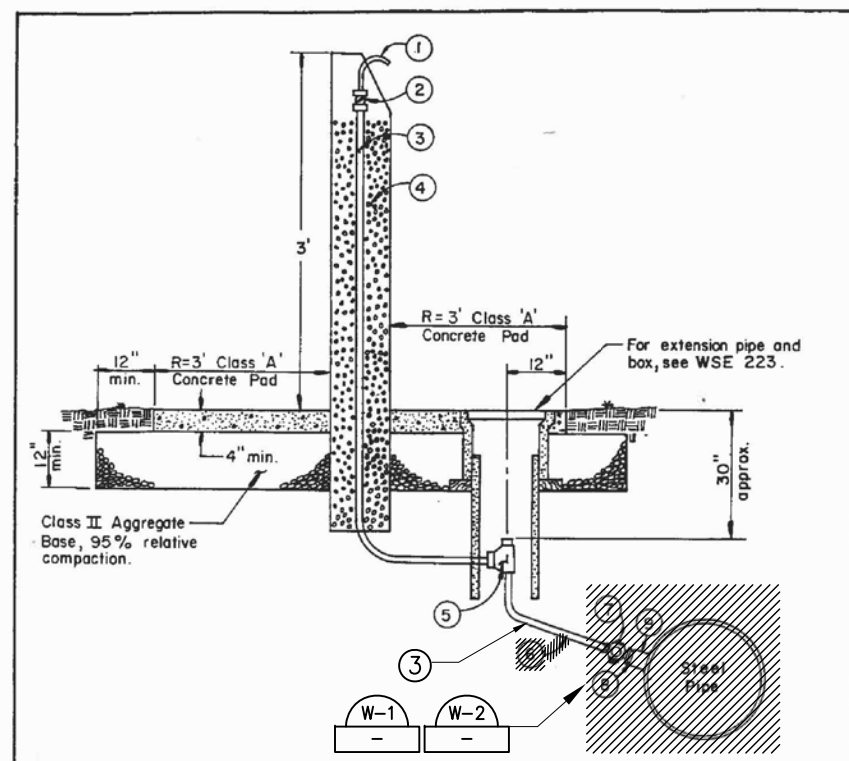
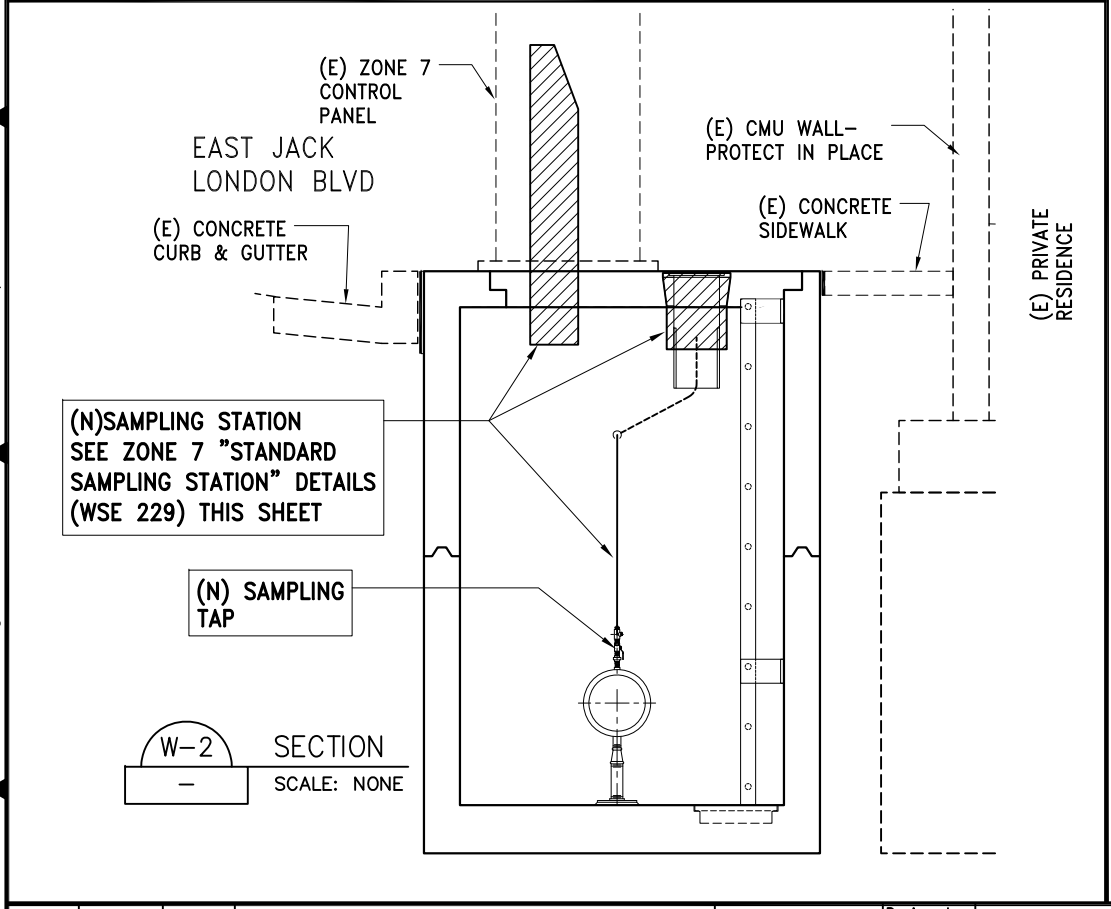
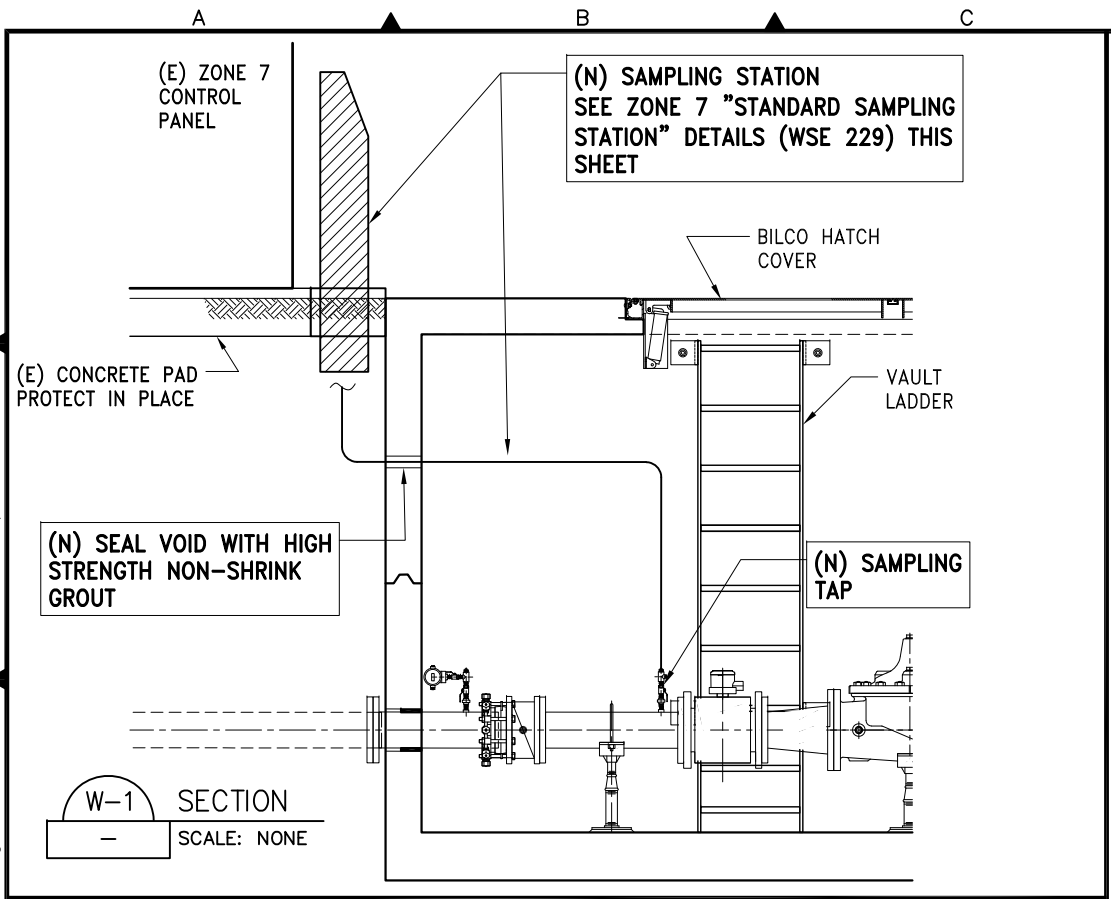
Designed TMS/ESB
 Drawn ESB
 Checked JK
 Date JAN 2019



BAR IS ONE INCH AT FULL SCALE
 0 1"
 IF NOT ONE INCH SCALE ACCORDINGLY

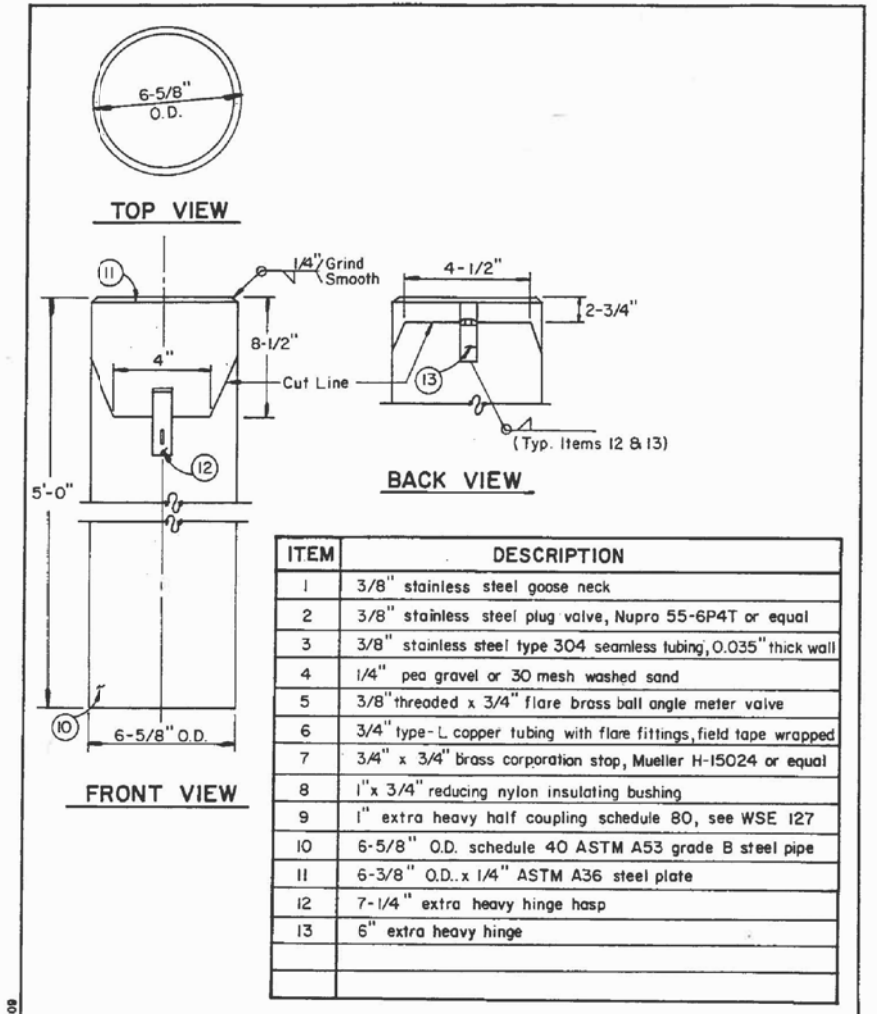
CWS 5 - TURNOUT REPLACEMENT
 STRUCTURAL
PRECAST CONCRETE VAULT PLAN

SHEET NO. 5 OF 13
 DRAWING NO. S-01
 FILE NO. WC-283



- NOTES:
1. Grind all cuts smooth.
 2. Provide necessary clearance to allow hasp to shut.
 3. Top plate is level when closed.
 4. Outside of finished station to receive one coat (sprayed or brushed) of:
 - a. Red oxide primer, Fuller - O'Brian Blox-Rust # 621-O4 or equal.
 - b. Oil base heavy duty industrial glass enamel, Fuller - O'Brian # 612-64, National Blue or equal.

DETRENCH POST NUMBER NO. 88600 6 5 4 3 2 1 REVISIONS	ZONE 7 ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		DRAWN: L.L.W. DESIGNED: U.K. CHECKED: <i>DHG</i> APPROVED: <i>Gene D'Amico</i> GENERAL MANAGER, ZONE 7 DATE: 9-92 SCALE: NONE FILE NO.: WSE 229 of 2
	STANDARD SAMPLING STATION		



ITEM	DESCRIPTION
1	3/8" stainless steel goose neck
2	3/8" stainless steel plug valve, Nupro 55-6P4T or equal
3	3/8" stainless steel type 304 seamless tubing, 0.035" thick wall
4	1/4" pea gravel or 30 mesh washed sand
5	3/8" threaded x 3/4" flare brass ball angle meter valve
6	3/4" type-L copper tubing with flare fittings, field tape wrapped
7	3/4" x 3/4" brass corporation stop, Mueller H-15024 or equal
8	1" x 3/4" reducing nylon insulating bushing
9	1" extra heavy half coupling schedule 80, see WSE 127
10	6-5/8" O.D. schedule 40 ASTM A53 grade B steel pipe
11	6-3/8" O.D. x 1/4" ASTM A36 steel plate
12	7-1/4" extra heavy hinge hasp
13	6" extra heavy hinge

DETRENCH POST NUMBER NO. 88600 6 5 4 3 2 1 REVISIONS	ZONE 7 ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		DRAWN: L.L.W. DESIGNED: U.K. CHECKED: <i>DHG</i> APPROVED: <i>Gene D'Amico</i> GENERAL MANAGER, ZONE 7 DATE: 9-92 SCALE: NONE FILE NO.: WSE 229 2 of 2
	STANDARD SAMPLING STATION		

EXHIBIT A-1 Sheet 1 of 1

		Designed ESB Drawn ESB Checked JK Date JAN 2019		ZONE 7 WATER AGENCY 100 NORTH CANYONS PARKWAY LIVERMORE CALIFORNIA, 94551	BAR IS ONE INCH AT FULL SCALE IF NOT ONE INCH SCALE ACCORDINGLY	CWS 5 - TURNOUT REPLACEMENT MECHANICAL WATER SAMPLING STATION	SHEET NO. 1 OF 1 DRAWING NO. FILE NO. WC-283	
REV DATE BY Description								PROJECT NO. 275-18