Attachment M

Wells 201, 202, 203 and 205 Centralized Treatment Facilities
90% Plans and Specifications
Riverside County
Perris, California

SPECIFICATION NO. 1381W

WELLS 201, 202, 203 AND 205
CENTRALIZED TREATMENT FACILITY

Work Order #’s
414736, 414737, 414738

A PUBLIC WORKS PROJECT

Contents:
Specifications | Notice Inviting Bids | Bidding Requirements | Bid Forms | Contract Forms |
Conditions of Contract

Paul D. Jones, II, P.E. - General Manager

Safety is of paramount and overriding importance to
Eastern Municipal Water District

Visit our website at www.emwd.org to view currently advertised projects
Navigate to Construction ➞ Construction Bid Opportunities
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NOTICE INVITING BID

NIB-1. Receipt of Bids. Sealed proposals (bids) for this project will be received and time-stamped by Eastern Municipal Water District no later than 10:00 a.m., , 20 (from time stamp clock) at which time and place they will be publicly opened.

Hand deliver/Fed Ex your bid to: EMWD, 2270 Trumble Road, Perris, CA, 92570
Mail your bid to: EMWD, P O Box 8300, Perris, CA 92572-8300

Bids are received at the Operations and Maintenance Center lobby only. Please follow the VENDORS/BIDDERS signs to the Operations and Maintenance parking lot, enter the lobby, and have your bids time-stamped by the Receptionist.

All bids submitted will become the property of EMWD and subject to disclosure under the Public Records Act. All bids will be posted on the website www.emwd.org approximately 10 days from bid opening.

NIB-2. Contract Documents. The contract documents, which include instructions to bidders, plans and specifications, are available at www.emwd.org. To view and download these documents, navigate to Doing Business, Construction and select Construction Bid Opportunities. If obtaining the contract documents online, please complete the Planholder Registration form to receive email notification of addenda issued. Bidders shall use full size drawings to prepare bid.

NIB-3. Location and Description of Work. The Wells 201, 202, 203 and 205 Centralized Treatment Facility is located the City of San Jacinto within District-owned property. The address of the facility is as follows:

- 1191 Hewitt Street, San Jacinto CA

The work comprises construction of the above-mentioned facility in accordance with the Specifications and Contract Drawings. The work generally consists of the following:

- Site Grading and Appurtenant Site Work including, but not limited to: existing chain link fence demolition; tree removal as required; AC pavement removal; clearing and grubbing as required; rough and finish grading; import and/or export material as required; vegetation removal as required; temporary fencing; site AC paving and class II
base; driveways, curb, gutter and sidewalks; masonry block perimeter wall and steel gates; motor operated site access gate; monument walls; drainage improvements, catch basins and storm drain inlets; preparing and implementing SWPPP; and miscellaneous on-site related work.

- Chemical Building with Electrical Room including, but not limited to: reinforced concrete foundation and slab; equipment and tank foundations; walls (exterior and interior); roof structure and parapet wall; windows; safety equipment; walk doors; rolling doors; fans and louvers; air conditioning units; air handlers; ventilators; ductwork; building fire suppression system; floor and roof drains; roof openings; painting and finish work; architectural treatments; corrosion protection coatings; exterior chemical sump; and miscellaneous building related work.

- Mechanical Work and Treatment Equipment including, but not limited to: furnishing, delivery and installation of treatment vessels, chemical storage and feed systems; mechanical process piping; surface wash pumps, pipe supports; isolation valves; motor operated valves; control valves; magnetic flow meters; air valves; start-up and commissioning; demonstration and training; and other miscellaneous work.

- Backwash Pump Station and Recycle Tank including but not limited to backwash transfer pump station and bolted steel tank including all pump station improvements and equipment; all process mechanical improvements (pumps, pipe, valves, and appurtenances); all mechanical improvements; foundation including over-excavation, backfill, and compaction, pressure testing, disinfection and startup as specified; and other related work.

- Pipeline Work and Equipment including but limited to: connections to existing pipelines; conveyance piping; facility process and inter-process piping; drain and sewer piping; backwash overflow piping; blow-offs and drain valves; air valves; pipe supports; fire hydrants; sampling ports; sample lines; chemical piping; couplings; reinforced concrete encasements; potholing of existing utilities; trenching and backfill; trench sheeting, shoring, and bracing per California Labor Code; import of backfill material; painting and coating; hydro-static testing, miscellaneous testing, chlorination/disinfection and field start-up and testing.

- Electrical, Instrumentation and Control Work and Equipment including, but not limited to: electrical power supply and distribution equipment, conduits, conductors, pullboxes, and ducts; meter panel; building lighting; standby generator; Motor Control Centers, soft starters, load center as well as service distribution panels and related conduits and wiring and connections; variable frequency drives for pumping equipment; grounding system; conduit and junction boxes for security system control panel, cameras, door and gate contacts, reader, (security system control panel,
cameras, door and gate contacts and readers by others); Communication tower; RTU panel, terminal strips, operator interface terminal and digital recorder; instrumentation equipment and panels; Programmable Logic Controller; HMIs; programming; unit flow meter conduits, wiring and connections; conduits and wiring for control valves; conduits for entry gate access control keypad, automatic sliding gate loops and conduits and wiring; conduits, wiring and connections; providing all trenching, pull boxes, conduits, sweeps, wiring, connections, encasements, temporary power, backfilling, compaction, and pavement repair.

- Other pertinent work for the construction of the complete and operable facility

**NIB-4. Mandatory Pre-Bid Walk-Through** will be conducted by EMWD on 20 at 9:00 a.m., meeting at the south west corner of the intersection of Hewitt Street and Old 2nd Street. Meeting will be by appointment only to ensure compliance with COVID-19 distancing mandate. If you would like to attend the walk-thru please call Amy Eichperger (951) 928-3777 ext. 4435 to schedule a time.

**Please arrive promptly!** All bidders must have an employee of their firm sign-in and attend the mandatory pre-bid walk-through meeting. Failure to do so shall deem your bid non-responsive.

**Personal Protective Equipment (PPE).** For your safety, attendees shall bring and wear hard hats, safety vests, and close-toed shoes, if construction is present.

**QUESTIONS:** All questions must be submitted in writing by 5:00 p.m. on to Mr. Dustin Christensen c/o Dustin Wetter; EMAIL: christed@emwd.org & wetterda@emwd.org. Questions received after this time may not be responded to.

**NIB-5. Contract Bonds.** All bonds shall be executed by admitted surety insurers, as defined in Code of Civil Procedure section 995.120. Each proposal must be accompanied by a certified check or satisfactory surety bond (by utilizing the District’s Bid Bond form BB-1) for not less than 10% of the bidder's total contract price as a guarantee that the bidder shall, within seven (7) days after the mailing of a notice of acceptance of bid by the District to the bidder, enter into the written contract supplied by the District. The District shall return the bid bond, upon request. The Contractor shall furnish a faithful performance bond in an amount equal to 100% of the amount of the contract and a labor payment bond in an amount equal to 100% of the contract amount.

Pursuant to Section 995.660(a) of the Code of Civil Procedure, the Contractor shall submit the following documents with the performance and payment bonds:
(1) The original, or a certified copy, of the unrevoked appointment, power of attorney, bylaws, or other instrument entitling or authorizing the person who executed the bond to do so;

(2) A certified copy of the certificate of authority of the insurer issued by the State of California’s Insurance Commissioner; and

(3) Copies of the insurer's most recent annual and quarterly statements filed with the Department of Insurance.

NO PAYMENT SHALL BE MADE UNTIL THE BONDS ARE APPROVED BY THE DISTRICT

NIB-6. **Safety.** Safety of all activities in connection with the work is of paramount and overriding importance to the District. The District is recognized by the California Occupational Safety and Health Administration (Cal OSHA) as an active participant in the California Voluntary Protection Program (Cal VPP). The District is designated a Cal STAR site due to our high-level commitment to safety. Bidders on this project will be required to comply with and meet all applicable Cal OSHA requirements of Title 8 of the California Code of Regulations, including their current Injury and Illness Prevention Plan, T8 CCR Section 3203.

All bidders shall complete the C-16 Annual Summary of Work Related Injuries and Illness (Cal/OSHA Form 300A) and the C-17 Contractor’s Cal/OSHA Compliance History and SIC Code form. *Failure to fully divulge, complete and submit these forms may deem your bid non-responsive.*

A safety conference shall be scheduled prior to the preconstruction conference to review the experience modification rating, the respective safety requirements, and to discuss implementation of all health and safety provisions related to this project.

NIB-7. **Contract Time.** No bid or bid security may be withdrawn for seventy-five (75) calendar days after the date bids are received. The successful bidder shall, within seven (7) calendar days after the District mails a notice of acceptance of bid, return the signed agreement and bonds, and attend the pre-construction conference at the District office. The contract period shall commence seven (7) calendar days from the date of the Notice-of-Acceptance-of-Proposal. The Contractor shall complete all work, including testing, within five hundred and forty (540) calendar days.

NIB-8. **Contractor Classification.** Bidders on this work will be required to be licensed by the State of California as Classification A - General Engineering Contractor at the time of the bid and at the time of award as such license is defined in Section 7056 and/or Section 7058 of the Business and Professional Code and Section 732 of the California Administrative Code.

Please refer to BR-1 Bidder’s Experience Record & Resumes Of Key Personnel for additional requirements.
NIB-9. Non-Discrimination. Bidders on this work will be required to comply with the provisions of the California Labor Code and with the President's Executive Order No. 11246 and supplements thereto. The requirements for bidders and contractors under this order are explained in the specifications.

NIB-10. Minimum Wages. In accordance with the provisions of the California Labor Code, the Director of Industrial Relations has ascertained the general prevailing rates of wages and the general prevailing rates for legal holiday and overtime work in Riverside County (refer to Section F-General Conditions). Copies of said rates are on file at the office of the District, which copies shall be made available for review to any interested party on request. The successful bidder shall post a copy of such determinations at the jobsite.

NIB-11. Public Works Requirements California Administrative Code, Title 8, Group 3, Section 16100 apply, which are/include:

A. all applicable requirements of sections 1771, 1774 - 1776, 1813, and 1815.
B. the appropriate number of apprentices are on the job site, as set forth in Labor Code Section 1777.5.
D. to keep accurate records of the work performed on the public works project, as set forth in Labor Code Section 1812.
E. inspection of payroll records pursuant to Labor Code Section 1776, and as set forth in Section 16400 (e) of these regulations.
F. and other requirements imposed by law.

NIB-12. Public Works Contractor and Subcontractor Registration. This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

No contractor or subcontractor may be listed on a bid proposal or be awarded a contract for a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].

BIDDERS AND THEIR SUBCONTRACTORS (listed on the Designation of Subcontractors List C-05) are to provide an extract (pdf) at time of bid showing active registration from the Public Works Contractor Registration online registration at: https://cadir.secure.force.com/ContractorSearch

All contractors and subcontractors, including soils, survey and inspection services must furnish electronic certified payroll records directly to the Labor Commissioner (aka Division of Labor Standards Enforcement). Additionally, the awarded Contractor shall submit certified payroll records to the District.
In addition, awarded Contractor must post jobsite notices prescribed by regulations.

**NIB-13. Ineligibility of Contractor or Subcontractor.** Pursuant to Section 1777.1 and 1777.7 of the Labor Code, any contractor or subcontractor who is found by the Labor Commissioner to be in violation of certain provisions of law and is debarred for a specific period of time, is ineligible to bid or work on, or be awarded, a public works contract.

**NIB-14. Substitution of Securities.** Substitution of securities shall be permitted for any monies withheld to ensure contract performance, in accordance with the provisions of law and Section F-General Conditions of the contract specifications.

**NIB-15. No Equal Clause.** The application of California Public Contract Code Section 3400 (b) applies. The District’s Board of Directors has authorized the General Manager to approve purchase and installation of certain equipment, material and services which has been designated sole-sourced and as no-equal in order to match other equipment and services already completed and as no-equal in order to match other equipment and services already completed or in the course of construction.

**NIB-16. Proposition 84 Grant Funding Requirements.** Funding for this project has been provided in full or in part through an agreement under Proposition 84 Integrated Regional Water Management Implementation Grant Funding Contract between the Department of Water Resources of the State of California (State), the Santa Ana Watershed Project Authority (SAWPA) and the Eastern Municipal Water District (District). By entering into a contract with the District, Contractor and its subcontractors shall comply with the Proposition 84 Integrated Regional Water Management Implementation Grant Funding requirements whether or not any such requirements are expressly delineated in these Contract Documents.

**NIB-17. Covid-19 Special Notice.** By submitting a Bid for this work, Bidder agrees to proceed with the work as proposed and to execute the contract in the form provided. Any conditions, caveats, or force majeure notices submitted with a bid will not be accepted and may result in a determination that the bid is non-responsive. Any such conditions, caveats, or notices submitted after award may result in the forfeiture of Bidder’s bid security and award to the next lowest bidder. Bidders shall comply with all governmental requirements for safety during the COVID-19 pandemic, including but not limited to orders and guidance of the California Department of Public Health, orders and guidelines of Cal/OSHA, and orders of the public health officer of the County of Riverside. The costs of adhering to and complying with such COVID-19 safety measures shall be the responsibility of the bidders and shall be included and incorporated into their respective bid amounts.
Eastern Municipal Water District

Paul D. Jones, II, P.E.
General Manager

Official Bid Publication: EMWD Website (www.emwd.org)

Posted date: ______________________________
**Mandatory**

Pre-Bid Walk-thru Map and Directions

**Site Address:** 1191 Hewitt Street, San Jacinto, CA 92583

**Directions From HWY 74 East:** Turn north on N. San Jacinto Street. Continue north on N. San Jacinto Street until reaching Esplanade Avenue, then turn east on Esplanade Avenue. Continue east on Esplanade Avenue to Hewitt Street, then turn north on Hewitt Street. Continue north on Hewitt Street to the intersection of Old 2nd Street. The pre-bid meeting will be conducted on the south west corner of the intersection of Hewitt Street and Old 2nd Street.
The Contractor shall construct the project under these Specifications all in conformance with the Contract Drawings listed in Section P and these Specifications.

The District reserves the right to:

A. Accept or reject any or all bids on this specification;
B. Award Contract to the lowest qualified bidder, based on the total bid price;
C. Waive any defects and informalities.

The District shall be the final authority with regard to whether a bid is responsive to the call for bids and to whether a bidder is a responsible bidder under the conditions of his bid, or for any reason.

The total contract price shall include all work, materials and equipment needed to complete the project as defined in the General Conditions, Section F. The bidder shall include costs for such other items in the most appropriate category (bid item).

**TO BE INSTALLED:**

The District will furnish the following item(s) to be installed by the Contractor:

**Telemetry Cable**
**Kingfisher Remote Terminal Unit (RTU)**
**Operator Interface Terminal (OIT)**

The District will furnish services and item(s) to be installed by the Contractor, which are identified in Special Condition SC-63. The Contractor shall pick up all furnished items at the District yard. Furnished items will be loaded onto the Contractor's truck by the District.
**EASTERN MUNICIPAL WATER DISTRICT**
**SPECIFICATION NO. 1381W**
**WELLS 201, 202, 203 and 205**
**CENTRALIZED TREATMENT FACILITY**

**BIDDING SHEETS**

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<tr>
<th>Bid Item</th>
<th>Qty</th>
<th>Unit</th>
<th>Description (Unit Price Written in Words)</th>
<th>Unit Price (Figures)</th>
<th>Total Amount (Figures)</th>
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<tr>
<td>1</td>
<td>1</td>
<td>LS</td>
<td>Mobilization and Approved: Bonds, Insurance, Schedule of Values (see Section 01026) and Preliminary Project Schedule (PPS) (see section 01310)</td>
<td>$ PRESET</td>
<td>$ 5% amt here</td>
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<tr>
<td>2</td>
<td>1</td>
<td>LS</td>
<td><strong>PRE-NEGOTIATED</strong>: Provide services of the Security System Contractor to furnish and install security system, as specified in the Special Conditions and per the quotation in Appendices.</td>
<td>$ Lump Sum</td>
<td>$</td>
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| 3        | 1   | LS   | **Site Clearing and Demolition**
Furnish and install all necessary materials and equipment for site clearing and demolition including the demolition and disposal of existing monitoring well and fences; abandonment of existing utilities; clearing and grubbing of site vegetation and trees, and other requirements in accordance with the Contract Drawings and Specifications. | $ Lump Sum | $ |

BS-2 00020 Bidding Sheets
## BIDDING SHEETS

<table>
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<tr>
<th>Bid Item</th>
<th>Qty</th>
<th>Unit</th>
<th>Description (Unit Price Written in Words)</th>
<th>Unit Price (Figures)</th>
<th>Total Amount (Figures)</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>LS</td>
<td><strong>Site Work:</strong> Furnish and install all necessary materials and equipment for Site Work including site improvements and grading; all buildings and structure excavation, over-excavation, backfill and compaction; hauling; sheeting and shoring; security walls, fences and gates; driveways, sidewalks, curbs and gutters; AC pavement and class II base site coverage; drainage improvements; monuments signs; communications tower; site survey and staking; traffic control when required; approval and implementation of a SWPPP; dust abatement; permits; and all other appurtenant site and civil work as required; in accordance with the Contract Drawings and Specifications.</td>
<td>$Lump Sum $</td>
<td></td>
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Lump Sum $ ___________________
### BIDDING SHEETS

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<td>1</td>
<td>LS</td>
<td>Yard Piping: Furnish and install all necessary materials and equipment for the construction of all yard piping and ancillary yard piping work including but not limited to: blending facility, site transmission, water service, sewer, storm drains and chemical yard piping; valves, blowoffs, air valves, flow meters and other appurtenances; connections to existing underground piping including shutdowns, dewatering, highlines, line stops and hot taps, if required; sewer and storm drain manholes, storm drain inlet structures and storm drain junction structures; yard piping survey and staking; trench sheeting, shoring and bracing; trench excavation, back fill and compaction; utility potholing and utility agency coordination; pressure testing, disinfection and startup as specified; and other appurtenant work in accordance with the Contract Drawings and Specifications.</td>
<td>$ Lump Sum $ __________________________</td>
<td>$(words)</td>
</tr>
</tbody>
</table>
## BIDDING SHEETS

<table>
<thead>
<tr>
<th>Bid Item</th>
<th>Qty</th>
<th>Unit</th>
<th>Description</th>
<th>Unit Price Written in Words</th>
<th>Unit Price (Figures)</th>
<th>Total Amount (Figures)</th>
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<tbody>
<tr>
<td>6</td>
<td>1</td>
<td>LS</td>
<td><strong>Offsite Piping:</strong> Furnish and Install 36-inch diameter steel potable water pipeline and 24-inch diameter PVC storm drain including shoring, excavation, bedding, backfill, valves, fittings, connections, thrust restraint, appurtenances, pavement removal, pavement replacement, pavement grind and cap overlay, clearing, grubbing, site restoration, pressure testing, disinfection, traffic control, all labor, materials, and equipment, as shown on the contract drawings and specifications complete and in place.</td>
<td>$ Lump Sum</td>
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(WORDS)
## BIDDING SHEETS

<table>
<thead>
<tr>
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<tr>
<td>7</td>
<td>1</td>
<td>LS</td>
<td>Backwash Pump Station and Recycle Tank:</td>
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<tr>
<td></td>
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<td></td>
<td>Furnish and install all necessary materials and equipment for the construction of the Backwash Transfer Pump Station and Bolted Steel Tank including all pump station improvements and equipment; all process mechanical improvements (pumps, pipe, valves, and appurtenances); all mechanical improvements; foundation including over-excavation, backfill, and compaction; pressure testing, disinfection and startup as specified; and other appurtenant work in accordance with the Contract Drawings and Specifications.</td>
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</table>

$ \text{Lump Sum} $ $ \text{Lump Sum} $ (words)
**EASTERN MUNICIPAL WATER DISTRICT**  
**SPECIFICATION NO. 1381W**  
**WELLS 201, 202, 203 and 205**  
**CENTRALIZED TREATMENT FACILITY**

**BIDDING SHEETS**

<table>
<thead>
<tr>
<th>Bid Item</th>
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<tbody>
<tr>
<td>8</td>
<td>1</td>
<td>LS</td>
<td><strong>Treatment Building:</strong> Furnish and install all necessary materials and equipment for the construction of the Treatment Building including all building architectural and structural improvements; all process mechanical improvements including the standby diesel generator with load bank, active diesel particulate filter and outside fuel tank, chemical storage and feed systems, analyzers, flow meters and appurtenances; interior and exterior chemical sumps; all building mechanical improvements including all heating, ventilating and air conditioning systems, duct work, dampeners and appurtenances; furnishings; testing, start-up and commissioning; and other appurtenant work in accordance with the Contract Drawings and Specifications.</td>
<td>$ Lump Sum</td>
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(removal of specified amount of text due to space constraint)

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00020 Bidding Sheets
<table>
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<tr>
<th>Bid Item</th>
<th>Qty</th>
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<th>Description</th>
<th>Unit Price (Figures)</th>
<th>Total Amount (Figures)</th>
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<tbody>
<tr>
<td>9</td>
<td>1</td>
<td>LS</td>
<td><strong>Treatment Filters and Mechanical Work:</strong> Furnish and install all necessary materials and equipment for the construction of the greensand Iron and Manganese Treatment system, including all process mechanical improvements (surface wash pumps, pipe, valves, flow meters, and appurtenances); all mechanical improvements; foundation including over-excavation, backfill, and compaction; pressure testing, disinfection and startup as specified; and other appurtenant work in accordance with the Contract Drawings and Specifications.</td>
<td>$Lump Sum $</td>
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</table>
# EASTERN MUNICIPAL WATER DISTRICT
## SPECIFICATION NO. 1381W
### WELLS 201, 202, 203 and 205
#### CENTRALIZED TREATMENT FACILITY

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<tr>
<td>10</td>
<td>1</td>
<td>LS</td>
<td><strong>Electrical Work:</strong> Furnish and install all necessary materials and equipment for the construction of the project electrical systems including Motor Control Centers (MCC); standby generator controls and monitoring; switchboards; panelboards and enclosures; motors; variable frequency drives; conduit and cable; duct banks; lighting; Arc Flash Analysis; testing; SCE scope of work approved per the SCE Plan of Service; SCE construction coordination and management; and other appurtenant work in accordance with the Contract Drawings and Specifications.</td>
<td>$Lump Sum$</td>
<td>$Lump Sum$</td>
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</tbody>
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BS-9 00020 Bidding Sheets
**EASTERN MUNICIPAL WATER DISTRICT**
**SPECIFICATION NO. 1381W**
**WELLS 201, 202, 203 and 205**
**CENTRALIZED TREATMENT FACILITY**

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<tr>
<td>11</td>
<td>1</td>
<td>LS</td>
<td><strong>Instrumentation and Control:</strong> Furnish and install all necessary materials and equipment including</td>
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<td></td>
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<td></td>
<td>owner furnished equipment for the construction and integration of the instrumentation and control</td>
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<td></td>
<td></td>
<td></td>
<td>system including programming, Programmable Logic Controllers (PLC), Remote Telemetry Unit (RTU)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>HMIs including process displays, Instrumentation devices, Security Access Control System, flow meters,</td>
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<td></td>
<td></td>
<td></td>
<td>analyzers and other appurtenant work in accordance with the Contract Drawings and Specifications.</td>
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</table>

$\text{Lump Sum} \quad $ \text{Figures}

$\text{Lump Sum} \quad $ \text{Figures} (words)
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<tbody>
<tr>
<td>12</td>
<td>LS</td>
<td></td>
<td><strong>ADDITION OR DEDUCTION</strong></td>
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</tbody>
</table>

Circle one (If applicable)

Addition (+)  
Deduction (-)

______________________________  $ ________  $ __________

______________________________  (words)

<table>
<thead>
<tr>
<th>TOTAL BID (Basis of award)</th>
<th>$________________________</th>
</tr>
</thead>
</table>
EASTERN MUNICIPAL WATER DISTRICT  
SPECIFICATION NO. 1381W  
WELLS 201, 202, 203 and 205  
CENTRALIZED TREATMENT FACILITY  

BIDDING SHEETS

**ADDITION OR DEDUCTION:** Provision is made here for the bidder to include an addition/deduction in their bid, *if desired*, to reflect any last minute adjustments in prices. The addition/deduction, if made, will be proportionately applied to item(s) ______________ (fill in) and reflected in the unit prices for payment purposes. If the addition/deduction affects more than one bid item, the proportionate application of the addition/deduction shall be mutually agreed upon by the Contractor and the District at the prejob.

**Addenda and/or Letter of Clarification**
By submitting a bid, Bidder certifies that any addenda and letters of clarification issued to these specifications, whether acknowledged or not below, shall be made a part of the contract. Bidder further agrees to perform all labor and services and furnish all materials, tools and appliances necessary for completing the work called out in the addenda or letter of clarification.

<table>
<thead>
<tr>
<th>Addenda received:</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter of Clarification received:</td>
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</tbody>
</table>

Person who inspected site of the proposed work as an employee of your firm: *(Representative must have inspected the jobsite and be an employee on the company’s payroll to be considered a responsive bidder)*

_________________________________________  (Name)  
_________________________________________  (Date of Inspection)
EQUIPMENT AND MATERIAL

Identify the name of the manufacturer for the equipment and/or material items listed below, if not specified. Acceptable manufacturers listed shall be utilized by the Contractor in his construction. No substitution of the Contractor's listed manufacturer will be permitted without written justification and the approval of the District. **PRODUCTS OF MANUFACTURERS LISTED AS EQUALS TO THOSE SPECIFIED MUST BE SUBMITTED FOR REVIEW AND APPROVAL BY THE DISTRICT NOT LATER THAN THE TENTH (10TH) DAY PRECEDING THE DATE SET FOR RECEIPT OF BIDS.**

**FAILURE TO PROVIDE THIS INFORMATION MAY RENDER YOUR BID NON-RESPONSIVE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Vessels</td>
<td></td>
</tr>
<tr>
<td>Variable Frequency Drive</td>
<td></td>
</tr>
<tr>
<td>Motor Control Equipment</td>
<td></td>
</tr>
<tr>
<td>Fiberglass Reinforced Tanks</td>
<td></td>
</tr>
<tr>
<td>Bolted Steel Tank</td>
<td></td>
</tr>
<tr>
<td>Fabricated Steel Pipe</td>
<td></td>
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<tr>
<td>Backwash Pumps</td>
<td></td>
</tr>
<tr>
<td>Diesel Generator</td>
<td></td>
</tr>
<tr>
<td>Chemical Metering Pumps</td>
<td></td>
</tr>
</tbody>
</table>
EASTERN MUNICIPAL WATER DISTRICT
SPECIFICATION NO. 1381W
WELLS 201, 202, 203 and 205
CENTRALIZED TREATMENT PLANT

SECTION H - PERMITS

The Contractor shall procure all permits and licenses; the District will reimburse the Contractor of all charges, fees and taxes; and the Contractor shall give all notices necessary and incidental to the due and lawful prosecution of the work; except as follows:

Permit(s) applied for by the District and attached hereto are:

<table>
<thead>
<tr>
<th>PERMITS/LICENSE</th>
<th>AGENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encroachment Permit</td>
<td>City of San Jacinto</td>
</tr>
<tr>
<td>Discharge Permit</td>
<td>Riverside County Flood Control and Water Conservation District (RCFC&amp;WCD)</td>
</tr>
<tr>
<td>NPDES Permit No. CAG998001</td>
<td>Regional Water Quality Control Board (RWQCB) Santa Ana Region</td>
</tr>
</tbody>
</table>

Permit(s) applied for by the Contractor are:

<table>
<thead>
<tr>
<th>PERMITS/LICENSE</th>
<th>AGENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Water Pollution Prevention Plan (SWPPP)</td>
<td>Regional Water Quality Control Board (RWQCB) Santa Ana Region</td>
</tr>
<tr>
<td>SCAQMD Permit</td>
<td>South Coast Air Quality Management District (SCAQMD)</td>
</tr>
</tbody>
</table>

The District is the main point of contact for District acquired permits. If required by the permitting agency, Contractor shall pull a duplicate permit.

It is the responsibility of the Contractor to contact the above agency and to make himself knowledgeable and responsible to all of their approval and construction requirements. Contractor shall, at no additional charge to the District, construct the work in strict accordance with the above listed agencies.
The Contractor shall coordinate with all jurisdictions to protect and replace, if necessary, survey monuments, property corners, TBM’s, etc. encountered during construction. A subsequent corner record shall be filed appropriately for the replacement of any damaged monument that has been destroyed, damaged, covered, obscured, or otherwise obliterated by construction.

The liability insurance required under Section F-04 under General Conditions and stated in the Special Conditions shall include as additional insureds EMWD and the above listed agencies.
SC-01. **Safety.** Safety of all activities in connection with the work is of paramount and overriding importance. See Section 01000 - General Safety Requirements for details.

A preconstruction safety conference shall be scheduled prior to the preconstruction conference to review the respective safety requirements and to discuss implementation of all health and safety provisions related to this project. The Contractor and District representatives shall be present.

Please note that the District reserves the right to suspend the work wholly or in part, for any time period as the District representative deems necessary, due to unresolved safety disputes. See Section 01000 - 1.04.

No additional compensation or contract time will be allowed for the period the work is wholly or in part suspended.

Should the contractor continue with the disputed work after having received a written notice of suspension, any work performed by the Contractor during the suspension shall be considered as having been done by the Contractor at the Contractor's own risk as a volunteer, and shall not entitle the Contractor to compensation or any other rights under the contract.

The Contractor shall submit an Injury and Illness Prevention Program and a Project Specific Safety Plan to the District at the pre-construction conference. The Contractor shall not begin work until the above referenced documents have been accepted by the District.

The Contractor shall conform to all applicable occupational safety and health standards, rules, regulations and orders established by local agencies, State of California, and California Division of Occupational Safety and Health Construction Safety Regulations (Cal Osha), including obtaining permits required by California Code of Regulations, Title 8, Sections 341 and 341 (a).

SC-02. **Scope of Work.** Under these Specifications, the Contractor shall furnish all labor, material, and equipment for construction of the complete and operable Centralized Treatment Plant in accordance with these specifications and contract drawings.
The work generally consists of the following:

- **Site Grading and Appurtenant Site Work including, but not limited to:** existing chain link fence demolition; tree removal as required; AC pavement removal; clearing and grubbing as required; rough and finish grading; import and/or export material as required; vegetation removal as required; temporary fencing; site AC paving and class II base; driveways, curb, gutter and sidewalks; masonry block perimeter wall and steel gates; motor operated site access gates; monument walls; drainage improvements, catch basins and storm drain inlets; preparing and implementing SWPPP; and miscellaneous on-site related work.

- **Chemical Building with Electrical Room including, but not limited to:** reinforced concrete foundation and slab; equipment and tank foundations; walls (exterior and interior); roof structure and parapet wall; windows; safety equipment; walk doors; rolling doors; fans and louvers; air conditioning units; air handlers; ventilators; ductwork; building fire suppression system; floor and roof drains; roof openings; painting and finish work; architectural treatments; corrosion protection coatings; exterior chemical sump; and miscellaneous building related work.

- **Mechanical Work and Treatment Equipment including, but not limited to:** furnishing, delivery and installation of treatment vessels, chemical storage and feed systems; mechanical process piping; surface wash pumps, pipe supports; isolation valves; motor operated valves; control valves; magnetic flow meters; air valves; start-up and commissioning; demonstration and training; HVAC equipment, and other miscellaneous work.

- **Backwash Pump Station and Recycle Tank including but not limited to** backwash transfer pump station and bolted steel tank including all pump station improvements and equipment; all process mechanical improvements (pumps, pipe, valves, and appurtenances); all mechanical improvements; foundation including over-excavation, backfill, and compaction, pressure testing, disinfection and startup as specified; and other related work.

- **Pipeline Work and Equipment including but limited to:** connections to existing pipelines; conveyance piping; facility process and inter-process piping; drain and sewer piping; backwash overflow piping; blow-offs and drain valves; air valves; pipe supports; fire hydrants; sampling ports; sample lines; chemical piping; couplings; reinforced concrete encasements; potholing of existing utilities; trenching and backfill; trench sheeting, shoring, and bracing per California Labor Code; import of backfill material; painting and coating; hydro-static testing, miscellaneous testing, chlorination/disinfection and field start-up and testing.
• Electrical, Instrumentation and Control Work and Equipment including, but not limited to: electrical power supply and distribution equipment, conduits, conductors, pullboxes, and ducts; meter panel; building lighting; standby generator; Motor Control Centers, soft starters, load center as well as service distribution panels and related conduits and wiring and connections; variable frequency drives for pumping equipment; grounding system; conduit and junction boxes for security system control panel, cameras, door and gate contacts, reader, (security system control panel, cameras, door and gate contacts and readers by others); Communication tower; RTU panel, terminal strips, operator interface terminal and digital recorder; instrumentation equipment and panels; Programmable Logic Controller; HMI; programming; unit flow meter conduits, wiring and connections; conduits and wiring for control valves; conduits for entry gate access control keypad, automatic sliding gate loops and conduits and wiring; conduits, wiring and connections; providing all trenching, pull boxes, conduits, sweeps, wiring, connections, encasements, temporary power, backfilling, compaction, and pavement repair.

• Other pertinent work for the construction of the complete and operable facility

**SC-03. Construction Period and Requirements.** The contract time is set forth in the Notice Inviting Bids. The following documents shall be accepted by the District prior to any construction:

A. Insurance Certificate(s) and all required endorsements
B. Injury and Illness Prevention Program
C. EN-84: Specific Operating Safety Procedure (see section 01000)
D. SWPPP: For the SWPPP, Submittal of the SWPPP and proof of filing of the NOI/LCAN must be completed prior to the commencement of any construction activities.
E. Project Sign
F. Preliminary Project Schedule (PPS see Section 01310)

Before any work of any subcontractor is started, the Contractor shall submit, at the preconstruction conference, a Subcontractors List and Worker Classification form giving the name, business, license number, email address, and worker classification for each subcontractor who will perform work on the project. Contractor shall update and resubmit the Subcontractors List and Worker Classification as required. (see Section F-General Conditions, F-17, Subcontracts, c. Contract Provisions).

**Schedule of Values.** The Contractor shall be responsible to submit and receive District approval of the Schedule of Values (see Section 01026) by the tenth (10th) of the month for processing of the monthly pay estimate. **All quantities are to be broken down per the detailed provision.** Submittal and approval of the Schedule of Values beyond the 10th of
the month will result in the pay estimate processed the following month (pay period ends on the 20th of each month).

**SC-04. Performance and Payment Bonds.** Pursuant to Section 995.660(a) of the Code of Civil Procedure, the Contractor shall submit the following documents with the performance and payment bonds:

1. The original, or a certified copy, of the unrevoked appointment, power of attorney, bylaws, or other instrument entitling or authorizing the person who executed the bond to do so;

2. A certified copy of the certificate of authority of the insurer issued by the State of California’s Insurance Commissioner; and

3. Copies of the insurer's most recent annual and quarterly statements filed with the Department of Insurance.

**NO PAYMENT SHALL BE MADE UNTIL THE BONDS ARE APPROVED**

**SC-05. Location of Contract Work Site.** The contract work site is located west of Hewitt Street and south of E Old 2nd Street within the City of San Jacinto, Riverside County (see pre-bid walk-through map and directions herein).

**SC-06. Liquidated Damages.** The fixed liquidated damages amount for each calendar day of unauthorized delay in completion of the work is hereby established at **one thousand five hundred dollars ($1,500)** per calendar day.

**Administrative Delay Liquidated Damages.** Liquidated damages may also be applied to compensate the District for undue delays in the completion of punch list items, site clean-up, demobilization, and miscellaneous contract obligations after a notice of Substantial Completion has been filed. The cost to the District for administration, inspection, mileage, and other similar items would be extremely difficult to determine. For that reason, additional liquidated damages, known as Administrative Delay Liquidated Damages shall be imposed in the amount of **$500** per day, effective 30 days after the Substantial Completion date is filed or the Revised Completion date is reached, whichever is later. Charges will be assessed until the Final Completion date is issued by the Inspector.

**SC-07. Construction Water.** For work under this specification, the Contractor can obtain water, free of charge, upon proper arrangements for metering its use from the Districts Resident Inspector at fire hydrants located adjacent to the project site.

Contractor shall provide all necessary piping and appurtenances, including pumps, to convey water to the work site. Arrangements for water from sources other than EMWD
shall be the sole responsibility of the Contractor, and no additional compensation will be allowed.

SC-08. **Insurance.** At all times during the life of this contract, Contractor and his subcontractors shall procure and maintain Commercial Liability, Automobile Liability, Workers Compensation, Equipment Floater and Installation Floater per Section F – General Conditions, F-04. **Contractor’s and Subcontractor’s Insurance.** Refer to Section F-04 for complete details, including required insurance limits, deductibles, and endorsements. Note: An Aggregate limit (cap), Professional Employer Organization (PEO), or Self Insurance Plan is not acceptable.

In addition to the requirements noted above and found in Section F-04, the following shall apply to this project:

**Commercial Liability Insurance.** Limits of insurance specified in section F-04.B, shall be changed to amounts not less than the following:

- $5,000,000 per each occurrence
- $10,000,000 General Aggregate Limit;
- $10,000,000 Products-Completed Operations Aggregate Limit;
- $5,000,000 Personal & Advertising injury limit;

**Automobile Liability Insurance.** Limits of insurance specified in section F-04.C, shall be changed to an amount not less than:

- $5,000,000 combined single limit.

**Additional Insureds.** The liability insurance required under Section F-04 under General Conditions shall include EMWD, City of San Jacinto, Tetra Tech Inc, Department of Water Resources of the State of California (STATE), Santa Ana Watershed Project Authority (SAWPA), California Regional Water Quality Control Board Santa-Ana Region (RWQCB), Riverside County Flood Control and Water Conservation District (RCFC & WCD), County of Riverside Department of Environmental Health and all agencies listed in Section H-Permits as additional insured. Refer to Section F-04 for additional requirements pertaining to this section

**Pollution Liability Coverage.** The Contractor shall procure Pollution Liability Coverage in amounts not less than the following:

- $2,000,000 per each occurrence
**Builders Risk, including Flood Insurance.** The Contractor and his subcontractors shall maintain or cause to be maintained at all times during the life of this contract, builders' risk "All Risk" completed value insurance, to include, at the option of the District, loss or damage caused by fire, FLOOD, insuring completed work, work in progress, material, supplies and equipment of the work site, in storage or in transit, in an amount equal to the full replacement cost thereof. Such insurance shall include the interests of the District, Contractor, all tiers of subcontractors, suppliers and materialmen, with deductible amounts, if any, for the sole account of and payable by Contractor. Loss under such insurance shall be adjusted with and payable to the District for the interest of all parties. The amount of property insurance shall be sufficient to protect against such loss or damage in full until the work is accepted by the District. **EMWD must be named as “loss payee” on the certificate for Builder’s Risk policy.**

Builder’s “All Risk” insurance policy shall contain a deductible not higher than $1,000 unless otherwise approved by the District.

Flood Insurance policy shall contain a deductible not higher than $100,000.00 unless otherwise approved by the District.

**SC-09. Compliance with Storm Water Regulations (NPDES) in Accordance with the General Permit for Storm Water Discharges Associated with Construction Activity Order No. 2009-0009 DWQ (NPDES General Permit No. CAS000002).** Contractor, as EMWD’s authorized representative, shall comply with the regulatory requirements of the State Water Resources Control Board’s (SWRCB) Order No. 2009-0009 DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002 for Discharges of Storm Water Runoff Associated with Construction Activity, copies of which are available on SWRCB website at: [http://www.swrcb.ca.gov/stormwtr/construction.html](http://www.swrcb.ca.gov/stormwtr/construction.html).

The Contractor shall submit a project specific Storm Water Pollution and Prevention Plan prepared by a Qualified SWPPP Developer (QSD) and certified by the Contractor as EMWD’s authorized representative in accordance with Order No. 2009-0009 DWQ, NPDES General Permit No. CAS000002. The Contractor shall submit 1 hard copy and 2 electronic copies (CDs in Smart pdf format) of the SWPPP to the District within two weeks of the contract start date. The District, upon approval of the SWPPP, shall electronically file Permit Registration Documents (PRDs) using the Stormwater Multi Application Reporting & Tracking System (SMARTS) and shall mail the Notice of Intent (NOI) Fee Statement with appropriate Application Fee to the State Water Resources Control Board. SWRCB will process the PRDs and a Waste Discharge Identification Number (WDID) will be assigned to the project. EMWD will forward the completed NOI including the WDID to the Contractor upon receipt.

The Contractor, as EMWD’s authorized representative, shall then maintain a copy of the SWPPP on the job site at all times for review and inspection by the Regional Water Quality
Control Board. Documents that shall be available on site include but are not limited to the SWPPP that is monitored as needed for current conditions; construction site monitoring plan (CSMP); weekly and extended rain event inspection checklists; pre- and post-rain event reports; quarterly non-stormwater monitoring reports; and Rain Event Action Plans (Risk Level 2 and 3 projects only). All on-site reports shall be revised and updated as necessary by noon every Monday. If a District observed holiday falls on Monday, all on-site reports shall be revised and updated by noon the next day.

The Contractor, as EMWD’s authorized representative, shall have a Qualified SWPPP Practitioner (QSP) to implement the SWPPP in compliance with Order No. 2009-0009 DWQ including but not limited to training/certification requirements for key personnel implementing the SWPPP/BMPs etc.; performance of weekly inspection reports; performance of all required monitoring and reporting including monitoring data/records and visual monitoring records; and maintaining records of corrective actions taken and not taken. Submittal of weekly inspections and monthly reports to EMWD in compliance with the permit is required by the end of each month. The Contractor’s QSP must be registered in SMARTS so EMWD may link the QSP to the project in SMARTS as a Data Person.

The District, at its discretion, may withhold payment and/or return pay requests if the contractor fails to submit monthly reports by the last working day of the month, properly maintain records, or otherwise comply with the permit requirements.

The Contractor shall include all costs for preparation of the SWPPP, record keeping, implementation, and reporting requirements of the permit. No additional compensation will be allowed.

SC-10. **Preconstruction Conference.** A Pre-job conference shall be scheduled prior to the start of the project. District representatives, Permit agencies, and the Contractor shall be present.

SC-11. **Preconstruction Audio Video Recording (DVD).** The Contractor shall make arrangements with a professional photographer, approved by the District, to prepare a full color pre-construction audio video recording on DVD of the project site with the Inspector present prior to mobilizing (refer to Section 01380 or 01381, whichever is applicable to these specifications) and provide the District with a copy.

SC-12. **Or Equal Substitutions.** Products of manufacturers listed as equals to those specified must be submitted for review and approval by the District not later than the tenth (10th) day preceding the date for receipt of bids.
**Specified Equipment with No Equal Substitution.** For the purposes of standardization within the DISTRICT, the following table of specification sections lists approved manufacturers and no equals. Manufacturers not named in these listed specifications will not be considered or approved. See Technical Sections for additional details.

<table>
<thead>
<tr>
<th>Section</th>
<th>Application</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>08711</td>
<td>Door Key System</td>
<td>Schlage</td>
</tr>
<tr>
<td>08711</td>
<td>Door Locks</td>
<td>Schlage</td>
</tr>
<tr>
<td>08711</td>
<td>Exit Devices</td>
<td>Von Duprin</td>
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<tr>
<td>08711</td>
<td>Door Closers</td>
<td>LCN</td>
</tr>
<tr>
<td>16040</td>
<td>Arc Flash Analysis</td>
<td>SKM Software</td>
</tr>
<tr>
<td>16160</td>
<td>Variable Frequency Drive</td>
<td>Allen Bradley, ABB, or Toshiba</td>
</tr>
<tr>
<td>16480</td>
<td>Motor Control Center</td>
<td>Eaton/Cutler-Hammer, Schneider Electric/Square D, Allen Bradley, or General Electric</td>
</tr>
<tr>
<td>16620</td>
<td>Emergency Diesel Engine Generator</td>
<td>Caterpillar, Generac, or Cummins</td>
</tr>
<tr>
<td>16950</td>
<td>Power Supply</td>
<td>Phoenix Contact</td>
</tr>
<tr>
<td>17010</td>
<td>Operator Interface Terminal (OIT)</td>
<td>Automation Direct</td>
</tr>
<tr>
<td>17010</td>
<td>Terminals/Terminal Strips</td>
<td>Phoenix Contact</td>
</tr>
<tr>
<td>17005</td>
<td>Pressure Switches</td>
<td>Allen Bradley</td>
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<tr>
<td>17005</td>
<td>Pressure Transmitters</td>
<td>Foxboro</td>
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<tr>
<td>17210</td>
<td>Magnetic Flow Meter</td>
<td>ABB, Siemens, or Endress Hauser</td>
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<tr>
<td>E8</td>
<td>40 Foot Antenna Mast</td>
<td>Universal Tower</td>
</tr>
<tr>
<td>SC-58</td>
<td>Chart Recorder – DR4300</td>
<td>Honeywell</td>
</tr>
</tbody>
</table>

**SC-13. Submission of Documents in Electronic Media Format.** Unless otherwise specified by the District, Contractor shall submit all documents (i.e.: RFIs, Contract Documents, Design Submittals, and Materials and Equipment Submittals) electronically via CIPO.

The Contractor shall be prepared to submit the following:

1. **Correspondence and Change Order Requests:** Electronic submission in WORD and PDF format, plus 1 hard copy.

2. **Request for Information (RFI’s):** Refer to Section F, F-30 Changes in Work and Extras.

3. **Shop Drawing Submittals:** Refer to Section F, F-29 Equipment and Material Items.

**SC-14. Potential COVID-19 Exposure.** There is no higher priority than the safety and well-being of our employees, our Contractors/Suppliers, and customers. Throughout the pandemic and beyond, the District will continue to assess our safety protocols and
take actions to maintain our operations and provide safe and reliable water, wastewater and recycle water service.

The District has implemented a new reporting mechanism specifically for Contactors/Suppliers to inform EMWD of potential COVID-19 exposures of their employees. Please forward an e-mail to riskmanagement@emwd.org to report potential exposure. Please abstain from notifying multiple District contacts as this results in duplicated efforts.

An e-mail should be forwarded each time any of your employees have been informed by a medical provider that they are suspected of having COVID-19 and they are asked to isolate from others or anytime an employee has tested positive for COVID-19. Along with this information the following should be provided:

- What District sites has the employee visited?
- When was the last date and time that they were on-site?
- Specifically what District employees were they in contact with?
- Did they practice social distancing at all times while on-site?
- Were they wearing a face covering while on-site?

The information provided will then be used to determine which EMWD personnel need to be notified of the potential exposure, to request that they self-monitor for symptoms and/or seek medical attention, and to determine what areas may require disinfection and sanitization.

If you use subcontractors/suppliers, please forward this communication on to them as well. As always, please continue to inform your Construction Administrator and Inspector of any questions regarding this protocol.

**SC-15. Control Density Fill (CDF):** The Contractor will be required to use CDF, in accordance with Section 02252 as backfill in areas under and around existing mainline utilities, and all utility crossings of the proposed underground piping and appurtenances, as shown on the plans. CDF shall be placed from the bottom of the excavation to the center grade of the utility and shall extend five feet each side of the existing facility. All costs associated with furnishing and placing CDF shall be included in the respective bid item.

**SC-16. Storage of Materials and Equipment and Security.** Contractor may utilize available land at the treatment plant site for storage of materials and equipment. Contractor shall coordinate the location of material and equipment storage with the District Inspector.

Contractor has the option to secure their own storage yard for materials and equipment. However, if private or public property is used, the Contractor must obtain written
permission from affected property owners and/or agencies in advance of moving said material or equipment onto offsite property. A copy of the letter from the private owner granting permission shall be submitted to the District prior to use of the site. The District will not approve the use of any property unless it can be considered “previously disturbed” in accordance with CEQA guidelines.

The Contractor shall be responsible for providing all security measures necessary to secure the stored materials or equipment and to protect the construction area regardless of whether it is stored on District property or Contractor acquired property. The District is not responsible for items lost, damaged or stolen from the secured site or for injuries to the public due to unsafe or unsecured conditions.

**SC-17. Project Sign.** Prior to the start of construction, the Contractor shall place a project sign at a prominent location on the project site, as directed by the District. The Contractor shall submit a prototype of the construction sign to the District for review and approval before posting the sign at the construction site. A construction project sign template and logo guidelines will be provided to the awarded contractor.

The sign shall be prepared in a professional manner, be at least four feet tall by eight feet wide, made of 3/4-inch thick exterior grade plywood or other approved material.

At a minimum, the following shall be included on the project sign:

- Project Title
- Purpose of Project
- Estimated Construction Duration
- Project Cost (if provided)
- Public Affairs contact: **(Contact name & ext to be provided at Prejob)**
- EMWD’s color logo
- One Water One Watershed logo
- Santa Ana Watershed Project Authority logo
- Department of Water Resources logo
- EMWD’s Mission Statement

In addition to the above, the sign shall include the following statement:

“This project is partially financed under the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84), administered by the State of California, Department of Water Resources”.

The Contractor shall be responsible to maintain the sign in good condition for the duration of the project.
**Purpose:** This project constructs a new centralized groundwater treatment plant as part of the Santa Ana River Conservation and Conjunctive Use Program.

**Estimated Project Duration:** Spring 2023

**Project Cost/Funding:**

The Mission of Eastern Municipal Water District is to deliver value to our customers and the communities we serve by providing safe, reliable, economical and environmentally sustainable water, wastewater and recycled water services.

This project is partially financed under the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84), administered by the State of California, Department of Water Resources.

**Public Outreach.** The District’s Public and Governmental Affairs (PGA) Department will perform public outreach to local residents informing them of upcoming construction activities. Therefore, the Contractor shall provide the District with four (4) week notice for the following activities: mobilization; final startup and testing at the site; construction of perimeter walls or fences on shared property lines; any work in the public ROW. The four (4) weeks provides the PGA Department the proper time to prepare and conduct the meetings. The Contractor’s CPM Schedule shall include these notification activities.

There may be times when other public outreach is necessary as determined by the PGA Department. That outreach may include attendance at community presentations, distribution of door hangers, distribution of letters or other like forms of community engagement. Any printed materials will be provided by the PGA Department.
If the District receives complaints from individuals or agencies affected by the project; the Contractor shall take immediate action to correct the situation as directed by the District.

If Contractor receives complaints directly, Contractor shall forward complaint directly to PGA Staff at (951) 928-3777 ext. 3430 and immediately notify the District Inspector. Thereafter, Contractor shall take immediate action to correct the situation as directed by the District.

**SC-19. Markups for Negotiated Change Order Work.**

**NEGOTIATED CHANGE ORDER WORK:**

- Labor Markup = 20%
- Material Markup = 15%
- Equipment Markup = 15%
- Contractor Markup for Subcontractor Work = 5% or $250 (Whichever is greater)
- Bonds = Actual premium (Separate Line Item) Contractor shall provide backup documentation of the actual rate

Note: The cost associated with the project superintendent and pricing of the proposal shall be considered part of the Overhead and Profit percentages previously noted.

**SC-20. Listing of Equipment Requiring Testing/Training by Factory-Trained Service Personnel.** After all equipment has been installed, tested, and adjusted, and placed into satisfactory operating condition, the individual equipment manufacturers shall provide classroom instruction to District's operating personnel in the use and maintenance of each item of equipment furnished. Contractor shall give the District formal written notice of the proposed instruction period at least two weeks prior to commencement of the instruction period. Scheduled training shall be at a time acceptable to the District and the manufacturer. During this instruction period, the manufacturer shall answer any questions from the operating personnel. The instruction period shall be as long as necessary to address details of operation, routine maintenance, repair, and special equipment features.

As a minimum, classroom instruction time shall include the following:

- Filter Vessels: 4 Hours
- Variable Frequency Drives: 2 Hours
- Chemical Injection Equipment: 4 Hours
- HVAC Equipment: 2 Hours
- MCCs: 2 Hours
- Magnetic Flow Meter: 2 Hours
- Instrumentation and Controls including System Interactions: 2 Hours
- Diesel Generator: 6 Hours
**SC-21. Pipeline Connection and Disinfection.** Prior to making connections, Contractor shall excavate and expose all existing utilities and specified connection points to determine exact location (horizontal and vertical) of each. Contractor shall determine the outside diameter, depth, and type of existing pipe at each connection location to the existing system.

Contractor shall install all piping and fittings for all connections as necessary to clear (1-foot minimum clearance) all existing utilities or interferences and to connect to existing facilities, all based on Contractor’s filed measurements, and all at no additional cost to the District.

The Contractor shall notify the District one (1) week in advance of the planned pipeline connections and also provide 48 hour and 24 hour advance confirmation of when the work will be performed. The Contractor shall be responsible for dewatering the trench excavations as necessary.

Contractor shall be responsible for dewatering, dechlorination, and disposal of all water from pipeline testing/flushing activities. Discharge of all water must abide by the District’s NPDES permit which limits total residual chlorine to a maximum concentration of 0.1 mg/l.

Contractor shall also protect existing water pipelines from contamination during connection procedures. Contractor shall disinfect all new pipelines, pipeline connection closure materials and the existing pipeline at connection points per AWWA Section C-651. All costs associated with connections to existing water pipelines shall be included in the appropriate bid item.

**SC-22. Soils or Geotechnical Reports, or Reference to.** Where investigations of subsurface conditions have been made by the District in respect to foundation or other structural design, and that information is shown in the plans, said information represents only the statement by the District as to the character of material which has been actually encountered by it in its investigation, and is only included for the convenience of bidders. Investigations of subsurface conditions are made for the purpose of design, and the District assumes no responsibility whatever in respect to the sufficiency or accuracy of borings or of the log of test borings or other preliminary investigations, or of the interpretation thereof, and there is no guaranty either expressed or implied, that the conditions indicated are representative of those existing throughout the work, or any part of it, or that unlooked for developments may not occur. Making such information available to bidders is not be construed in any way as waiver of the provisions of the first part of this article and bidders must satisfy themselves through their own investigations as to conditions to be encountered. Geotechnical reports are provided in the appendices.
SC-23. **Early Submittal Items.** As soon as practicable, and consistent with the schedule of construction, the Contractor shall submit the following early submittals to EMWD for approval. All materials supplied shall be in accordance with EMWD’s approved manufacturers’ list contained within Appendix A. Submittals shall be provided in accordance with the General Conditions, Section F-Labor and Construction, F-30 “Submittals”.

A. Permit application packages for diesel generator sets, including proposed generators, diesel particulate filters, silencers, all generator appurtenances, and documentation for public notification.

B. Long lead time electrical equipment including MCC’s, VFD’s, and switchgear.

SC-24. **Reference to District’s Standard Drawings and Detailed Provisions.** Any and all referenced Standard Drawings and Detailed Provisions shall be considered part of the contract drawings and specifications. All referenced Standard Drawings and Detailed Provisions of the District are available from the District upon request. The Contractor shall not be entitled to any compensation due to referenced documents not included in the Specifications and Contract Drawings.

SC-25. **Shutdown Requirements, Work Restrictions and Operations Coordination.** Contractor shall coordinate the shutdown operation of existing systems with the District, to include the Inspector and Operations and Maintenance personnel. No work shall be performed without 2 week prior notice followed by forty-eight (48) hour prior and twenty-four (24) hour confirmation notices to the District. No work shall be done without a District representative present.

SC-26. **Construction Control Survey and Soils Tests.** The baseline survey coordinates/points are shown on the construction contract drawings. Upon the Contractor's request, the District will provide a control survey by a licensed surveying professional to verify existing horizontal and vertical control as shown on the construction drawings. The contractor shall provide all other required surveying and staking for the project. All costs for surveying, staking, and/or re-staking shall be included in the contractor’s base bid prices(s). Contractor shall notify the District of impending survey work no less than 48 hours prior to commencement.

Geotechnical observation and testing is required during all grading, earthwork, and compaction activities. Upon the Contractor’s request, the District will provide geotechnical observation and soil/compaction testing by a geotechnical professional. Any required re-compaction or re-installation of fill material as determined by the geotechnical professional shall be performed at no additional cost to the district.
Contractor shall notify the District of impending earthwork no less than 48 hours prior to commencement.

**SC-27. Tracer Wire.** Tracer wire is to be placed over any and all pipelines regardless of product and electrical duct banks to be installed on this project. After all trench backfill operations are complete, the District shall pay for and conduct the locatability test to confirm that the wire is continuous. The Contractor shall be responsible for all costs to confirm, locate and repair any breaks in the tracer wire identified in the locatability test. In addition, the Contractor shall reimburse the District for all costs to retest repaired sections of the wire. The Contractor is advised to use care in the installation and backfilling operations to prevent damage to the wire.

Tracer wire shall be a #14 AWG (0.0641” diameter) fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation and rated for direct burial use at 30 volts. HS-CCS conductor must be at 21% conductivity for locating purposes. Break load of 282 pounds. HDPE installation shall utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities.

Manufacturers supplying copper clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used.

Origin of copper clad steel manufacturer is required and steel core must be manufactured in the United States. If manufacturer has not completed 5 year corrosion testing, a 5-year warranty must be provided.

Where utility marking tape is also required for the installation, only “NON-DETECTABLE” marking tape will be allowed.

**SC-28. Existing Underground Utilities and Potholing for Existing Utilities.** Unless otherwise indicated on the plans or directly by the utility owner, all utilities shall be protected in place and service maintained as described in Section 02201 Part 1.02 of the Specifications. Utilities crossing the proposed water pipeline alignment are plotted on the plan view of the plans. The utilities were plotted based on information provided from the respective utility owners. The accuracy of plotted utilities is not guaranteed as indicted in Section F-25 of the General Conditions.

Existing utilities have been identified and located on the plans based on the best information available. The Contractor is responsible for performing exploratory excavations (potholing) along the alignment of the project to confirm location of existing utilities and to establish connection requirements to existing pipelines. **All Contractors**
under contract with EMWD are hereby granted permission to use vacuum excavation on EMWD facilities. Vacuum excavations may not be used on any other facilities unless written permission is obtained from the owner of the facility in accordance with State Law 4216.

The Contractor shall field survey the elevation and location of utilities, including tie-in points, and provide the information to the District’s inspector a minimum of two weeks ahead of construction to permit design revisions should a conflict arise. All associated costs with potholing shall be included in the unit bid price per lineal foot of pipe stated in the Schedule of Values and no additional compensation will be allowed.

SC-29. **Maintenance Bond for Pumping Equipment.** The contractor or his supplier shall provide a maintenance bond (EMWD standard form C-14 or C-14.1) from a bonding company acceptable to the District equal to 100% of the pumping equipment value (including motors, pumps and pump assemblies) for a two (2) year term starting when the District has accepted the contracted work. Equipment and/or components failing within this period due to deficiency in design, workmanship or material shall be removed, replaced, and reinstalled at no cost to the District, and said replacement shall be guaranteed for two years continuous service. The maintenance bond shall be submitted to the District prior to the performance test of the pump(s).

**Warranty.** All pumping equipment shall carry an extended warranty for a two-year period from the date of installation. All warranties shall be turned into the District prior to project completion.

SC-30. **Detailed Provision Section 16480: Main Switchboard and Motor Control Center.** Power Monitor shall be installed on all motor control centers unless specifically stated otherwise in the plans or specifications. Refer to Part 2.04A Miscellaneous Devices, Power Monitor, for further details.

SC-31. **Knox Switch.** Provide a Knox Keyed Entry Switch (Model 3502 or approved equal) adjacent to the front gate. Information and location shall be submitted by the Contractor to and approved by the local Fire Department. Knox switch shall be wired (per EMWD Sec.16010) to the RTU to indicate status/alarm.

SC-32. **Contractor Office at Site of Work.** During the performance of this Contract, Contractor shall maintain a suitable field office at or near the Site which shall be the headquarters of its representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative or delivered at Contractor's office at the Site in the representative's absence shall be deemed to have been delivered to Contractor. Refer to General Conditions, Section F-31 for Field Office requirements.
SC-33.  **Earthquake Design and Restraint.** Reference is made to Section 11005, Part 3.11. All equipment, its major components, anchorage parts, and bolts shall be designed to withstand stresses caused by ground movement (seismic forces) in accordance with the California Building Code (CBC) latest edition for Occupancy/Risk Category IV Facilities. Horizontal and vertical seismic forces shall be considered to act simultaneously. Safety factor for overturning shall be 1.5:1. The following seismic design parameters shall be utilized:

\[
\begin{align*}
S_S &= 2.48 \\
S_1 &= 1.13 \\
F_a &= 1.0 \\
F_v &= 1.5 \\
S_{MS} &= 2.48 \\
S_{M1} &= 1.70 \\
S_{DS} &= 1.65 \\
S_{D1} &= 1.13 \\
I_e &= 1.50 \\
\text{Seismic Design Category} &= D \\
\text{Site Class Definition} &= D
\end{align*}
\]

Calculations and anchorage details shall be prepared by State of California licensed engineer (civil or structural) and submitted for District's review for the following equipment:

1. Electrical Service Switchboard
2. Motor Control Center
3. Variable Frequency Drive Unit
4. Remote Telemetry Unit
5. A/C System Air Handling Unit
6. A/C System Condenser Unit
7. Generator Terminal Box
8. Generator Load Bank

SC-34.  **Preservation of Paved Surfaces, Restoration of Work Site, and Disposal of Spoil and Waste Materials.** Contractor shall perform his operations so that existing roads and other paved surfaces adjacent to or in the vicinity of the work site are not damaged. Contractor shall repair any damaged pavement which results from his operations (except that which is specifically a part of the Contract Work) to the satisfaction of the District, all at his expense.

All work sites shall be restored to pre-job conditions and shall meet the requirements of the District and property owners.
District is obligated to keep visual impact of the work sites to a minimum; therefore, Contractor is required to restore all areas altered by construction to pre-existing conditions. Such areas shall include, but shall not be limited to, areas used for travel, parking, and storage of vehicles, equipment and materials.

Contractor shall be responsible for the proper disposal of all waste materials resulting from his operations, including equipment and material specified to be demolished, rubbish, packaging materials, discarded equipment parts, and damaged construction materials, in a manner and at locations suitable to the District and all health and other regulatory agencies.

**SC-35. Owner Furnished, Contractor Installed (OFCI) Equipment.** Owner (District) will furnish and Contractor shall install and four (4) RTU panels with Kingfisher PLC and operator interface terminal (OIT), as shown on the Drawings. District will program the Kingfisher PLC.

For the RTU installation, wiring, programming and startup, the Contractor shall confirm that the District inspectors have notified the District electrical staff 90 days in advance of each item of work. The Contractor shall include the notifications as a milestone in the project schedule.

For the RTU improvements, the Contractor shall hold a coordination meeting after the 90-day notification if provided between the District electrical staff, District inspectors and Contractor.

**SC-36. Electrical Service.** Contractor shall construct new electric services per Southern California Edison (SCE) requirements and in accordance with Contract Documents. Contractor shall coordinate all required work with SCE and District, including: (1) removal of existing transformer (by SCE) at Well 27, precast concrete slab box, conduit, conductors (by SCE), grounding system, guard posts, and appurtenances; and (2) installation of new transformer, precast concrete slab box, conduit, conductors, electrical service switchboard, grounding system, guard posts, and appurtenances. A copy of the approved SCE Service Plans for the proposed new electrical service and removal of the existing electrical service are provided in the Appendices.

All electrical service material and equipment shall be in strict accordance with SCE requirements. Prior to commencing construction of electrical service facilities, Contractor shall submit shop drawings of proposed material and equipment to SCE and District for review and approval.

Contractor’s work will be inspected by SCE’s Inspector and the District’s Inspector. District will pay directly all SCE fees required for new service. Refer to SCE plan in Appendix F for further contract requirements.
SC-37. **Spoil Material.** Excess soils from excavation shall be spoiled entirely at Contractor's expense off the project site to an approved disposal area through the County or City. In no instance shall excess spoil become a public nuisance or threat to public safety.

SC-38. **Trench and Excavation Protection.** Before making any excavation or trench 5 feet or more in depth, Contractor shall submit to District a detailed excavation plan and drawing(s) showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection. In addition to worker protection, the shoring system shall be designed and constructed in a manner to protect adjacent property and existing public and private improvements. Drawings shall be specific as to where the design applies, and shall reference the code sections, geotechnical parameters, and calculations. Proceeding with excavation without accepted excavation plan is a contract violation and, upon notification of District, Contractor shall stop excavating and backfill and compact the excavation until such time as the plan has been submitted and accepted by the District. Excavation protection shall be installed as excavation proceeds. Excavation depth shall not exceed 5 feet without protection.

If said excavation plan and drawing(s) do not vary from the requirements of the OSHA Construction Safety Orders (Cal/OSHA or FED OSHA, whichever is more stringent at the time of construction), a statement signed by a civil or structural engineer registered in the State of California, engaged by Contractor at his expense, shall be submitted certifying that the Contractor's excavation drawings comply with OSHA Construction Safety Orders. In addition, the submittal shall include the procedures and sequence for construction/installation of the excavation protection system. The excavation protection system shall be installed as excavation progresses to protect workers and adjacent property and improvements.

If said excavation plan and drawing(s) vary from said OSHA Construction Safety Orders, the excavation plan and drawing(s) shall be prepared and certified by a registered civil or structural engineer and said engineer shall affix his seal and signature to each sheet of said drawing. The submittal shall include the procedures and sequence for construction/installation and removal of the excavation protection system including sequence for installing and removal of cross bracing. The excavation protection system shall be installed as excavation progresses to protect workers and adjacent property and improvements.

Contractor shall not perform any excavation that will be over 5 feet in depth until District has received and acknowledged the properly certified excavation plan and drawing(s) and supporting calculations with the registered engineer’s statement or stamped drawings.

SC-39. **Local Conditions.** The Contractor shall assess, by personal investigation, local conditions affecting the work. Neither the information contained in this section nor that derived from any maps or plats, or from the District or employees shall act to relieve
the Contractor of any responsibility herein or from fulfilling any and all of the terms and requirements of this Contract.

Nuisance water, such as rainfall, irrigation water, or local surface runoff may occur within construction areas during the period of construction under this contract. The Contractor, by submitting his bid, will be held responsible for having investigated the risks arising from such water and shall take all due measures to prevent delays in progress of the work caused by such waters.

**SC-40. Equipment Warranty.** All pumps, chemical analyzers and motor operated valve actuators shall carry an extended warranty for a two-year period from the date of Functional Acceptance testing. All warranties shall be turned into the District prior to project completion.

**SC-41. Maxim Security Systems Coordination.** The District currently uses a specific security system provider to provide and install its treatment plant security devices. The system is provided by Maxim Security Systems. The Contractor shall hire Maxim Security Systems (Security System Contractor) and include all costs for coordination, start-up and installation of the security system for the Centralized Treatment Plant project in the Bidding Sheets. The pre-negotiated cost and scope of work for the security system equipment, installation, and other services to be provided by the Security System Contractor is included in the Appendices.

The Contractor shall issue a purchase order to the security system provider 30 to 45 days following the notice to proceed, as noted in the Appendices, and shall hold a coordination meeting with security system provider and District staff 45 days prior to security equipment installation.

The Contractor shall coordinate with the Security System Contractor to ensure that the Security System Contractor completes their work and makes the security equipment and control available and operational during the Field Test, Adjustment, Training, and Initial Operation phases. The Contractor shall include this work as a specific item on the construction schedule and all subsequent updates.

Security System Contractor will furnish and install the security network panel, remote security devices (intrusion alarms, cameras, card readers, and electric door latch mechanisms with armored cables), and conductors between the security network panel and remote security devices.

Contractor shall provide rough-in work at doors for door switches, electric locks and card readers. All doors shall be installed by the Contractor. Contractor shall install all conduit and junction boxes for the security system as shown on the drawings. Contractor shall
install a pull string in each security system conduit. Security System Contractor will then install and terminate all wiring for the security system.

The Maxim Security Systems Coordination Table below includes tasks and specific responsibilities related to the security system for the site.

<table>
<thead>
<tr>
<th>Maxim Security Systems Coordination Table</th>
</tr>
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<tbody>
<tr>
<td><strong>Task</strong></td>
</tr>
<tr>
<td>Furnish and install intrusion switches on rolling and pedestrian gates.</td>
</tr>
<tr>
<td>Furnish and install access control and intrusion of all outside doors and entries.</td>
</tr>
<tr>
<td>Furnish and install flood lighting.</td>
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<tr>
<td>Furnish and install video surveillance system (6 cameras).</td>
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<tr>
<td>Furnish and install conduit and junction boxes (with pull string).</td>
</tr>
<tr>
<td>Perform rough in work for doors (including prep for door switches, electric locks, and card readers).</td>
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<tr>
<td>Furnish and install lighting control panel (including area lighting).</td>
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<tr>
<td>Furnish and install motion detectors.</td>
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<tr>
<td>Furnish and install all conduits to the security system control panel.</td>
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<tr>
<td>Furnish and install Knox boxes.</td>
</tr>
<tr>
<td>Furnish and install intrusion to Knox boxes.</td>
</tr>
<tr>
<td>Furnish and install security system control panel.</td>
</tr>
<tr>
<td>Furnish and install card readers and associated wiring to the security system control panel.</td>
</tr>
<tr>
<td>Furnish and install door switches and intrusion switches and corresponding wiring to the security system control panel.</td>
</tr>
<tr>
<td>Furnish and install wiring for electronic locks on exterior doors to the security system control panel.</td>
</tr>
<tr>
<td>Program security and access control system per EMWD</td>
</tr>
</tbody>
</table>
The Contractor is solely responsible for providing a complete security system, including, but not limited to, being responsible for the Security System Contractor completing their scope of work for the listed pre-negotiated price, and providing all services and equipment required for the complete system not included in the security system supplier scope of work.

**SC-42. Aluminum Sign.** For access gate on Evans Street, the Contractor shall construct the Aluminum Sign per the requirements specified herein, providing a vinyl sheeting letter aluminum sign with the following information:

![Centralized Treatment Plant Sign](image)

The font shall be 'Calibri' or alternative as approved by EMWD. Contractor shall attach 24” H x 36” W aluminum sign to double swing gate as shown on the drawings. The sign shall be placed as field directed by EMWD inspector.

Contractor shall submit the proof of the sign and dimensions showing the sign location on the double gates (see Note 10 on C-101) for approval by EMWD prior to constructing the wall adjacent to the gate. A sample of a District-approved sign can be found in the Appendices.

**SC-43. Specified Manufacturers and Model Numbers.** Inclusion of a specific manufacturer's name in the Specifications or on the Construction Drawings does not mean that the specific manufacturer's standard equipment will be acceptable. Specified manufacturer's or other manufacturer's standard equipment shall be modified as required to meet the requirements of the Specifications and Construction Drawings.
All model numbers used herein are provided for information only, to assist Contractor in selecting equipment that conforms to specifications. In case of any conflict between model numbers given herein and the descriptive specifications or performance specified, the descriptive specifications and performance specified shall govern.

**SC-44. Location of Equipment and Ambient Environmental Conditions.** All mechanical and electrical equipment shall be designed to operate at the project site. Derating and necessary oversizing to achieve performance shall be incorporated in equipment design.

The project site is at an elevation approximately 1,590 feet above mean sea level. Maximum design ambient temperature shall be 115°F and minimum design ambient temperature shall be 20°F. Relative humidity may range from 10% to 90%. Cooling of equipment will be by circulation of outside air which often contains dust. Equipment shall be designed to prevent damage which could be caused by high or low ambient temperature within the specified range, freezing, dust in the air, winds of up to 70 mph, and wet weather conditions. Equipment shall be specifically designed to function satisfactorily under said conditions. All electrical and mechanical equipment shall be suitably sealed.

**SC-45. Noise Control Requirements.** Contractor shall comply with local ordinances concerning noise abatement. Noise suppression shall be practiced at all times to minimize disturbance to persons living or working nearby, and to the general public.

The measures to be used in effecting noise suppression shall include, but are not limited to, equipping all internal combustion engines with critical residential silencers (mufflers), sound blankets shielding noise-producing equipment from nearest areas of human occupancy by locating in such positions as to direct greatest noise emissions away from such areas, and conducting operations in the most effective manner to minimize noise generation consistent with the execution of the contract in a timely and economic manner.

Noise levels at the property line in excess of the limits of the agency having jurisdiction shall be allowed only for critical operations during daytime hours for brief periods of time. If nighttime operation is allowed by the District, Contractor shall make every reasonable effort to minimize levels below City nighttime ordinance limits at the time of the work being performed.

For nighttime work, the Contractor shall take noise measurements at the nearby property lines before and during operation and notify the District Inspector of ambient and operational noise level readings.

Should a complaint be filed by surrounding property owners, the Contractor shall submit a noise monitoring report, which will include steps to mitigate the excessive noise levels.
SC-46. **Mitigation Monitoring and Reporting Program.** The contractor is responsible for implementation and compliance with the mitigation measures as described in the Mitigation Monitoring and Reporting Checklist found in the Appendix. All costs for implementation and compliance shall be included in the contractors bid price.

The District will be responsible for performing all monitoring and conducting the necessary surveys as described in the MMRP. The District will retain all biologists, archaeologists, and paleontologists as described in the MMRP.

SC-47. **Operation and Maintenance Manuals and Manufacturer's Instructions.** Contractor shall upload detailed operations and maintenance (O&M) manuals into CIPO at least 30 days prior to startup and testing for all mechanical and electrical equipment he furnishes. During startup, the equipment manufacturers shall provide instructions to the District's personnel on operation and maintenance. This time shall not be considered required classroom time. O&M manuals shall be provided in accordance with requirements of the General Conditions, Section F – Labor and Construction, and Detailed Provision Section 01430.

SC-48. **Reduced Pressure Backflow Prevention Devices (RPBPD).** Contractor shall provide lead free reduced pressure backflow prevention devices in accordance with the District's Approved Materials List, District Standard Drawings and Detailed Provisions, and as shown on the Drawings. Upon completion of RPBPD installation and disinfection, Contractor shall arrange District to certify backflow device. Certification reports shall be submitted for each RPBPD.

SC-49. **Records of Construction.** Contractor shall keep and maintain, one record set of Construction Drawings as specified in the General Conditions, Section F - Labor and Construction, F-08, Reports, Records, and Data.

In addition, Contractor shall provide as-built electrical schematics and wiring diagrams in hard copy form and computer form (CAD) for the following: interconnect diagrams with appropriate wire and terminal numbering for all equipment and controls. Electronic files shall be provided in AutoCAD (dwg) format.

SC-50. **Trench and Excavation Protection.** Before making any excavation or trench 5 feet or more in depth, Contractor shall submit to District a detailed excavation plan and drawing(s) showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection. In addition to worker protection, the shoring system shall be designed and constructed in a manner to protect adjacent property and existing public and private improvements. Drawings shall be specific as to where the design applies, and shall reference the code sections, geotechnical parameters, and calculations. Proceeding with excavation without accepted excavation plan is a contract violation and, upon notification of District, Contractor shall stop excavating and backfill and compact the excavation until such time as the plan has been submitted and accepted by the District.
Excavation protection shall be installed as excavation proceeds. Excavation depth shall not exceed 5 feet without protection.

If said excavation plan and drawing(s) do not vary from the requirements of the OSHA Construction Safety Orders (Cal/OSHA or FED OSHA, whichever is more stringent at the time of construction), a statement signed by a civil or structural engineer registered in the State of California, engaged by Contractor at his expense, shall be submitted certifying that the Contractor’s excavation drawings comply with OSHA Construction Safety Orders. In addition, the submittal shall include the procedures and sequence for construction/installation of the excavation protection system. The excavation protection system shall be installed as excavation progresses to protect workers and adjacent property and improvements.

If said excavation plan and drawing(s) vary from said OSHA Construction Safety Orders, the excavation plan and drawing(s) shall be prepared and certified by a registered civil or structural engineer and said engineer shall affix his seal and signature to each sheet of said drawing. The submittal shall include the procedures and sequence for construction/installation and removal of the excavation protection system including sequence for installing and removal of cross bracing. The excavation protection system shall be installed as excavation progresses to protect workers and adjacent property and improvements.

Contractor shall not perform any excavation that will be over 5 feet in depth until District has received and acknowledged the properly certified excavation plan and drawing(s) and supporting calculations with the registered engineer’s statement or stamped drawings.

**SC-51. Certificate of Installation.** Contractor shall submit a "Manufacturer’s Certificate of Proper Installation" for major equipment including: chemical storage, chemical feed pumps; treatment vessels, backwash pumps; motor drives, and HVAC systems. Refer to the Appendices for certificate form. **Contractor shall submit completed Certificate of Unit Responsibility for all equipment requiring unit responsibility in the Detailed Provisions.**

**SC-52. Compliance with ANSI/NSF Standard 61 and NSF 372.** All pipe, fittings, pumping equipment and appurtenances shall be constructed of materials and provided with interior coatings and linings that are certified to be in accordance with ANSI/NSF Standard 61 for potable water contact and indirect additives, as well as NSF 372 lead free requirements.

**SC-53. Encroachment Permit.** The Contractor shall obtain an encroachment permit from the City of San Jacinto. The Contractor shall prepare and submit the required information to the City of San Jacinto and shall perform all coordination necessary to obtain the permit. It is anticipated that the District will be billed for the permit fee and associated inspection fees directly. If the City requires a deposit or fee payment made at
any time during the course of the permit application or construction process, the Contractor shall coordinate obtaining a check from the District for said deposit or fees. All costs for obtaining and complying with all provisions of the permit shall be included in the original bid and no additional compensation will be allowed. The Conditional Encroachment Permit is included in 00066 Section H – Permits.

**SC-54. Contractor Cooperation and Coordination.** Contractor shall cooperate with the District, District Representatives and all other jurisdictional agencies. The District will have representatives on site to observe and verify compliance with Contract Documents. Contractor shall notify the District a minimum of 2 weeks prior to commencing construction.

It shall be the Contractor's responsibility to coordinate his activities with all the other contractors performing work in the project area and to cooperate with all other contractors within reasonable and professional norms so that all construction may be completed in a timely manner. In the event a scheduling conflict arises between contractors performing work on the job site and if both parties are unable to reach an agreement, the District shall be the final authority in resolving said scheduling conflict. No additional compensation will be allowed due to conflicts with other construction in the area.

Portions of the Work shall require coordination between the contractor for this project and other contractors for the PHASE 1B CONVEYANCE PIPELINES project, and the WELLS 201, 202, 203 AND 205 EQUIPPING project. The contractor shall participate in a monthly coordination meeting with the contractors of these other projects at the treatment plant site for coordination of work activities. This monthly meeting is in addition to the other project meetings required by the Contract. The contractor’s superintendent, at a minimum, shall attend this meeting. Coordination shall be considered incidental to the Work and shall be included in the base bid for the applicable bid items.

**SC-55. Buried Butterfly Valves.** All butterfly valves shall be from the District’s approved material list. Buried butterfly valves shall be installed similar to EMWD Standard Drawing No. B-577. The Contractor shall pothole each connection point to confirm exact depth of connection. The Contractor shall notify District Inspector of depth of cover and receive written approval prior to ordering valves.

**SC-56. Air Valves.** All air and vacuum valves shall be from the District’s approved material list. Air and vacuum valves shall be installed similar to EMWD Standard Drawing No. B-367. The Contractor shall pothole each connection point to confirm exact depth of connection. Flared fittings WILL NOT BE PERMITTED on the air vacuum and air release assemblies.
SC-57. **Electrical System Studies and Field Testing.** The Contractor shall provide the Electrical Short Circuit/Coordination Study, Arc Flash Hazard Study and Field Testing of Electrical system for the entire station per Section 16040. The Contractor shall ensure that all safety measures are implemented.

SC-58. **Data Recorder.** The Contractor shall supply and install one (1) electronic data recorder. The data recorder shall be Honeywell-Minitrend DR4300, with no substitutions allowed.

SC-59. **Construction Staking.** Contractor shall provide all construction staking included, but not limited to, property corners, plant piping, masonry block wall, masonry block building and all survey that is needed to construct per the contract documents. Contractor shall bare all costs associated with the required construction staking for the project.

SC-60. **DDW Inspection.** The Contractor shall notify EMWD three (3) weeks prior to the project substantial completion date such that the California Department of Drinking Water (DDW) may schedule and perform the final site inspection.

SC-61. **NSF Certification.** All materials in contact with potable water shall comply with the applicable provisions of California Title 22 Regulations Related to Drinking Water, including NSF 60 and 61 certifications; all at no additional cost to the District. Additionally, Contractor shall provide the District with a written "Affidavit of Compliance" with the California Drinking water Regulations as part of the submittal approval process. The District may provide copies of the Contract Documents and related project information to the California department of Public Health for their approval.

SC-62. **Emergency Generator Noise Requirements.** The permanent standby power generator is designated as emergency equipment and is regarded as exempt from the noise restrictions designated in the City of San Jacinto noise ordinance. Operation and testing of the emergency generator is regarded as exempt under Sections 11.80.030 E.2 of the Municipal Code. However, conditions of operation that shall be adhered to are as follows:

1. Testing of generators shall comply with all hourly restrictions provided in the SCAQMD permits. Testing should be kept to the minimum duration necessary. For generators on sites located adjacent to schools, no testing of the generator shall occur between 7:30 am and 3:30 pm on days when school is in session. Any additional hourly restrictions provided in the SCAQMD permits shall take precedence.

2. During any operation, testing and/or start-up of the emergency generator, the Contactor shall follow all applicable conditions described in Section 11.80.030 (D.8.c) of the Municipal Code, required for testing of emergency signaling devices.
3. During initial testing and start-up, the Contractor shall take noise measurements at the property line before and during operation and notify the District Inspector of ambient and operational noise level readings.

4. No testing shall be performed before 8 am or after 5 pm at the Well 203 site. No testing shall be performed on weekends or holidays at any site.

**Emergency Generator AQMD Permits.** The contractor is responsible for acquiring the AQMD permits for the emergency generator sets, including all public notification requirements. The contractor shall have complete and approved permits from South Coast Air Quality Management District (SCAQMD) prior to installing any of the generator sets. The contractor should take note, based on the contract drawings, that several of the proposed generators are located in close proximity to sensitive receptors such as private residences and schools. The approved generator sets shall meet all requirements of SCAQMD including the most current tier requirements, approved diesel particulate filters, silencers, and load banks.

The permit submittal and approval process shall include coordination with EMWD. Prior to submittal of permit applications to SCAQMD, the contractor shall submit the permit applications to EMWD for review and comment. Draft permits will also be submitted to EMWD for review. Prior to any public notification, the contractor shall submit all documentation for public notice to EMWD for review and comment. All SCAQMD requirements for the public notification process shall be met.

**Private Improvements.** Protection of private improvements within the right of way adjacent to the Project site against damage caused by construction is of the utmost importance. The Contractor shall protect in place or replace in kind all landscaping, fencing, mailboxes, etc. Disturbed by the Work. All protection measures shall be provided by the Contractor. If the Contractor cannot reasonably protect private improvements in place during construction, the private improvement shall be either temporarily relocated and replaced after construction is complete or replaced in kind. In this case, the Contractor shall notify the property owner and District of said requirements and coordinate the temporary relocation and replacement prior to any removal. All costs for this Work shall be included in the original bid and no additional compensation will be allowed.

**Operation of Existing Facilities.** Contractor shall not operate any existing facilities, including opening or closing of existing pipeline valves, appurtenances and electrical equipment. If required, the Contractor shall be fully responsible for coordinating with the District or other agencies for operation of their facilities.
**SC-66. Pavement Repair, Replacement, and Recapping.** Pavement replacement shall comply with the City of San Jacinto encroachment permit requirements. Unless otherwise noted within the permit, materials/requirements shall consist of 6 inches of Class II aggregate base, 3 inches of base pavement PG-64-10 (3/4” max), with a minimum cap overlay of 0.10' in depth using PG-64-104 (1/2” max), for a 12 foot minimum width or full lane whichever is wider; replacement of any berm or rolled berm pavement edge; replacement and repair of P.C.C. cross gutters, including sawcut/grinding at all edges or transitions. The pavement repair will apply to all lanes impacted by the Contractor’s operation.

**SC-67. Survey Monuments and Benchmarks.** The Contractor shall not disturb existing survey monuments or benchmarks, except for those specifically noted on the project drawings. Contractor shall have a Licensed Land Surveyor registered in the State of California locate, mark, reference and prepare a Corner Record prior to construction, for all monuments that will be disturbed pursuant to Business and Professions Code, Sections 8700 to 8805 of the Land Surveyor’s Act, specifically Section 8771(b). The contractor shall notify the District at least 72 hours prior to working near any monuments or benchmarks. For any monuments that are destroyed or disturbed, the Contractor shall have a Licensed Land Surveyor registered in the State of California reset the monuments and file a Corner Record or a Record of Survey with the County Surveyor prior to the District recording a Certificate of Completion for the project.

**SC-68. Work Hours.** Contractor shall perform all contract work between the hours of 7:00 AM and 5:00 PM, Monday through Friday unless otherwise restricted by encroachment permit terms per the local permitting agencies.

The project site is within the vicinity of Edward Hyatt Elementary School. The Contractor will be responsible for obtaining the school’s yearly calendar and providing a copy to the District. The contractor shall coordinate all construction activities with the school schedules and abide by any additional work hour constraints required by the school due to school traffic and bussing.

Work at other times and work on holidays will be permitted only with the prior approval or direction of the District’s representative. Contractor may be required to construct connections outside normal work hours, or on weekends or holidays as directed by District, all at no additional cost to District.

**SC-69. Dust Control Requirements.** Contractor shall maintain the work area in a neat, safe, clean and sanitary condition at all times. Streets shall be kept clean of debris, with dust and nuisance being controlled. A water truck shall be actively operating during work hours to spray water on dry soil areas for dust control. The Contractor shall be responsible for any cleanup of adjacent streets affected by his construction. The Contractor shall clean streets with sweeper prior to the end of each work day as a minimum.
Contractor shall comply with South Coast Air Quality Management District’s Rule 403 – Fugitive Dust to actively prevent, reduce or mitigate fugitive dust emissions. Contractor shall implement the Best Available Control Measures as referenced in Table 1 of Rule 403.

**SC-70. Construction Work Area and Restrictions.** Contractor shall confine his work, including construction activities, equipment and/or material storage, and access to areas within street right-of-way, District easements and properties, and as shown on Drawings. Work within the street right-of-way shall be in accordance with the City of San Jacinto Encroachment Permit.

If Contractor performs work or stores equipment and/or materials outside the limits specified above, Contractor shall stop all work immediately and restore all areas to their pre-construction condition to the satisfaction of District and the property owners. The Contractor shall also provide an indemnification letter to District regarding any unauthorized work outside above specified areas.

**SC-71. Traffic Control.** The Contractor is responsible for the preparation and submittal of Traffic Control Plans to the appropriate local jurisdiction (City of San Jacinto) for approval of this project. The Contractor shall implement approved traffic control measures. Throughout each work period the Contractor shall inspect traffic control (signs, barricades, arrow boards, delineators, etc.) necessary to maintain traffic flow, as required by agencies having jurisdiction over the roadway in the work area.

The Contractor shall also provide traffic control measures for pothole and surveying crews performing any work within the public Right-of-Way or traveled pavements associated with this project. These measures shall include but not be limited to signs, barricades, arrow boards, delineators, traffic warning signs, flagmen, and other traffic control devices as required to maintain traffic flows, as required by agencies having jurisdiction of the roadways in the work area. All cost associated with traffic control shall be included in the bid for this item and no additional compensation shall be allowed.

**SC-72. Business and Resident Access.** The Contractor will be required to provide complete unobstructed access to each resident's driveway at the end of every workday. In addition, the Contractor will be required to provide complete unobstructed access to each commercial property at all times during construction. The Contractor will be responsible for coordinating with EMWD Public and Governmental Affairs staff for notifying the businesses and residents 72 hours in advance that the construction activity will occur in front of their property, business, or residence and that their driveways may be blocked by these construction activities. All costs associated with coordination, notification and providing access to businesses and residents shall be included in the base bid and no additional compensation will be allowed.
SC-73. **Groundwater and Dewatering.** Contractor is responsible for all dewatering operations and no additional compensation will be provided should groundwater levels be encountered that are different than those described in the plans and specifications.

Contractor shall consider the distinct possibility that the existing water system line valves will not achieve 100-percent closure and may cause water leakage during tie-in procedures and abandonments; therefore, the Contractor may need to continuously dewater existing water pipelines during tie-in work.

The costs associated with dewatering, including pumping, de-chlorination and disposal shall be included in the bid price.

Discharge of all water must abide by the District’s NPDES permit. Discharge of groundwater shall also comply with local, state, and federal regulations, including, but not limited to required discharge permits from Riverside County Flood Control and Water Conservation District and the Santa Ana Regional Water Quality Control Board.

SC-74. **Removal of Asbestos, or Asbestos Cement Pipe (ACP).** This project may require the removal and disposal of existing Asbestos, or Asbestos Cement Pipe (ACP). The contractor shall refer to the hazardous materials survey provided in the Appendix. The contractor is advised **ASBESTOS IS A KNOWN HUMAN CARCINOGEN** when inhaled and poses serious health risks. If asbestos or ACP is identified, the Contractor shall immediately notify the District Inspector. If it is determined by the District Inspector that demolition is required, the Contractor shall coordinate with the District so that they can obtain a permit from the Riverside County Office of Environmental Health (RCOEH) and AQMD for the removal. The Contractor shall legally abandon and/or dispose of the asbestos under those permit regulations.

In the event that ACP demolition and disposal is required, the Contractor shall perform all handling and disposal of ACP in strict conformance with applicable CAL/OSHA, EPA and government health agency requirements.

The preferred method will be for the Contractor to remove existing ACP to the next joint beyond the limits of removal shown on the plans and only cut the ACP pipe when removal to the next joint is feasible. The final decision on cutting shall be made by the District Inspector. Contractor and his employees or subcontractor must be trained according to CAL-OSHA guidelines. Handling and disposal must meet CAL-OSHA, CAL-EPA, and AQMD guidelines.

The Contractor is responsible for correct handling, transportation, and disposal of asbestos or asbestos cement pipe. Contractor shall provide EMWD all Bill of Lading and Manifest associated with the transportation and disposal of the waste material.
**SC-75. Lead Base Paint.** The Contractor is responsible for correct handling, transportation and disposal of lead-based paint. The Contractor must comply with all federal, state and local requirements for demolition, containment and disposal for all of the materials at this station. Contractor shall provide EMWD all Bill of Lading and Manifest associated with the transportation and disposal of the waste material.

Disposal of waste coating and abrasives shall be at the Contractor’s expense and in strict compliance with State and Federal statutes. The District shall be furnished with all documentation related to spent abrasives and waste paint debris, including analytical results of concentrations for the metals zinc, cadmium, chromium, and lead. The cost of this item including the permits acquisition shall be included in the appropriate bid item. The contractor shall refer to the hazardous materials survey provided in the Appendix.

**SC-76. Gas Service.** The existing Southern California gas service is currently active but will be removed as part of this project. Disconnection and removal of the existing Southern California gas service is required. Disconnection of the existing gas service shall be scheduled and coordinated with the District and the Southern California Gas Company.

**SC-77. Locksets and Doors.** Locksets are historically a long lead item and should be ordered in a timely manner so as not to delay the installation. Contractor shall coordinate with the door manufacturer to assure that the pre-drilled openings in the door and door thickness are compatible with the door hardware and locks to be installed by the Contractor. See Section 08100 for details and requirements.

**SC-78. Property Line Easements/License Agreements for Walls and Fences.** The District is in the process of acquiring easements/license agreements for the construction of the perimeter block walls along shared property lines. Construction of proposed EMWD walls along shared property lines shall not commence until the contractor has verified with EMWD that the easements/license agreements have been approved for construction. The contractor shall prepare their construction schedule such that the perimeter walls and fences are not a critical path item, and may be constructed towards the end of the project if necessary, without impacting the project schedule.

Temporary construction fencing with mesh privacy/dust screen shall also be constructed in locations where there is no existing perimeter fencing on EMWD property. Existing and temporary construction fencing shall not be removed at the project site until the contractor begins construction of the proposed fences/walls.

**SC-79. Architectural Color Boards and Color Books.** The color schedule in the contract drawings details the architectural color selections at each well site for the well building interior, exterior, perimeter walls and fences, and all other materials and appurtenances. Within 60 days of the Notice to Proceed, the contractor shall submit to the District detailed architectural color boards demonstrating the proposed color schemes as outlined in the contract documents. The color boards shall be professionally prepared.
by a California licensed architect and shall contain physical color samples of all selected materials (as opposed to photos or pictures). In the event a color listed on the schedule is not currently available, the Contractor shall work with District personnel to provide a product that closely matches the specified color. Color boards shall be revised as needed based on comments from the District, and final color selections shall be approved prior to procurement of materials. The Contractor shall then prepare a color book for each well site to document the selected colors for the District’s use for future maintenance purposes. The color book shall consist of a three-ring binder labeled with the Facility Name, “Color Book” and date on the cover. The book shall contain the manufacturer name, local supplier contact information, color name, color number, mix design (if custom paint color), and physical color sample (color chip) for each color/piece of equipment. The color books shall be submitted to the District for review. District comments shall be incorporated, and a final color book placed at each well building upon acceptance of that well site by the District.

SC-80. **Spectrum Services Coordination.** The Contractor shall coordinate with District field engineering staff the Spectrum Services at the project site. The Contractor shall install the infrastructure (e.g. conduits, pull boxes, network panel enclosure, etc) shown on the drawings to provide a service to the site. District field engineering staff will establish service with Spectrum Services. The final location of the Spectrum pull box will be coordinated in the field and may vary from where shown on the plans. District provides and installs the Ethernet switch, the UPS and the Spectrum modem/router in the Contractor furnished and installed network rack. Spectrum Services will be responsible to install the cabling in the Contractor furnished and installed conduits and pull boxes into the network panel enclosure. Connection between the security system and District’s ethernet network will be performed by Maxim per SC-42 within the Contractor furnished and installed conduits. The Contractor shall notify the District field engineering and District electrical staff 60 days in advance of this work item and include notifications as a milestone on the project schedule.

**END OF SECTION**
SSC-1. Section 03150 – Formwork for Cast-in-Place Concrete

Add to section 1.01:

1.01 DESIGN REQUIREMENTS

A. CONTRACTOR is solely responsible for design, engineering and construction of formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

B. Forming, shoring and bracing designs for footings, walls and roofs shall be provided by the CONTRACTOR to meet all requirements specified here-in.

C. If requested by the ENGINEER, drawings and calculations shall be submitted verifying the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, shoring of roof forms, or any other part of forming, shoring or bracing which may be considered critical by the ENGINEER.

D. A civil or structural engineer hired by the Contractor, and registered in the same state in which the project is located must design all falsework and forming requirements for roof support systems. The drawings, with supporting calculations, must each be signed and sealed by the engineer. No work shall be started until the roof support and form design has been submitted to the DISTRICT for records. The falsework design engineer must visit the site and approve the erection of all shoring prior to the placement of any concrete.

E. The CONTRACTOR shall be solely responsible for the adequacy of the forming, shoring and bracing design.

F. Any formwork and falsework installed by CONTRACTOR shall be solely at CONTRACTOR's risk. The submittal of the design will not lessen or diminish the CONTRACTOR's liability.
Add to end of 1.02.A:
“Falsework shall be designed under the direct supervision of a licensed Structural or Civil Engineer experienced in the design of this work and licensed in California.”

Replace text in 1.03.B as follows:
Replace “ACI 347R-88” with “ACI 301-16 and ACI 347R-14”.
Replace “ACI 117-90” with “ACI 117-10”

Add to end of 3.05.A:
“Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.”

Add to end of 3.05.B:
“Verify lines, elevation levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings. Clean surfaces of all forms to be in contact with concrete of all previous concrete or contaminants prior to erection. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.”

Change 3.06.A
From: “Column forms and wall forms.......................2 days”
To: “Column forms and wall forms...12 hours of accumulative time with ambient temperature over 50°F

Add “(and only when concrete test breaks indicate the concrete placed for the slab has reached a minimum of 85% of its required 28-day compressive strength.)” after “14 days” for the removal requirements for “Forms supporting roof or floor slabs (but not shoring)”

SSC-2. Section 03200 – Reinforcing

Replace in section 1.02.A:
“Chapter 26 of the Uniform Building Code” with “ACI 301-16 and ACI 318-14”

Replace in section 2.04:

Replace in section 2.07:
“Conform to CRSI Manual...” with “Conform to ACI 315-18 and CRSI Manual...”

Add to end of section 3.01.C:
“Reinforcement in masonry shall be secured against displacement prior to grouting by wire positioners or other suitable devices at intervals not exceeding 180 bar diameters.”

SSC-2 00110 Supplemental Special Conditions
Replace in section 3.01.D:
“(Class A) (Class C) top bars” with “Class B”

Replace last paragraph in section 3.01.H with:
“Installation of epoxy bonded dowels, including the drilling and preparation of holes, shall conform to the applicable ICC Evaluation Report for the approved adhesive”

SSC-3.  Section 03200 – Reinforcing
Add the following paragraph to section 1.01 as paragraph D:
“The requirements specified herein are minimum requirements only and shall not be interpreted as all inclusive. It is the responsibility of the CONTRACTOR to employ the necessary practices based on the referenced ACI Standards to ensure the completion of quality concrete construction, of the strengths specified within the Construction Documents, and relatively free of cracks.”

SSC-4.  Section 03300 – Cast-in-Place Concrete
Add the following standards to section 1.02:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACI 117</td>
<td>Standard Tolerances for Concrete Construction and Materials</td>
</tr>
<tr>
<td>ACI 214</td>
<td>Recommended Practice for Evaluation of Strength Test Results of Concrete</td>
</tr>
<tr>
<td>ACI 301</td>
<td>Specifications for Structural Concrete for Buildings</td>
</tr>
<tr>
<td>ACI 305R</td>
<td>Hot Weather Concreting</td>
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<tr>
<td>ACI 306R</td>
<td>Cold Weather Concreting</td>
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<tr>
<td>ACI 308</td>
<td>Standard Specifications for Curing Concrete</td>
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<tr>
<td>ACI 309</td>
<td>Consolidation of Concrete</td>
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<tr>
<td>ACI 315</td>
<td>Details and Detailing of Concrete Reinforcement</td>
</tr>
<tr>
<td>ACI 318</td>
<td>Building Code Requirements for Reinforced Concrete</td>
</tr>
<tr>
<td>ASTM C31</td>
<td>Practices for Making and Curing Concrete Test Specimens in the Field</td>
</tr>
<tr>
<td>ASTM C39</td>
<td>Test Method for Compressive Strength of Cylindrical Concrete Specimens</td>
</tr>
<tr>
<td>ASTM C94</td>
<td>Specification for Ready-Mixed Concrete</td>
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<tr>
<td>ASTM C136</td>
<td>Method for Sieve Analysis of Fine and Coarse Aggregates</td>
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<tr>
<td>ASTM C143</td>
<td>Test Method for Slump of Hydraulic Cement Concrete</td>
</tr>
<tr>
<td>ASTM C156</td>
<td>Test Methods for Water Retention by Concrete Curing Materials</td>
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</tbody>
</table>
ASTM C157  Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C 192 Method of Making and Curing Concrete Test Specimens in the Laboratory
ASTM C309  Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494  Specification for Chemical Admixtures for Concrete

Add the following to the end of first paragraph of section 1.04:
“All mix designs shall be signed, sealed and stamped by a California licensed Civil or Structural Engineer with a date of signature.”

Replace in section 1.04.A.g (i):
“...Sections 5.3, respectively, Standard Building Code Requirements for Reinforced Concrete (ACI 318, latest edition...” with “...Section 4 of ACI 301-16...”

Add to the end of section 3.04.B:
“The hot weather concreting requirements in ACI 305R shall be strictly followed.”

SSC-5.   Section 04220 – Concrete Masonry Unit
Add the following paragraph to section 2.01 as paragraph L:
“Anti-Graffiti Coating. Provide a siloxane or RTV silicone rubber graffiti protectant coating. Coating shall be formulated to provide protection against, and easy removal of, unwanted graffiti. Coating shall protect vertical concrete block, other masonry substrates with little or no change to the appearance of the untreated substrate. Protectant shall penetrate into the pores to prevent graffiti penetration and be stable against ultraviolet ray exposure. Coating shall dry clear and be non-yellowing with a low luster sheen. Coating shall be compliant by VOC compliant with current codes. Anti-graffiti coating shall be compatible with water repellent product. Substrate preparation and coating application of anti-graffiti coating and primers shall be per manufacturer’s recommendation. Manufacturers shall be Sherwin Williams, Tnemec or equal.”

SSC-6.  Section 08365 – Rolling Service Doors – Chain Operated
Replace in section 1.03.A:
“International Conference of Building Officials (ICBO)” with “International Code Council (ICC)”

Replace in section 1.03.A.1:
“Uniform Building Code (UBC)” with “California Building Code (CBC)”
Add the following at the end of section 08711:

A. **Hardware Schedule**

The following hardware schedule is provided as a guide. Contractor shall furnish all hardware necessary for the project. Hardware required for any particular location, but not scheduled, shall be the same as that scheduled for similar locations.

Catalog numbers listed in the hardware schedule are from the catalogs of the following manufacturers:

<table>
<thead>
<tr>
<th>Code</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBW</td>
<td>Builders Brass Works</td>
</tr>
<tr>
<td>C</td>
<td>Corbin Co.</td>
</tr>
<tr>
<td>H</td>
<td>Hager</td>
</tr>
<tr>
<td>LCN</td>
<td>LCN Closers</td>
</tr>
<tr>
<td>N</td>
<td>Norton Door Controls</td>
</tr>
<tr>
<td>Mc</td>
<td>McKinney Mfg. Co.</td>
</tr>
<tr>
<td>P</td>
<td>Pemko Mfg. Co.</td>
</tr>
<tr>
<td>Q</td>
<td>Quality Hardware Co.</td>
</tr>
<tr>
<td>RE</td>
<td>Reese Enterprises, Inc.</td>
</tr>
<tr>
<td>RU</td>
<td>Russwin</td>
</tr>
<tr>
<td>SCH</td>
<td>Schlage (No substitute)</td>
</tr>
<tr>
<td>STA</td>
<td>Stanley</td>
</tr>
<tr>
<td>VD</td>
<td>Von Duprin, Inc.</td>
</tr>
<tr>
<td>Z</td>
<td>Zero Weatherstripping</td>
</tr>
</tbody>
</table>

Listed manufacturers are used to establish the quality and type of hardware to be furnished. Hardware equal in quality and function may be submitted to the District for approval, provided Contractor demonstrates substitute hardware conforms in function, quality, finish, and workmanship to the products hereinafter specified. Provide product of one manufacturer for each specified hardware item for standardization of appearance, maintenance, and replacement.
Hardware Schedule

**HW-1 (Ext. Single Door)**
Each door shall have:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Manuf. Descript.</th>
<th>Catalog No.</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Hinges</td>
<td>Mc</td>
<td>T4B3386 (5&quot;)</td>
<td>US32D</td>
</tr>
<tr>
<td>1</td>
<td>Lockset</td>
<td>SCH</td>
<td>L9453P034</td>
<td>US26D</td>
</tr>
<tr>
<td>1</td>
<td>Stop</td>
<td>Q</td>
<td>433ES</td>
<td>US26D</td>
</tr>
<tr>
<td>1</td>
<td>Holder</td>
<td>Q</td>
<td>1149A</td>
<td>US26D</td>
</tr>
<tr>
<td>1</td>
<td>Threshold</td>
<td>P</td>
<td>157A</td>
<td>ALUM</td>
</tr>
<tr>
<td>1 set</td>
<td>Head/Jamb</td>
<td>P</td>
<td>290AS</td>
<td>USP</td>
</tr>
<tr>
<td>1</td>
<td>Bottom</td>
<td>P</td>
<td>216AV</td>
<td>USP</td>
</tr>
<tr>
<td>1</td>
<td>Head Drip</td>
<td>P</td>
<td>346A (door width +3&quot;)</td>
<td>USP</td>
</tr>
<tr>
<td>1</td>
<td>Closer</td>
<td>LCN</td>
<td>4110 Series, H-Cush ARM 4110-3049 CNS</td>
<td>USP</td>
</tr>
</tbody>
</table>

**SSC-8. Section 09871 – Coating System for Water Pumping Plants**

Remove Section 2.03 in its entirety and replace with the following:

2.03  COLOR AND PAINT SCHEDULE: The color of materials and equipment shall be per the color schedule on the plans.

**SSC-9. Section 11005 – General Mechanical and Equipment Provisions**

Delete Section 3.11.B in its entirety and replace with:

B. Minimum Earthquake Forces: The minimum earthquake forces shall be those prescribed for Essential Facilities by the 2019 California Building Code and applicable supplements as published by the International Code Council, and the ASCE 7-16 Minimum Design Loads for Buildings and Other Structures or as specified in the “Soil Investigation Report,” whichever is greater.

Contractor shall submit shop drawings, details, and data herein before specified in Section F General Conditions, F-30, “Submittals.”

**END OF SECTION**
SECTION P - CONTRACT DRAWINGS

P-01. **General.** The location of the work, its general nature and extent, the outline of the land owned or controlled by the District and the form and general dimensions of the facilities (i.e. pipelines, appurtenances, etc.) are as shown on the drawings attached and made a part of this Specification as listed below.

P-02. **Standard Drawings.**

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-540</td>
<td>Emergency Shower and Eyewash</td>
</tr>
<tr>
<td>B-271</td>
<td>Saddle Outlets ¾” to 36” Diameter</td>
</tr>
<tr>
<td>B-286B</td>
<td>Trench Backfill</td>
</tr>
<tr>
<td>B-288</td>
<td>Steel Flanges 4”-54”</td>
</tr>
<tr>
<td>B-304</td>
<td>Butt Strap Details</td>
</tr>
<tr>
<td>B-342</td>
<td>1 ½” Meter Installation</td>
</tr>
<tr>
<td>B-344A</td>
<td>2” Copper Service Connection</td>
</tr>
<tr>
<td>B-351</td>
<td>6” x 1-2 ½” Blow-Off Installation – Steel Pipe</td>
</tr>
<tr>
<td>B-577</td>
<td>Installation of Butterfly Valves</td>
</tr>
<tr>
<td>B-561</td>
<td>4” x 1-2 ½” Blow-Off Temp End Installation – Steel Pipe</td>
</tr>
<tr>
<td>B-597A</td>
<td>Reduced Pressure Backflow Preventer Assy for Sizes 3/4” through 2”</td>
</tr>
<tr>
<td>B-656</td>
<td>Locater Wire Installation</td>
</tr>
<tr>
<td>B-660</td>
<td>Test Stations: Insulated Joint and Insulated Joint at Valve</td>
</tr>
<tr>
<td>B-661</td>
<td>Thermite Weld Details</td>
</tr>
<tr>
<td>B-665</td>
<td>Guard and Marker Posts</td>
</tr>
<tr>
<td>B-668</td>
<td>Valve Cap and Riser Detail</td>
</tr>
<tr>
<td>B-987</td>
<td>EMWD Facility Monument Sign</td>
</tr>
<tr>
<td>SB-52</td>
<td>Precast Reinforced Concrete Standard 48” and 60” I.D. Manhole</td>
</tr>
<tr>
<td>SB-53</td>
<td>Manhole Cover and Frame Standard &amp; Watertight Manholes</td>
</tr>
<tr>
<td>SB-157</td>
<td>Pipe Zone Bedding for Sewer Pipe</td>
</tr>
<tr>
<td>SB-158</td>
<td>Trench Backfill for Sewer Pipe</td>
</tr>
<tr>
<td>SB-176</td>
<td>Sewer Lateral Connections</td>
</tr>
</tbody>
</table>
P-03. **County of Riverside Standard Drawings.**

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Type A-6 Curb</td>
</tr>
<tr>
<td>205</td>
<td>Curb and Gutter Joints</td>
</tr>
<tr>
<td>207</td>
<td>Residential Driveway with Sidewalk at Curb</td>
</tr>
<tr>
<td>209</td>
<td>Cross Gutter, Layout and Section</td>
</tr>
<tr>
<td>401</td>
<td>Sidewalk and Curb</td>
</tr>
</tbody>
</table>

P-04. **RCFC & WCD Standard Drawings.**

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB108</td>
<td>Inlet Type X (Grate)</td>
</tr>
<tr>
<td>M803</td>
<td>Concrete Collar for Pipes 12” Through 66”</td>
</tr>
<tr>
<td>MH251</td>
<td>Manhole No. 1</td>
</tr>
</tbody>
</table>

P-05. **Greenbook Standard Drawing.**

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>601-4</td>
<td>Reinforced Concrete Block Wall</td>
</tr>
</tbody>
</table>

P-06. **City of San Jacinto Standard Drawings.**

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>City Standard Utility Trench Surface Repair</td>
</tr>
</tbody>
</table>

P-04. **Construction Drawings.**

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-60359</td>
<td>TITLE SHEET, LOCATION MAP AND VICINITY MAP</td>
</tr>
<tr>
<td>D-60360</td>
<td>SHEET INDEX, COLOR SCHEDULE AND SHUTDOWN SCHEDULE</td>
</tr>
<tr>
<td>D-60361</td>
<td>GENERAL NOTES, ABBREVIATIONS AND LEGEND</td>
</tr>
<tr>
<td>D-60362</td>
<td>PROCESS FLOW DIAGRAM</td>
</tr>
<tr>
<td>D-60363</td>
<td>HORIZONTAL CONTROL PLAN FOR SITE IMPROVEMENTS</td>
</tr>
<tr>
<td>D-60364</td>
<td>HORIZONTAL CONTROL PLAN FOR YARD PIPING</td>
</tr>
<tr>
<td>D-60365</td>
<td>DEMOLITION PLAN</td>
</tr>
<tr>
<td>D-60366</td>
<td>SITE PLAN</td>
</tr>
<tr>
<td>D-60367</td>
<td>GRADING PLAN</td>
</tr>
<tr>
<td>D-60368</td>
<td>YARD PIPING PLAN</td>
</tr>
<tr>
<td>D-60369</td>
<td>36-INCH OFFSITE WATER LINE PLAN AND PROFILE</td>
</tr>
<tr>
<td>D-60370</td>
<td>24-INCH OFFSITE DRAIN PLAN AND PROFILE</td>
</tr>
<tr>
<td>D-60371</td>
<td>YARD PIPING PROFILES</td>
</tr>
<tr>
<td>D-60372</td>
<td>YARD PIPING PROFILES</td>
</tr>
</tbody>
</table>
D-60373 WALL PROFILES
D-60374 WALL PROFILES
D-60375 WALL PROFILES
D-60376 SITE DETAILS
D-60377 SITE DETAILS
D-60378 SITE DETAILS
D-60379 WALL DETAILS
D-60380 YARD PIPING DETAILS
D-60381 MASTER TREATMENT SITE LAYOUT
D-60382 GENERAL STRUCTURAL NOTES
D-60383 SPECIAL INSPECTIONS AND STRUCTURAL OBSERVATIONS
D-60384 FOUNDATION PLAN
D-60385 ROOF FRAMING PLAN
D-60386 TRUCK CONTAINMENT SLAB
D-60387 BACKWASH TANK FOUNDATION PLAN
D-60388 FILTER FACILITY FOUNDATION PLAN
D-60389 BLENDING STATION FOUNDATION PLAN
D-60390 STRUCTURAL SECTION
D-60391 STRUCTURAL SECTION
D-60392 TYPICAL STRUCTURAL DETAILS 1
D-60393 TYPICAL STRUCTURAL DETAILS 2
D-60394 STRUCTURAL DETAILS 3
D-60395 STRUCTURAL DETAILS 4
D-60396 STRUCTURAL DETAILS 5
D-60397 STRUCTURAL DETAILS 6
D-60398 STRUCTURAL DETAILS 7
D-60399 STRUCTURAL DETAILS 8
D-60400 STRUCTURAL DETAILS 9
D-60401 FLOOR PLAN
D-60402 ROOF PLAN
D-60403 ELEVATIONS 1
D-60404 ELEVATIONS 2
D-60405 MECHANICAL LEGEND AND ABBREVIATIONS
D-60406 BASIS OF DESIGN AND TABULATED DATA
D-60407 SCHEDULES
D-60408 MECHANICAL PLAN
D-60409 PLUMBING DETAILS
D-60410 MECHANICAL DETAILS
D-60411 MECHANICAL DETAILS
D-60412 BLENDING STATION
D-60413 FILTER FACILITY PLAN
D-60414 BACKWASH WASTE TANK PLAN
D-60415 CHEMICAL BUILDING PLAN
D-60416  GENERATOR ROOM
D-60417  BLENDING STATION SECTIONS
D-60418  PRESSURE FILTER SECTIONS
D-60419  BACKWASH RECYCLE TANK SECTIONS
D-60420  CHEMICAL BUILDING SECTION
D-60421  PROCESS DETAILS
D-60422  PROCESS DETAILS
D-60423  PROCESS DETAILS
D-60424  GENERATOR DETAILS
D-60425  STEEL TANK PROCESS DETAILS
D-60426  STEEL TANK PROCESS DETAILS
D-60427  PROCESS EQUIPMENT SCHEDULE
D-60428  ELECTRICAL SYMBOLS AND ABBREVIATIONS
D-60429  ELECTRICAL SITE PLAN
D-60430  ELECTRICAL LIGHTING PLAN
D-60431  CHEMICAL BLDG POWER PLAN
D-60432  CHEMICAL BLDG INSTRUMENTATION AND CONTROL PLAN
D-60433  BACKWASH, BLENDING STATION, AND VESSEL POWER PLANS
D-60434  BACKWASH AND VESSEL INSTRUMENTATION AND CONTROL PLAN
D-60435  ELECTRICAL GROUNDING PLAN
D-60436  ELECTRICAL DETAILS
D-60437  ELECTRICAL DETAILS
D-60438  DUCT BANK DETAILS
D-60439  SINGLE LINE DIAGRAM - MSB
D-60440  SINGLE LINE DIAGRAM SWBD-1
D-60441  MSB, SWBD-1 AND MCC-1 ELEVATION
D-60442  SINGLE LINE DIAGRAM SWBD-2 FUTURE
D-60443  PUMP CONTROL SCHEMATIC - VFD
D-60444  PUMP CONTROL SCHEMATIC FVNR STARTER
D-60445  EXTERIOR LIGHTING CONTROL PANEL SCHEMATIC
D-60446  CONDUIT SCHEDULES
D-60447  CONDUIT SCHEDULES
D-60448  PANEL SCHEDULES
D-60449  LIGHT FIXTURE SCHEDULE
D-60450  P&ID SYMBOLS, LEGEND, AND ABBREVIATIONS
D-60451  SCADA BLOCK DIAGRAM
D-60452  P&ID CENTRAL TREATMENT FACILITY FEED AND PRESSURE FILTERS
D-60453  P&ID TYPICAL PRESSURE FILTER
D-60454  P&ID EFFLUENT BLENDING AND SAMPLE STATION
D-60455  P&ID BACKWASH RECYCLE TANK AND PUMP STATION
D-60456  P&ID SODIUM HYPOCHLORITE CHEMICAL SYSTEM
D-60457  COMMUNICATION PANEL ELEVATION
D-60458  FILTER CONROL PANEL LAYOUT

00200 Section P Contract Drawings
SPECIFICATIONS - DETAILED PROVISIONS
Section 01026 - Schedule of Values

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PART 2 - EXECUTION ...........................................................................................................................2
  2.01 SAMPLE SCHEDULE OF VALUES ......................................................................................2
PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Preparation, format, and submittal of Schedule of Values.

B. The Schedule of Values will establish unit prices for individual items of work.

C. The Schedule of Values will be the basis for payment of contract work and will be used to establish payment for any “extra work” i.e., work requested which is beyond the scope of the original contract.

1.02 PREPARATION

A. Prepare satisfactory Schedule of Values identifying costs of items of work shown in sample included at the end of the Section.

B. Assign unit prices to items of work and calculate total prices, which aggregate the Contract Price. Base unit prices on costs associated with scheduled activities for each item of work. For any bid item broken down into unit prices, Contractor shall verify that the unit cost of the items does not extend beyond two decimal places and that the unit cost when multiplied by the unit quantity equals the exact bid item value with no remainder.

1.03 SUBMITTAL

A. Submit preliminary Schedule of Values at the preconstruction meeting to the District for review and approval. DO NOT SUBMIT THE SCHEDULE OF VALUES WITH YOUR BID PACKAGE.

B. Submit corrected Schedule of Values within ten (10) days upon receipt of reviewed or rejected Schedule of Values for approval by the District.

C. Upon request, support prices with data which will substantiate their correctness.
PART 2 - EXECUTION

2.01 SAMPLE SCHEDULE OF VALUES

The following is a sample and acceptable form for Schedule of Values.

The District may request additional detail as necessary to adequately represent the Scope of Work. The contractor may provide an additional breakdown of any of the items listed below. THE CONTRACTOR SHALL VERIFY ALL QUANTITIES AND ITEMS OF WORK PRIOR TO SUBMITTAL.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Unit</th>
<th>Description</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>LS</td>
<td>Mobilization and Approved: Bonds, Insurance, Schedule of Values, and Preliminary Project Schedule (PPS).</td>
<td>PRESET</td>
<td>$550,000</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>LS</td>
<td>PRE-NEGOTIATED: Provide services of the Security System Contractor to furnish and install security system, as specified in the Special Conditions and per the quotation in the Appendix.</td>
<td>PRESET</td>
<td>TBD</td>
</tr>
</tbody>
</table>

3.0 Site Clearing and Demolition

3.1 1 LS Demolition of existing monitoring well and onsite vegetation, abandonment of existing utilities, and other items at Centralized Treatment Facility per Drawings and Specifications. | LUMP SUM | $

3.2 1 LS Demolition of existing chain link fence at Centralized Treatment Facility per Drawings and Specifications. | LUMP SUM | $

4.0 Site Work

4.1 1 LS Survey as needed for site work, such as control lines, slope stakes, batter boards, and stakes for curb and structure points and other working points, lines, and elevations. | LUMP SUM | $

4.2 1 LS Preparation of the SWPPP, record keeping, and reporting requirements of the permit and implementation including: complying with all provisions; and all miscellaneous compliance work. | LUMP SUM | $

SCHEDULE OF VALUES
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Unit</th>
<th>Description</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3</td>
<td>1</td>
<td>LS</td>
<td>Centralized Treatment Facility site grading and appurtenant site work, including over-excavation, temporary placement / storage of material, replacement of site material, engineered fill, compaction, rough grading, and finish grading; import and/or export material as required; temporary security fencing and gates; and miscellaneous site work as shown on the Drawings and Specifications, but not specifically listed above.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4.4</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install shoring and bracing for site work construction per California Labor Code per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td>LF</td>
<td>Furnish and install all 8-ft masonry block perimeter walls, including concrete footing, reinforcing steel, mortar, grout, and anti-graffiti coatings per Drawings and Specifications.</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>4.6</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all powder coated manual steel gates, security pickets, and appurtenances including painting, coatings, and anti-graffiti coatings per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4.7</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all powder coated electrified steel gates, including gate operators, loop detectors, access cards and reader stations, gate hardware, security pickets, and appurtenances including painting, coatings, and anti-graffiti coatings per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4.8</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install monument sign and appurtenances including lights, painting, coatings, and anti-graffiti coatings per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4.9</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all on-site, asphalt paving, redwood headers and aggregate base per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>Item No.</td>
<td>Qty</td>
<td>Unit</td>
<td>Description</td>
<td>Unit Cost</td>
<td>Total Cost</td>
</tr>
<tr>
<td>---------</td>
<td>-----</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>4.10</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all concrete site work not designated elsewhere, including driveways, equipment pads, building entrance approaches, drain sumps, sidewalks, curbs, gutters, ribbon gutters and bollards per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4.11</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install communication tower per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5.0 Yard Piping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>1</td>
<td>LS</td>
<td>Survey as needed for yard piping construction, such as control lines, slope stakes, batter boards, and stakes for pipe locations and other working points, lines, and elevations.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5.2</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install trench sheeting, shoring and bracing per California Labor Code per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5.3</td>
<td></td>
<td>LF</td>
<td>Furnish and install 36-inch diameter CML&amp;C carbon steel pipeline and appurtenances per Drawings and Specifications.</td>
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</tr>
<tr>
<td>5.4</td>
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<td>LF</td>
<td>Furnish and install 30-inch diameter CML&amp;C carbon steel pipeline and appurtenances per Drawings and Specifications.</td>
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</tr>
<tr>
<td>5.5</td>
<td></td>
<td>LF</td>
<td>Furnish and install 24-inch diameter CML&amp;C carbon steel pipeline and appurtenances per Drawings and Specifications.</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>5.6</td>
<td></td>
<td>LF</td>
<td>Furnish and install 24-inch diameter PS 46 PVC pipeline, manholes and appurtenances per Drawings and Specifications.</td>
<td></td>
<td>$</td>
</tr>
<tr>
<td>5.7</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install 12-inch diameter CML&amp;C carbon steel pipeline and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5.8</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install 8-inch diameter CML&amp;C carbon steel pipeline and</td>
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<tr>
<td>Item No.</td>
<td>Qty</td>
<td>Unit</td>
<td>Description</td>
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<td></td>
<td>Furnish and install 4-inch diameter SDR35 PVC pipeline, manholes and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5.9</td>
<td>1</td>
<td>LS</td>
<td>Miscellaneous piping and related work as shown on the Drawings and Specifications not specifically listed elsewhere, including, but not limited to, water service, water meter, backflow device, eye washes, hose bibs and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5.11</td>
<td>1</td>
<td>LS</td>
<td>Other above grade yard piping and appurtenances, including the Blending Station Facility, valves, equipment, pipe supports, valve supports, blow-offs, painting and coating, hydro-testing, miscellaneous testing, chlorination/disinfection and field start-up and testing, and all other miscellaneous work as shown on the Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
</tbody>
</table>

### 6.0 Offsite Piping

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Unit</th>
<th>Description</th>
<th>Unit Cost</th>
<th>Total Cost</th>
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</thead>
<tbody>
<tr>
<td>6.1</td>
<td></td>
<td>LF</td>
<td>Furnish and install 36-inch diameter CML&amp;C carbon steel pipeline and appurtenances per Drawings and Specifications.</td>
<td>$</td>
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</tr>
<tr>
<td>6.2</td>
<td></td>
<td>LF</td>
<td>Furnish and install 24-inch diameter PS 46 PVC pipeline, manholes and appurtenances per Drawings and Specifications.</td>
<td>$</td>
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</tr>
<tr>
<td>6.3</td>
<td>1</td>
<td>LS</td>
<td>Miscellaneous piping and related work as shown on the Drawings and Specifications not specifically listed elsewhere, including, but not limited to, traffic control, hydro-testing, miscellaneous testing, chlorination/disinfection.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>6.4</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install grind and cap paving overlay per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>Item No.</td>
<td>Qty</td>
<td>Unit</td>
<td>Description</td>
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<tr>
<td>6.5</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install trench sheeting, shoring and bracing per California Labor Code per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>7.1</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install 165,000-gallon bolted steel backwash waste tank, concrete pad and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>7.2</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install 30-HP End Suction Centrifugal pumping units and motors, piping, valves, supports, and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>8.1</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install Treatment building including excavation, reinforced concrete footings, slabs on grade, equipment pads, and masonry block walls, including reinforcing steel, mortar, grout, and metal coping per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>8.2</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install Chemical Receiving Station and Chemical Sump including, emergency eyewash/shower stations, excavation, reinforced concrete footings, walls, slabs, equipment pads including reinforcing steel per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>8.3</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install emergency generator with load bank, active diesel particulate filter, external fuel tank, fuel containment piping and appurtenances.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>8.4</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install chemical storage tanks, fume scrubber, feed systems and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>8.5</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all HVAC system, including air conditioning unit, duct work,</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>Item No.</td>
<td>Qty</td>
<td>Unit</td>
<td>Description</td>
<td>Unit Cost</td>
<td>Total Cost</td>
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<td>fans, louvers, and supports per Drawings and Specifications.</td>
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</tr>
<tr>
<td>8.6</td>
<td>1</td>
<td>LS</td>
<td>Prepare and submit Operations and Maintenance Manual per Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>8.7</td>
<td>1</td>
<td>LS</td>
<td>Provide Testing and Start-up including testing and start-up plan, equipment manufacturer’s certifications, equipment start-up, testing, and functional testing, complete per Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
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<tr>
<td><strong>9.0 Treatment Filters and Mechanical Work</strong></td>
<td></td>
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<tr>
<td>9.1</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install Iron and Manganese treatment system including vessels, concrete pad, greensand media, surface wash, horizontal end suction centrifugal pumping units and motors, piping, valves and appurtenances per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
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<tr>
<td><strong>10.0 Electrical Work</strong></td>
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<tr>
<td>10.1</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all electrical conduit and cable, including trenching, backfill, compaction, conduits, sweeps, pull boxes, wiring, terminations, and encasements.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>10.2</td>
<td>1</td>
<td>LS</td>
<td>Electrical work and equipment including: providing all trenching, pull boxes, conduits, sweeps, wiring, connections, encasements, temporary power, backfilling, compaction, and all other electrical work as shown on the Drawings and Specifications not specifically listed under other items.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>10.3</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all electrical power supply conductors and equipment, including connection to the new SCE transformer, meter, panels, conduits, conductors, terminations, testing, start-up and coordination with the SCE, including excavation, encasement, backfill, and compaction, per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>Item No.</td>
<td>Qty</td>
<td>Unit</td>
<td>Description</td>
<td>Unit Cost</td>
<td>Total Cost</td>
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<tr>
<td>10.4</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all onsite conduit, cable and ducts between new transformer and meter, including excavation, encasement, backfill, and compaction, per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>10.5</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all electrical distribution conductors and equipment including automatic transfer switch, MCC, soft starts, load center as well as service distribution panels and related conduits and wiring and connections; per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>10.6</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all building lighting per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
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<tr>
<td>11.0 Instrumentation and Control</td>
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<tr>
<td>11.1</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all instrumentation equipment, panels, electronic chart recorder, and terminal strips for connection to District furnished and installed RTU per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>11.2</td>
<td>1</td>
<td>LS</td>
<td>Coordinate with the District for District provided programming and program installation.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>11.3</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all unit flow meter conduits, wiring and connections; and pressure transducers per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>11.4</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all field instrumentation, including pressure transducers, switches, gages, and transmitters, per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>11.5</td>
<td>1</td>
<td>LS</td>
<td>Furnish and install all related conduits, wiring, loops, and connections for entry gate access control, keypad pedestal, and gates per Drawings and Specifications.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>Item No.</td>
<td>Qty</td>
<td>Unit</td>
<td>Description</td>
<td>Unit Cost</td>
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<tr>
<td>11.6</td>
<td>1</td>
<td>LS</td>
<td>Integrate into construction and start-up all District furnished items including but not limited to the following items: RTU, Ethernet Router, Network Panel, Cable, RTU Programming.</td>
<td>LUMP SUM</td>
<td>$</td>
</tr>
</tbody>
</table>

**TOTAL (MUST EQUAL BID AMOUNT) $**

---

DO NOT SUBMIT THE SCHEDULE OF VALUES WITH YOUR PROPOSAL PACKAGE

END OF SECTION 01026
PART 1 - GENERAL

1.01 FACILITY OPERATION RESTRICTIONS AND CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

A. The Centralized Treatment Facility is being constructed on the existing Potable Water Well No. 27 site. Well No. 27 is not currently operational.

1. The Well No. 27 onsite 12" Raw Water Discharge and Well Blow-off pipelines shall be protected in place.

2. The existing SCE electrical service is currently active but will be removed and a new service will be installed as part of this project. Disconnection and removal of the existing SCE electric service is required. Disconnection of the existing electrical service shall be scheduled and coordinated with the District and SCE and shall adhere to the restrictions specified herein.

3. The existing Southern California gas service to Well No. 27 is currently active and shall be protected in place.

B. The Centralized Treatment Facility is being constructed on the existing Monitoring Well No. 9 site. Monitoring Well No. 9 is not currently operational.

1. Monitoring Well No. 9 shall be demolished

2. The Monitoring Well No. 9 onsite 12" Water Discharge shall be demolished to the limits shown on the drawings.

3. The existing Southern California gas service to Monitoring Well No. 9 is currently active but will be removed as part of this project. Disconnection and removal of the existing Southern California gas service is required. Disconnection of the existing gas service shall be scheduled and coordinated with the District and the Southern California Gas Company and shall adhere to the restrictions specified herein.

C. All existing facilities shall be protected in place, demolished, or modified as specified on the drawings and as specified herein.
D. Certain work will require short duration interruption of offsite pipeline operation. Interruptions of the pipeline operations shall be scheduled and coordinated with the District and shall not exceed the duration specified on the shutdown schedule shown on sheet G-002.

E. The Wells 201, 202, and 203 Phase 1B Conveyance Pipeline and Wells 201, 202, 203 and 205 Equipping projects are being constructed concurrently with this project. The CONTRACTOR shall plan for and incorporate the following work activities that impact the other concurrent contracts that are part of this program:

1. Wells 201, 202, 203 and 205 Equipping Project:
   a. Coordinate delivery of water utilizing wells that are completed.
   b. Coordinate SCADA testing and Overall System Well Call to Run Testing for wells that are completed.

CONTRACTOR agrees to cooperate and coordinate its Work with the work conducted by other contractor(s) within the project area so that this project can be completed in an orderly and coordinated manner, reasonably free of significant disruption to any party. Without limitation of the foregoing, CONTRACTOR understands and agrees that areas of the project limits may be utilized by other contractor(s) or the District personnel. All parties shall be solely required and obligated to coordinate and cooperate with each other to accomplish the scope of work required by their respective contracts, meaning the District shall have no duty to administer, perform or supervise the coordination for the use of the project limits by all contractors. CONTRACTOR agrees that any delay or hindrance caused by or contributed to by failure to cooperate and/or coordinate among all parties will be governed by this paragraph.

F. Contractor shall conduct work in a manner that will not impair the operational capabilities of the existing pipelines or reduce the access capacity of the District.

G. The Centralized Treatment Facility shall be defined as "operational" and of beneficial use to the District when construction is complete, field testing, startup and initial operation is complete, and the facilities are capable of pumping water and providing disinfection residual as specified herein.

H. Contractor shall include costs in his bid price for compliance with the specific sequencing limitations and all the constraints.

I. Prior to commencing work, Contractor shall submit for District's approval a detailed project schedule with narrative descriptions for his proposed sequence of work. The project schedule shall be provided in accordance with the General Conditions, Section F – Labor and Construction, and as specified herein. The
schedule shall show all construction activities and sub-activities, address all work restrictions and constraints, and include critical events that may impact the operation of existing facilities. The submittal shall clearly identify the work that will require shutdowns, or interruptions of the pipelines and the duration of shutdowns/interruptions. Submittal shall also indicate the schedule for shutdown of the existing SCE service and energizing of the new SCE service.

1.02 INTERRUPTION OF EXISTING FACILITIES

A. Contractor shall execute the work while the existing facilities are in operation.

B. Contractor shall indicate required shutdowns of existing facilities or interruptions of existing operations on his Progress Schedule. Shutdowns will be permitted to the extent that existing operation of the water system will not be jeopardized and identified constraints and restrictions are satisfied.

C. Unless specified otherwise, Contractor shall submit notification of required shutdowns of existing facilities at least 14 days prior to the planned date of shutdown.

D. Each request will be evaluated based on the water systems ability to reliably meet capacity demands.

E. Contractor shall not begin alterations until District's written permission has been received.

F. Isolation of individual facilities or process units may require valve closures. All valves shall be operated by District staff. Contractor shall not operate any existing valves.

G. Contractor shall minimize shutdown times by thorough advanced planning. At the time of shutdown, Contractor shall have onsite all equipment, materials, and labor necessary to perform the required work.

1.03 COMPLIANCE WITH PERMITS

Contractor shall comply with the City of San Jacinto encroachment permit for work in the right of way.

1.04 OPERATIONS AND MAINTENANCE ACCESS

Contractor shall provide safe, continuous access to the sites for District staff.


1.05 UTILITIES

A. Provide advance notice to and the utilize services of Underground Services Alert (U.S.A.) for location and marking of underground utilities operated by utility agencies other than the District.

B. Provide a minimum of 72 hours advance notice to District's Inspector for marking/locating District's underground facilities.

1.06 GENERAL REQUIREMENTS

A. The work sequence and restrictions presented herein does not include all items affecting completion of the work but are intended to describe some of the critical events necessary to minimize disruption of the existing facilities and to ensure compliance with permit requirements. It is the Contractor's responsibility to identify any additional constraints for completion of the work and keep the existing systems and facility fully operational at all times.

B. Contractor shall comply with shutdown constraints to keep the existing facilities operational as required by the District.

C. Prior to beginning construction, Contractor shall excavate, expose, and determine ("pothole") the exact size, elevation, and horizontal location of each and every potential interference, including, but not limited to, all facilities shown specifically (location and/or depth) on the Drawings. In addition, Contractor shall field verify all locations and dimensions at connections with existing piping systems. If necessary, the Contractor shall revise the plans or dimensions in order to meet the tie-in time constraint without violating the intent of the design. All Contractor revisions shall be approved by the District prior to any work.

D. The Contractor shall complete all possible portions of new construction and/or modifications to existing facilities, including testing and simulation of controls, prior to making any connection to existing facilities. All parts, fabrications, and other components necessary to complete the work during the shutdown and startup must be at the job site prior to final scheduling of the shutdown unless otherwise authorized herein or by District.

E. The Contractor shall submit a detailed Work Plan/Sequence for each shutdown and receive District's approval prior to scheduling any shutdown. Alternative equivalent construction methods and sequences must be submitted to the District in a timely manner to allow for review, revisions, and approval prior to scheduling of the shutdown. Unless specifically indicated otherwise, no more than 2 hours of shutdown of any existing facility shall be allowed.
F. The Contractor shall be responsible for dewatering, evacuation of all fluids and gases from the existing facilities, and all other work associated with making connections to the existing facilities with the specified shutdown limitations.

G. Any proposed modifications to the Sequence of Work provided herein shall be submitted in writing to District for approval. If approved, said modified Sequence of Work shall be implemented by the Contractor at no additional cost to District. Any proposed modifications to the specified Sequence of Work shall reflect the necessary changes to all other project components.

1.07 SEQUENCE OF COMPLETION

The Centralized Treatment Facility shall be constructed, tested and operational to deliver water to the distribution system XXX days after NTP.

Liquidated damage shall be assessed at the amount shown for each calendar day of unauthorized delay in the completion of the work. Liquidated damages for each milestone will be calculated independent of the other completion milestones.

1.08 GENERAL SEQUENCE AND WORK RESTRICTIONS FOR TREATMENT FACILITY

A. Provide temporary construction fencings, as required around the site to secure the site. Note that in lieu of providing temporary fencing, the Contractor may elect to construct the permanent site wall and gates to secure the site.

B. Over excavate, recompact, and perform site grading, as specified.

C. Procure and deliver to the site all materials required for the facilities.

D. Construct the facilities as specified on the Drawings and in the Specifications.

E. Perform wet test of treatment facilities.

F. Schedule offsite pipeline operation interruption. While pipeline operation is interrupted perform the following:

1. Dewater pipeline.

2. Connect to distribution system.

Said interruption shall not exceed one (1) eight-hour day.
G. Contractor shall maintain access to all facilities and shall coordinate construction activities with District staff to minimize impact to the daily facilities operation. Contractor shall provide access to all facilities and shall backfill trenches and excavations blocking access at the end of each workday.

1.09 MISCELLANEOUS ITEMS

For all other facilities not indicated above, Contractor shall also coordinate and submit details of any other connections to or modifications of the existing facilities or any other construction impacting the existing facilities to the District for review and approval. No more than 2 hours of shutdown shall be allowed for any other connection to or modification of the existing facilities unless specifically approved otherwise in writing by the District. The timing of any such shutdowns shall be as required by the District. Contractor shall include in his bid the costs of making connections to the existing items with the specified shutdown limitations and providing all temporary facilities for all facilities requiring a shutdown of more than 2 hours.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 COORDINATION OF WORK

A. Maintain overall coordination of work execution.

B. Obtain schedules from subcontractors and suppliers and assume responsibility for correctness.

C. Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with work, sequencing, and shutdown constraints.

3.02 WORK BY OTHERS

Where proper execution of the work depends upon work by others, inspect and promptly report discrepancies and defects.

END OF SECTION 01185
SPECIFICATIONS - DETAILED PROVISIONS
Section 01430 - Maintenance Manual Requirement Section

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PART 2 - PRODUCTS (NOT USED) ............................................................................................. 9

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MAINTENANCE SUMMARY FORM
PART 1 - GENERAL

1.01 DEFINITIONS

A. Maintenance Operation: As used in the Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.02 MAINTENANCE DOCUMENTS

A. Maintenance Manuals shall include, but not be limited to:
   1. Parts books
   2. Service / Shop manuals
   3. Performance curve
   4. Specifications
   5. Warranty info

B. Manuals for equipment and systems shall be prepared by equipment or system manufacturer only.

1.03 MAINTENANCE MANUAL - GENERAL

A. Prepare data in the form and format of an instructional manual for use by DISTRICT's personnel.

B. Manual Format:
   1. Size: 8½ inches by 11 inches.
   3. Text: Manufacturer's printed data, or neatly typewritten.
   4. Drawings:
a) Provide reinforced punched binder tab, bind in with text.
b) Reduced to 8½ inches by 11 inches, or 11 inches by 17 inches folded to 8½ inches by 11 inches.
c) Where reduction is impractical, fold and place in 8½ inches by 11 inches envelopes bound in text.
d) Suitably identify Specification section, product type Drawings, and envelopes.

5. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.

6. Provide fly-leaf for each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment and provide with heavy section dividers with numbered plastic index tabs.

7. Provide each manual with title page, and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.

8. Cover: Identify each volume with typed or printed title "OPERATION AND MAINTENANCE MANUAL, VOLUME NO.," if applicable, and list:
   a) Project title.
   b) Designate the system or equipment for which it is intended.
   c) Identity of separate structure as applicable.
   d) Identity of equipment number and Specification section.

9. Assemble and bind material in same order as specified, as much as possible.

10. Prepare material in manuals suitable for reproduction, copy clarity, and quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Binders:

1. Preliminary Manuals: Heavy paper covers.

2. Final Manuals: Commercial quality, substantial, permanent, three-ring binders with durable, cleanable, plastic binders.

D. Table of contents neatly typewritten, arranged in a systematic order:

1. CONTRACTOR, name of responsible principal, address, and telephone number.
2. List of each product required to be included, indexed to content of each volume.

3. List with Each Product: Name, address, and telephone number of Subcontractor, Supplier, installer, and maintenance contractor, as appropriate.
   a) Identify area of responsibility of each.
   b) Provide local source of supply for parts and replacement.

4. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.

E. Product Data:
   1. Include only those sheets that are pertinent to specific product.
   2. Clearly annotate each sheet to:
      a) Identify specific product or part installed.
      b) Identify data applicable to installation.
      c) Delete references to inapplicable information.

F. Drawings: Supplement product data with drawings as necessary to clearly illustrate:
   1. Relations of component parts of equipment and systems.
   2. Control and flow diagrams.
   3. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
   4. Do not use Project record documents as maintenance manual drawings.

G. Instructions and Procedures: Within text, as required to supplement product data.
   1. Handling, storage, maintenance during storage, assembly, erection, installation, adjusting, testing, operating, shutdown in emergency, troubleshooting, maintenance, interface, and as may otherwise be required.
   2. Organize in a consistent format under separate heading for each different procedure.
   3. Provide a logical sequence of instructions for each procedure.
   4. Provide information sheet for DISTRICT's personnel, including:
      a) Proper procedures in the event of failure.
b) Instances that might affect the validity of warranties or Bonds.

H. Electronic Format:

1. Flash Drive in Smart PDF format

1.04 MANUALS FOR EQUIPMENT AND SYSTEMS

A. Provide an operation and maintenance manual for each item of equipment or system as specified in the individual Specification sections in the quantity listed in Article MANUAL SUBMISSION REQUIREMENTS.

B. Content for each unit (or common units) and system, as appropriate, complete including controls, accessories, and appurtenances.

1. Description of Unit and Component Parts:
   a) Function, normal operating characteristics, and limiting conditions.
   b) Performance curves, engineering data, nameplate data, and tests.
   c) Complete nomenclature and commercial number of replaceable parts.

2. Operating Procedures:
   a) Startup, break-in, routine, and normal operating instructions.
   b) Test procedures and results of factory tests where required.
   c) Regulation, control, stopping, and emergency instructions.
   d) Shutdown instructions for both short and extended durations.
   e) Summer and winter operating instructions, as applicable.
   f) Safety precautions.
   g) Special operating instructions.
   h) Installation instructions.

3. Maintenance and Overhaul Procedures:
   a) Final Maintenance Summaries as accepted by ENGINEER for respective unit or system.
   b) Routine operations.
   c) Guide to troubleshooting.
   d) Disassembly, repair, and reassembly.
   e) Alignment, adjusting, and checking.
4. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance. Preventive maintenance and overhaul instructions.
   a) Predicted life of parts subject to wear.
   b) Items recommended to be stocked as spare parts and ordering instructions.

5. Service and Lubrication Schedule:
   a) Instructions and diagrams showing grease/oil points.
   b) Recommended type, grade, and temperature range of lubricants and frequency of lubrication.
   c) Include list of lubricants required.

6. Manufacturer's printed operating and maintenance instructions.

7. Description of operation sequence by control manufacturer.

8. List of electrical relay settings, and control and alarm contact settings.

9. Electrical interconnection wiring diagram, including control and lighting systems.

10. As-installed control diagrams by control manufacturer.

11. Results of field functional and performance tests as required.

12. As-installed, color-coded piping diagrams.

13. Charts of valve tag numbers, with the location and function of each valve.

14. Original manufacturer's recommended spare parts list, manufacturer's current prices, and recommended quantities to be maintained in storage.

15. Other data as required under individual Specification sections.

C. Content for each electric or electronic item or system, as appropriate:

1. Description of Unit and Component Parts:
   a) Function, normal operating characteristics, and limiting conditions.
   b) Performance curves, engineering data, nameplate data, and tests.
   c) Complete nomenclature and commercial number of replaceable parts.
   d) Interconnection wiring diagrams, including all control and lighting systems.
2. Circuit Directories of Panelboards:
   a) Electrical service.
   b) Controls.
   c) Communications.

3. As-installed, color-coded, wiring diagrams.

4. Operating Procedures:
   a) Routine and normal operating instructions.
   b) Sequences required.
   c) Safety precautions.
   d) Special operating instructions.

5. Maintenance Procedures:
   a) Routine operations.
   b) Guide to troubleshooting.
   c) Adjustment and checking.
   d) List of relay settings, control and alarm contact settings.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of the Specifications. Prepare and include additional data when the need for such data becomes apparent during instruction of DISTRICT's personnel.

D. Additional Requirements for Operating and Maintenance Data: See individual Specification sections.

1.05 MANUALS FOR MATERIALS AND FINISHES

A. Provide an operation and maintenance manual for materials and finishes as specified in the individual Specification sections in quantity listed in Article MANUAL SUBMISSION REQUIREMENTS herein.

B. Content for Architectural Products, Applied Materials, and Finishes:
   1. Manufacturer's data, giving full information on products:
a) Catalog number, size, and composition.
b) Color and texture designations.
c) Information required for reordering special-manufactured products.

2. Instruction for Care and Maintenance:
   a) Manufacturer's recommendation for types of cleaning agents and methods.
   b) Cautions against cleaning agents and methods that are detrimental to product.
   c) Recommended schedule for cleaning and maintenance.

C. Content for Moisture Protection and Weather Exposed Products:
   1. Manufacturer's data, giving full information on products:
      a) Applicable standards.
      b) Chemical composition.
      c) Details of installation.
   2. Instructions for inspections, maintenance, and repair.

1.06 MANUAL SUBMISSION REQUIREMENTS

A. Manuals for Equipment and Systems

   1. Preliminary Manuals: Deliver 1 hard copy plus 3 Flash Drives in Smart PDF format at the same time or prior to the date equipment, system subsystem, or component arrives at Project site or offsite storage. Include copy of warranties, Bonds, and service agreements if specified. No partial payments will be made for equipment or systems on hand or installed until preliminary manuals have been submitted.

   a) ENGINEER will review and determine adequacy of content, organization, quality, and fulfillment of requirements of the Contract Documents.
   b) Disposition: In accordance with Section F-29, Equipment and Material Items, under General Conditions.
      (i) The EN-14 Shop Drawing submittal transmittal shall provide the required corrections needed, or acceptance.
   c) If unacceptable, resubmit 1 hard copy plus 3 Flash Drives in Smart PDF format for ENGINEER’s review.
   d) The preliminary O&M Manual must be accepted with no comments not less than 30 days prior to equipment or system field testing or startup.
2. Final Manuals: Submit 1 hard copy plus 3 Flash Drives in Smart PDF format.

   a) ENGINEER will compare final manuals with accepted preliminary manuals.
      (i) If identical, or otherwise acceptable, CONTRACTOR will be so notified.
      (ii) If rejected, the hard copy will be returned to CONTRACTOR for revision; or the hard copy will be retained by DISTRICT and the necessary revision data will be requested from CONTRACTOR, at DISTRICT’s option. 3 Flash Drives shall be revised and resubmitted.

   b) The final manual shall include the following information:
      (i) Field functional and performance test results, if required, signed by manufacturer's authorized representative.
      (ii) Final Maintenance Summary Forms as accepted by ENGINEER.
      (iii) Manufacturer Field Service Report complete and certified by manufacturer’s authorized representative.
      (iv) Any revisions found desirable during instruction of DISTRICT’S personnel.
      (v) Revised table of contents, as applicable.

   c) The final manual shall be bound in 3-ring binders. It shall include each individual manual and as many 3-ring binders as required to make a complete manual. Individual manuals shall be inserted into each binder chronologically by Specification Section Number. Each binder, or Volume of the final manual, shall have a complete table of contents.

1.07 SCHEDULE OF MANUALS

A. Prepare equipment and system operation and maintenance manuals for each of the following:

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Type of Equipment or System</th>
</tr>
</thead>
<tbody>
<tr>
<td>02574</td>
<td>Gate Operators</td>
</tr>
<tr>
<td>08100</td>
<td>Doors, Frames, and Hardware</td>
</tr>
<tr>
<td>11200</td>
<td>Water Filtration Equipment</td>
</tr>
<tr>
<td>11224</td>
<td>Static Mixers</td>
</tr>
<tr>
<td>11246</td>
<td>Chemical Metering Pumps</td>
</tr>
<tr>
<td>11931</td>
<td>Horizontal Centrifugal Water Pumps</td>
</tr>
<tr>
<td>15102</td>
<td>Resilient-Seated Gate Valves</td>
</tr>
<tr>
<td>15103</td>
<td>Butterfly Valves</td>
</tr>
<tr>
<td>15111</td>
<td>Check Valves</td>
</tr>
<tr>
<td>15700</td>
<td>HVAC Equipment</td>
</tr>
<tr>
<td>16160</td>
<td>Variable Frequency Drives</td>
</tr>
<tr>
<td>16480</td>
<td>Motor Control Centers, Switchboards, and Panelboards</td>
</tr>
<tr>
<td>16620</td>
<td>Emergency Diesel Engine Generator</td>
</tr>
<tr>
<td>17210</td>
<td>Magnetic Flow Meter</td>
</tr>
</tbody>
</table>
1.08 MAINTENANCE SUMMARY

A. Fill out and complete in the order and format of the Maintenance Summary Form bound at the end of this section and described below.

1. Each Maintenance Summary may take as many pages as required.
2. Use only 8½ inches by 11 inches size paper.
3. Use typewriter or electronic printing.

B. Compile an individual Maintenance Summary for each equipment item, respective unit or system, and for components or subunits.

1. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
2. All spare parts data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals. "Unit" is the unit of measure for ordering the part, e.g., each, lot of 3, box of 100, etc. The term "Quantity" is the number of units recommended. The term "Unit Cost" is the purchase price of a unit at the time the Equipment Data Form is completed.

C. Preliminary Summaries: Submit 1 hard copy plus 3 Flash Drives in Smart PDF format with, but as a separate submission from, respective operation and maintenance manual.

1. ENGINEER will review and provide EN-14 Shop Drawing Submittal Transmittal with comments whether accepted or rejected.
2. The manufacturer's standard form will not be an acceptable substitute.

D. Final Summaries: Final copies shall be included in the preliminary O&M Manual; refer to part 1.06.A.2).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01430
MAINTENANCE SUMMARY FORM

PROJECT  _______________________________  CONTRACT NO.  ________________

1. EQUIPMENT ITEM  _______________________________________________________

2. MANUFACTURER  _______________________________________________________

3. EQUIPMENT/TAG NUMBER(S)  ____________________________________________

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)  __________________

5. NAMEPLATE DATA (hp, voltage, speed, etc.)  ________________________________

6. MANUFACTURER'S LOCAL REPRESENTATIVE
   a. Name __________________________  Telephone No. ________________________
   b. Address _________________________

7. MAINTENANCE REQUIREMENTS

<table>
<thead>
<tr>
<th>Maintenance Operation Comments</th>
<th>Lubricant Frequency</th>
<th>(If Applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)</td>
<td>List required frequency of each maintenance operation.</td>
<td>Refer by symbol to lubricant list required.</td>
</tr>
</tbody>
</table>
8. **LUBRICANT LIST**

<table>
<thead>
<tr>
<th>Reference Symbol</th>
<th>Shell</th>
<th>Standard Oil</th>
<th>Gulf</th>
<th>Arco</th>
<th>Or Equal</th>
</tr>
</thead>
<tbody>
<tr>
<td>List symbols used in No. 7 above.</td>
<td>List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. **RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note: Identify parts provided by this contract with two asterisks.
SECTION 02715
PVC GRAVITY DRAIN PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

The CONTRACTOR shall furnish and install all materials for testing and installation of polyvinyl chloride (PVC) gravity drainpipe and fittings, complete in place as specified herein and in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02221 Trenching, Backfilling and Compacting
B. Section 15043 Leakage and Infiltration Testing of Non-Pressure Pipelines

1.03 SUBMITTALS

C. Provide materials list showing material of pipe and fittings with ASTM references and grade.

1.04 APPLICATION

PVC Pipe PS 46 shall be used for the 18-inch gravity drainpipes shown on the drawings.

PART 2 - MATERIALS

2.01 PIPE AND FITTINGS

A. ASTM Requirements: Pipe, fittings, couplings, and joints shall be in conformance with the size, material and performance requirements of ASTM D F679, PS 46, and shall have gasketed joints. Pipe shall be made of PVC plastic having a cell classification as defined in ASTM D 1784. Fittings shall be made of PVC plastic having corresponding cell classification. All pipe shall be of solid wall construction with smooth interior and exterior surfaces.

B. Manufacturer’s Testing Certification: During production of the pipe, the manufacturer shall perform the specified tests for each pipe marking. A certification by the manufacturer indicating compliance with specification
requirements shall be delivered with the pipe. The certification shall include the test result data.

C. Pipe Marking: All pipe, fittings, and couplings shall be clearly marked at an interval not to exceed 5-feet as follows:

1. Nominal pipe diameter
2. PVC cell classification
3. Company, plant, shift, ASTM, PS, and date designation
4. Service designation or legend

D. For fittings and couplings, the PS designation is not required. All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.

E. Additional Pipe Tests Following Delivery: When pipe is delivered to the jobsite, the District may require additional testing to determine conformance with the requirements of pipe flattening, impact resistance, pipe stiffness, and extrusion quality. When testing is required, one test pipe shall be selected at random by the Engineer from each 1,200 feet or fraction thereof of each size of pipe delivered to the jobsite but not less than one test pipe per lot. A lot shall be defined as pipe having the same identification marking. The length of specimen for each selected pipe shall be a minimum of 8-feet.

F. Pipe Retest: Pipe which is not installed within 120 days of the latest test shall not be used without prior approval of the District.

G. Fitting and Coupling End Configurations: The socket and spigot configurations for fittings and couplings shall be compatible with those used for the pipe.

H. Manufacturers: Pipe shall be as manufactured by J-M Manufacturing Ring-Tite, Vinyltech, P W Pipe, Diamond Plastics, Carlon, or approved equal. Fittings shall be as manufactured by J-M Manufacturing, GPK Products, Spears or approved equal.

2.02 GASKETS FOR PVC PIPE

A. General: Unless otherwise specified, gaskets shall be manufactured from a synthetic elastomer, and shall be extruded or molded and cured in such a manner as to be dense, homogeneous and of smooth surface, free of pitting, blisters, porosity, and other imperfections. The compound shall contain not less than 50 percent by volume of first-grade synthetic rubber. The remainder of the compound shall consist of pulverized fillers free of rubber substitutes, reclaimed
rubber, and deleterious substances. The tolerance for any diameter measured at any cross section shall be ±1/32-inch (.8mm).

B. Gasket Material Requirements: When required by the District, the contractor shall furnish test samples of gaskets from each batch used in the work. Gasket material shall meet the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>ASTM Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (min. psi)</td>
<td>2,000</td>
<td>D 412</td>
</tr>
<tr>
<td>Elongation at break (% min.)</td>
<td>350</td>
<td>D 412</td>
</tr>
<tr>
<td>Shore durometer, Type A</td>
<td>40 to 65*</td>
<td>D 2240</td>
</tr>
<tr>
<td>(Pipe manufacturer shall select value suitable for type of joint)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression set (constant deflection) max % of original deflection</td>
<td>16</td>
<td>D 395</td>
</tr>
<tr>
<td>Compression strength after oven aging (96 hours, 158°F {70°C}) % of tensile strength before aging</td>
<td>80</td>
<td>D 573</td>
</tr>
<tr>
<td>Increase in Shore durometer hardness after oven aging. Maximum increase over original Shore durometer</td>
<td>10</td>
<td>D 2240</td>
</tr>
<tr>
<td>Physical requirements after exposure to ozone concentration (150 pphm. 70 hours, 140°F {40°C}), 20% strain)</td>
<td>No Cracks</td>
<td>D 1149</td>
</tr>
</tbody>
</table>

* This applies only to the sealing component of the gasket.

C. Splices: No more than one splice will be permitted in a gasket. A splice shall be made by applying suitable cement to the ends and vulcanizing the splice in a full mold. The splice shall show no separation when subjected to the following tests:

D. Elongation Test: The part of the gasket which includes the splice shall withstand 100% elongation with no visible separation of the splice. While in the stretched position, the gasket shall be rotated in the spliced area a minimum of 180 degrees in each direction to inspect for separation.

E. Bend Test: The portion of the unstretched gasket containing the splice shall be wrapped a minimum of 180 degrees and a maximum of 270 degrees around a rod of a diameter equal to the cross-section diameter of the gasket.
PART 3 - EXECUTION

3.01. DELIVERY AND TEMPORARY STORAGE OF PIPE AT SITE

A. Onsite Storage Limitation: Onsite pipe storage shall be limited to a maximum of one week, unless exception is approved by District.

B. Care of Pipe: At times when the pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the noon hours as well as overnight. In no event shall the sewers be used as drains for removing water which has infiltrated into the construction trenches.

3.02 HANDLING OF PIPE

A. Moving Pipe: Pipes shall be lifted with handling beams or wide belt slings as recommended by the pipe manufacturer. Cable slings shall not be used. Pipe shall be handled in a manner to avoid damage to the pipe. Pipe shall not be dropped or dumped from trucks or into trenches under any circumstances.

B. Inspection Pipe: The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench.

3.03 PLACEMENT OF PIPE IN TRENCH

A. General: All pipe shall be laid without a break, upgrade from structure to structure, with the bell ends of the pipe upgrade. Pipe shall be laid to the line and grade given so as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line.

B. Trench Excavation: Dewatering, excavation, shoring, sheeting, bracing, backfill material placement, material compaction, compaction testing, and pipe laying requirements and limitations shall be in accordance with Section 02221, Trenching, Backfilling, and Compacting.

C. Pipe Bedding Thickness: Unless shown otherwise on the drawings, pipe bedding material shall be as specified in Section 02221, Trenching, Backfilling, and Compacting.
D. Subgrade at Joints: At each joint in the pipe, the pipe subgrade shall be recessed in firm bedding material so as to relieve the bell of the pipe of all load and to ensure continuous bearing along the pipe barrel.

E. Cleaning: The interior of the gravity drainpipe shall be cleaned of all dirt and superfluous materials as the work progresses.

F. Joints: The mating surfaces of the pipe to be joined shall be wiped clean of all dirt and foreign matter and a lubricant applied that is approved by the pipe manufacturer. Then, with the surfaces properly lubricated, the spigot end of the pipe shall be positioned inside the bell and the joint shoved home.

G. Pipe Alignment: Unless specified otherwise, pipeline line and grade shall be as shown on the plans. Grade shall be measured along the pipe invert.

H. PVC Pipe Curvature: Construction of curved reaches of PVC pipe shall be accomplished by deflecting joints. For 18-inch diameter pipe, the deflection at joints shall be limited to the lesser of 0.75 degrees or half of the manufacturer’s recommendation.

I. Backfill: Backfill shall be placed and compacted in accordance with the requirements of Section 02221, Trenching, Backfilling and Compacting.

3.04 CLEANING

Before testing, each pipe shall be thoroughly cleaned from manhole to manhole with a sewer scrubbing ball, and all debris and trash shall be removed from each manhole.

3.05 MANDREL TEST FOR PVC GRAVITY DRAIN

Following placement and compaction of backfill for all utilities, and prior to the placement of permanent pavement, the drain line shall be cleaned and mandrelled to verify that the pipeline is free from obstructions (deflections, joint offsets, etc.). A rigid mandrel, with a circular cross section having a diameter of at least 95 percent of the specified inside pipe diameter, shall be pulled through the pipe by hand. The minimum length of the circular portion of the mandrel shall be equal to the nominal diameter of the pipe.

3.06 LEAKAGE AND INFILTRATION TEST

The pipe, manholes, and other appurtenances shall be tested for leakage and infiltration per Section 15043, Leakage and Infiltration Testing.
3.07 FINAL INSPECTION

After paving has been completed and all manholes raised to grade, a final visual inspection shall be made. The necessary labor shall be furnished to assist the District in making the final inspection. Additional balling may be required if the lines are dirty, even though lines were previously balled. The contractor shall furnish a responsible person or supervisor for the final inspection to remove manhole covers and to note any corrections required by the District in order to obtain final approval. Final District inspection shall be requested by giving at least two day's notice.

END OF SECTION 02715
SECTION 02833
ORNAMENTAL STEEL FENCING AND GATES

PART 1 - GENERAL

1.01 GENERAL

Contractor shall furnish and install ornamental steel fencing system, including fence panels, posts, gates, and accessories, as shown on the Drawings and as specified herein.

1.02 APPLICABLE SPECIFICATIONS AND STANDARDS

The following documents of issue in effect on the date of bid form a part of this specification to the extent specified herein:

A. American Society for Testing and Materials (ASTM) Publications:
   1. ASTM A36 - Carbon Structural Steel.
   2. ASTM A121 - Zinc-Coated (Galvanized) Steel Barbed Wire.
   4. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   5. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
   6. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

11. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.03 CONTRACTOR SUBMITTALS

A. All Submittals shall be provided in accordance with the General Conditions, Section F - Labor and Construction.

B. Submittals shall include, but not be limited to, the following:

1. Product data for all fence and gate components and accessories.

2. Shop drawings showing layout, dimensions, and spacing of all fence and gate components, and anchorage and installation details.

3. Coating color chart of available fence and gate colors for selection by Owner.

4. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.

5. Copy of warranty specified in Paragraph 1.05.

1.04 WARRANTY

Manufacturer shall provide 10 years (minimum) warranty for factory finish against cracking, peeling, and blistering.

1.05 QUALITY ASSURANCE

Ornamental steel fencing and gates shall be as manufactured by Morgan Fence Company, Builders Fence Company, Inc., or equal.

PART 2 - PRODUCTS

2.01 FENCING

A. Fence framework, including pickets, rails, and posts, shall be manufactured from electrically welded pre-galvanized tubing conforming to ASTM A513 and
having minimum yield strength of 45,000 psi. Zinc coating with a minimum weight of 0.90 ounces per square foot (coating designation G-90) shall meet the requirements of ASTM 653.

B. Fence panel sections shall be capable of supporting a 1000-pound load applied at the mid-span with deflection limited to L/240 and no permanent deformation.

C. Pickets shall be minimum 1" square steel tubing with 11-gauge wall thickness, built on 4" centers.

D. Rails shall be minimum 2" square steel tubing with 11-gauge wall thickness.

E. Posts shall be minimum 4" square steel tubing with 11-gauge wall thickness.

F. Fence panel geometry, length, and height shall be complying with the nominal dimensions shown on the Construction Drawings. Minor variations in dimensions may be necessary to accommodate actual field conditions and selected fence components.

Pickets, rails and posts shall be assembled in accordance with the manufacturer's approved shop drawings and the Construction Drawings. Prior to commencing fabrication, Contractor shall field verify all fence dimensions, including post locations and fence segment lengths.

G. Pickets, rails and posts shall be Electro-MIG welded per the final approved shop drawings. All joints shall be fully welded (seal welded) to prevent corrosion from moisture. Kit type field assembled fence panels are not acceptable.

H. Posts shall be provided with zinc plated press-on type steel caps. Post bases shall be drilled base plate or sleeve for mounting to concrete footing or pier as indicated on the Construction Drawings.

2.02 GATES

A. General

1. Contractor shall provide gates of type and size indicated on the Drawings. Manufacturer shall equip gates with all hardware and appurtenances as required for complete functional operation.
2. Gate framework, including pickets, rails, and posts, shall be manufactured from structural tubing conforming to ASTM A36/A500 and having a minimum yield strength of 46,000 psi or from electrically welded pre-galvanized tubing conforming to ASTM A513 and having a minimum yield strength of 45,000 psi. All gate framework shall be provided with zinc coating with a minimum weight of 0.90 ounces per square foot (coating designation G-90) shall meet the requirements of ASTM A123/A653.

3. Where shown on the Drawings, gates shall include 18-gauge perforated steel backing with 33 1/8" diameter holes per square inch.

B. Hinged Swinging Gates

1. Construction: Frames fabricated from minimum 3" square steel tubing with 11-gauge wall thickness. Frames shall be fully welded. Unless shown otherwise on the Drawings, gate configuration shall be similar to fence sections. Gate pickets shall match fence pickets. Where shown on the Drawings, gates shall be provided with perforated metal backing (18 gauge minimum) attached to gate frame and pickets. Attachment system shall be unobtrusive and not visible from outside the gate.

2. Gate Size: Gates shall be single or double with heights and widths as shown on the Drawings.

3. Hardware:
   a. Hinges: Size and type as determined by manufacturer. Unless shown otherwise on the Drawings, provide 3 hinges for each gate leaf up to 6 feet high and 1 additional hinge for each additional 24 inches in height or fraction thereof. Hinges shall be manufactured to allow 90-degree opening of gate(s).
   b. Latch: 3/4-inch diameter slide bolt to accommodate padlock.
   c. For double gates provide pad lockable, 5/8-inch diameter center cane bolt assembly and strike.

C. V-Wheeled Rolling Gates

1. Construction: Frames fabricated from minimum 3" square steel tubing with 11-gauge wall thickness. Frames shall be fully welded with mitered corners. Unless shown otherwise on the Drawings, gate configuration shall be similar to fence sections. Gate pickets shall match fence pickets. Where shown on the Drawings, gates shall be
provided with perforated metal backing (18 gauge minimum) attached to gate frame and pickets. Attachment system shall be unobtrusive and not visible from outside the gate.

2. Gate Opening and Size: Gate opening shall be as shown on the Drawings. Gate height shall match adjacent fence or wall heights. Gate length and travel distance shall be as required to accommodate the gate support system and electric gate operator (where specified).

3. Support Posts: Pair of minimum 4” square steel tubing with ¼” wall thickness and solid cap.

4. Rolling Mechanism: Steel wheels with V-shaped edge groove and 4 inches (152 mm) diameter, mounted to gate frame and riding on ground set V-track. Assembly braced at top by adjustable guide wheels mounted with brackets to support posts.

5. Contractor shall coordinate gate fabrication to ensure size, weight, and design of gate is compatible with proposed gate operator.

2.03 ACCESSORIES

A. Unless specified otherwise, all fence and gate hardware and accessories shall be carbon steel or malleable iron.

B. All fasteners shall be 304 (or better) stainless steel.

C. All ferrous metal hardware and accessories shall be hot dipped galvanized, and finish coated as specified herein.

2.04 FINISH COATING

A. Preparation: Upon completion of fabrication, all fence and gate assemblies shall receive a three-stage pretreatment to clean and prepare galvanized surfaces for finish coating. First stage shall consist of iron phosphate surface pretreatment to clean and promote coating adhesion. Second stage shall consist of clean water rinse. Third stage shall consist of non-chromate conversion coating to seal all surfaces and provide additional corrosion protection.
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B. All ornamental metal fencing shall receive an electrostatically applied colored polyester powder coating heat cured to 450 degrees F to chemically bond finish to metal substrate. Polyester powder coating shall be applied to a thickness of 3 mils (minimum).

1. Minimum hardness measured in accordance with ASTM D3363: 2H.

2. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.

3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16-inch undercutting.

4. Weatherability tested in accordance with ASTM D822: No film failure and 85 percent (minimum) gloss retention after 1-year outdoor exposure.

5. Where perforated metal backing is specified, care shall be taken with the coating material to preclude the coating from "bridging" the perforations.

C. Color: Refer to color schedule on plans.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to fabrication, field verify required fence and gate dimensions.

B. Contractor shall install fencing in accordance with manufacturer's written installation instructions and approved shop drawings.

C. Verify areas to receive fencing are completed to final grades, elevations, and materials.

D. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.
E. Where specified, coordinate gate installation with provision of gate operation specified, including power supply, control devices, and routing of conduit and wiring

3.02 INSTALLATION

Unless shown otherwise on the Drawings, fence and gate installation shall comply with the following requirements.

A. Where independent concrete footings are specified, provide footings in accordance with requirements herein, Specification Section 03300 - Cast-in-Place Concrete, and as shown on the Drawings and approved shop drawings.

1. Post footing soil shall be firm and undisturbed.

2. Minimum footing diameter:
   a. Terminal fence posts and gate posts: 18 inches.
   b. Intermediate fence line posts: 10 inches.

3. Minimum post embedment:
   a. Terminal fence posts and gate posts: 36 inches.
   b. Intermediate fence line posts: 30 inches.

4. Provide 12 inches minimum concrete beneath post bottom.

5. Trowel finish around posts and provide slope to direct water away from posts.

B. Where fence installation is specified in existing concrete slabs or structures, core drill existing concrete for embedment of fence and gate posts. Core drill hole shall be 2 inches (minimum) greater than post width.

C. Where fence and gate post installation are specified in masonry walls, provide galvanized steel post sleeves with 1/2” +/- annular space and grout to fill post and sleeve. Grout shall be non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

D. Where surface mounting of posts is specified, provide flange type base plates with 4 holes. Anchor bolts shall be 304 stainless steel wedge anchors with size and embedment as required for design loads. Provide leveling nuts beneath base plate for post adjustment and fill space beneath plate with non-shrink
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grout, 3/4" minimum thickness.

E. Fence and gate posts shall be installed plumb and level. Temporarily brace posts with 2 by 4 wood supports until concrete or grout is set.

F. Gates:

1. Concrete footings for gate posts shall attain full design strength before gates are hung.

2. Install gates and adjust hardware for smooth operation.

3. Provide concrete center foundation for drop rod retainers at center of double swinging gate openings.

4. Provide concrete foundation (12" minimum thickness) for length of operation of V-wheeled rolling gate. Anchor gate track to concrete with stainless steel countersunk fasteners.

5. Upon completion of gate installation, test gate and electric operator (where specified) operation. Adjust safety and control devices to achieve proper operation. Correct deficiencies and adjust for smooth and easy operation.

G. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 02833
PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Contractor shall furnish all labor, material, and equipment and perform all operations necessary to execute all concrete masonry construction as required in the Contract Documents.

B. Contractor shall make all preparations and do all work necessary to receive and adjoin other work.

C. Contractor shall give the work his personal supervision and shall keep a competent foreman on the job at all times.

D. Contractor shall inspect and verify position of all dowels required for masonry on other construction including foundations.

E. Contractor shall arrange necessary storage space for construction materials at the job site.

F. Contractor shall call for all inspections required in the course of his work.

1.02 REFERENCE CODES, SPECIFICATIONS, AND STANDARDS

A. Codes

Whenever reference is made herein to Building Code, it shall mean the California Building Code (CBC), latest edition, of the California Building Standards Commission.

B. Specifications

Whenever reference is made herein to Standard Specifications, it shall mean the Standard Specifications for Public Works Construction, latest edition, as published by Building News Incorporated of Los Angeles, California.

C. Commercial Standards

Whenever reference is made herein to ASTM, it shall mean the Annual Book of ASTM Standards, latest edition, as published by the American Society for Testing and Materials.

1.03 CONTRACTOR SUBMITTALS

All submittals shall be provided in accordance with the requirements of the General Conditions, Section F – Labor and Construction. Contractor shall submit complete information and technical data for all material and components, including, but not limited to, the following:
A. Certification

Concrete block manufacturer shall provide certified data demonstrating that the masonry units to be furnished will meet or exceed the requirements of this specification.

B. Samples

Prior to commencing work, Contractor shall submit samples of the block units for District’s acceptance of type and color.

C. Mix Designs

Prior to beginning the work, Contractor shall submit to District, for acceptance, proposed grout and mortar mix designs which shall show the proportions and gradations of all materials proposed for each mix to be used on the job. The mix designs shall be designed by an independent testing laboratory acceptable to the District. All costs related to such mix designs shall be borne by the Contractor.

D. Preconstruction Test Results

Prior to commencing work, Contractor shall submit preconstruction test results in accordance with Part 1.04.F. - Preconstruction Testing.

1.04 QUALITY ASSURANCE

A. All concrete masonry shall comply with the Building Code and reference material published by the Masonry Institute of America.

B. Sample Panel

Contractor shall build a sample panel, approximately 4 feet by 6 feet, for review and acceptance by District before any masonry construction is performed. Said sample panel may be part of the project and incorporated into the wall system. Full size concrete masonry units which have been selected and accepted by the District to show color range, maximum texture range, bond, mortar, tooling of joints, and quality of workmanship shall be used in the sample panel. Sample panel shall remain on the project for comparison purposes with the actual masonry work.

If the sample panel is not part of the wall system, it shall be demolished and removed from the site after completion and acceptance for the project concrete masonry work, unless Contractor is directed otherwise by the District.

C. Certified Delivery Tickets

Where ready-mix grout is used, Contractor shall provide certified delivery tickets at the time of delivery of each load of grout. Each certificate shall show the total quantities (by weight) of cement, sand, each class of aggregate, and admixtures, and the amounts of water (by gallons) in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it
left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

D. Testing of Grout

1. Test Specimens and Samples
   a. Contractor shall take field samples on the first day of masonry construction, at any change in materials during construction, and whenever, in the judgment of the District, tests are necessary to determine the quality of the materials.
   b. Contractor shall prepare three grout specimens per sample. Each grout specimen shall be a square prism, nominally 3 inches or larger on the sides and twice as high as the width.

2. Procedures
   a. Contractor shall construct samples in the presence of the District or its representative. The same personnel who lays the block in the structure shall construct the grout specimens.
   b. Contractor shall prepare each specimen in a mold consisting of masonry units proposed for construction with the same moisture condition as those being laid. The units shall form a space with dimensions of 3-5/8 inches by 3-5/8 inches by 7-5/8 inches. The space shall be lined with a permeable paper (such as a paper towel) or porous separator to prevent bonding to the masonry units, but still allowing the excess water to be absorbed.

       Contractor shall place a representative sample of the grout into the molds, puddle, and keep damp and undisturbed for 48 hours. After 48 hours, District's Representative will transport the specimens to a test laboratory for storage.

E. Testing of Mortar

1. Test Specimens and Samples
   a. Contractor shall take field samples on the first day of masonry construction, at any change in materials during construction, and whenever, in the judgment of the District, tests are necessary to determine the quality of the materials.
   b. Contractor shall prepare three mortar specimens per sample. After 48 hours, District's Representative will transport the specimens to a test laboratory for storage.
F. Preconstruction Testing

1. Contractor shall perform preconstruction testing to determine the minimum net area compressive strength of grouted CMU assembly. Preconstruction testing shall be performed at the Contractor’s expense.

2. Where the minimum net area compressive strength of grouted CMU assembly (F’m) is required to be 1,500 psi at 28 days, it shall be determined by the Unit Strength Method. The CMU shall be tested in accordance with ASTM C140 and the grout shall be tested in accordance with ASTM C1019.

3. Where the minimum net area compressive strength of grouted CMU assembly (F’m) is required to be 3,000 psi at 28 days, it shall be determined by the Prism Test Method in accordance with ASTM C1314. Contractor shall schedule masonry procurement sufficiently in advance to allow for prism construction and curing. Three prisms shall be constructed and tested for each type of construction required.

1.05 PRODUCT STORAGE

Contractor shall store and protect all materials as follows:

A. Masonry Units

Masonry units shall be carefully stacked prior to use and shall be properly protected from weather by cover or inside storage. All units shall be handled with reasonable care to prevent marring or damaging of faces, edges, and corners of units. All marred or damaged units shall be discarded.

B. Lime and Cement

Lime and cement shall be delivered in original packages and stored on platforms above ground, protected against moisture.

C. Aggregates

Aggregates shall be stored on platforms so as to exclude dirt.

D. Reinforcing Steel

Reinforcing steel shall be stored above ground to prevent bending or rusting.
PART 2 - PRODUCTS

2.01 MATERIALS

All products shall conform to the following requirements:

A. Concrete Masonry Units

1. Masonry units shall be hollow load-bearing concrete masonry units conforming to ASTM C90, latest, and manufactured in accordance with requirements of the Concrete Masonry Association Specifications.

2. Masonry units shall have maximum shrinkage of .08 of 1% from the saturated to the oven dry condition.

3. Unless specified otherwise on the Drawings, masonry units shall be medium-weight units (105 to 125 lb/cubic foot) manufactured by a member of the Concrete Masonry Association. Masonry units may be high temperature steam cured. District shall select color of masonry units.

B. Cement

1. Cement for mortar shall be Type I, II, or III Portland cement conforming to ASTM C150, latest.

2. Air-Entrained Portland Cement for mortar shall be Type I-A, II-A, or III-A conforming to ASTM C150, latest. (Note: When using air-entrained cements, mortar shall not contain more than 1/10 part lime putty.)

3. Plastic cement shall have less than 12% total volume in approved plasticizing agents and shall conform to all of the requirements for Portland cement in ASTM C150, latest, except with respect to limitations on insoluble residue, air-entrained, and additions subsequent to calcination.

C. Aggregate

1. Aggregate shall be clean, sharp, and well graded, and free from injurious quantities of dust, lumps, shale, alkali, surface coatings, and organic matter.

2. Sand shall conform to ASTM C144, latest.

3. Pea gravel shall be graded with 100% passing the 3/8 inch sieve and not more than 5% passing the No. 8 sieve.

D. Lime Putty

1. Lime putty shall be made from approved hydrated lime or quicklime and shall weigh not less than 83 pounds per cubic foot.

2. Hydrated lime shall conform to ASTM C207, latest.
3. Quicklime shall conform to ASTM C5, latest. Quicklime shall be slaked and then screened through a 16-mesh sieve. After slaking, screening, and before using, it shall be stored and protected for minimum 10 days.

E. Admixtures

Admixtures shall not be used in mortar or grout unless specifically approved by Engineer.

F. Reinforcing Steel

1. Reinforcing steel shall be Grade 60 deformed bars conforming to ASTM A615, latest, except that 1/4 inch ties may be plain bars.

2. Reinforcing steel shall be clean and free from loose rust, scale, and dirt, and coatings that reduce bond.

2.02 MORTAR AND GROUT

A. Mortar

Mortar shall be freshly prepared and uniformly mixed in ratio 1 part portland cement, 1/4 part lime putty, and 3-1/2 parts sand and shall conform to ASTM C270.

Where the minimum net area compressive strength of grouted CMU assembly (F\text{'}m) is required to be 1,500 psi at 28 days, mortar shall be Type S with a minimum compressive strength of 1,800 psi at 28 days.

Where the minimum net area compressive strength of grouted CMU assembly (F\text{'}m) is required to be 3,000 psi at 28 days, mortar shall be Type M with a minimum compressive strength of 3,750 psi at 28 days.

B. Grout

1. Where the minimum net area compressive strength of grouted CMU assembly (F\text{'}m) is required to be 1,500 psi at 28 days, grout shall have a minimum compressive strength of 2,000 psi at 28 days.

2. Where the minimum net area compressive strength of grouted CMU assembly (F\text{'}m) is required to be 3,000 psi at 28 days, grout shall have a minimum compressive strength of 3,500 psi at 28 days.

3. Grout shall be of fluid consistency and mixed in ratio 1 part cement, 3 parts sand for grout spaces less than 4 inches in any dimension. Grout shall be of fluid consistency and mixed in ratio 1 part cement, 2 parts sand, and 2 parts pea gravel for grout spaces greater than 4 inches.

4. Fluid consistency shall mean that consistency of fluid shall be enough for pouring and yet not so fluid that the constituent parts of the grout separate when grout is poured (slump equals 9 inches + 1 inch).
PART 3 - EXECUTION

3.01 WORKMANSHP

A. Masonry work shall be started only when horizontal and vertical alignment of foundation is within 1 inch of plumb or line.

B. Contractor shall prevent grout and mortar stains. Contractor shall keep wall continually clean. If grout runs over, Contractor shall clean wall immediately.

C. All masonry shall be laid true, level and plumb in accordance with the Construction Drawings.

D. Contractor shall cut all masonry units accurately to fit all openings, conduit, ducts, and plumbing. All holes shall be neatly patched.

E. Construction support shall not be attached to the wall except where specifically permitted by the Engineer.

F. The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed by sandblasting prior to starting masonry construction.

G. Where no bond pattern is shown, walls shall be laid up in straight, uniform courses with regular half or running bond.

H. All work, bond patterns, or special details shown on the Construction Drawings shall be accurately and uniformly executed.

3.02 PROTECTION OF THE WORK

A. Contractor shall protect all sills, ledges, and offsets from mortar droppings or other damage during construction.

B. Contractor shall prevent visible mortar and grout stains on the exterior of the work. Contractor shall remove stains immediately if they occur.

3.03 MASONRY UNITS

A. All masonry units shall be sound, free of cracks, or other defects that would interfere with the proper placing of the unit or impair the strength of construction.

B. All masonry units shall be stored on the job so that they are kept off the ground and protected from the elements. Wetting of units is not permitted.

C. Proper masonry units shall be used to provide for all windows, doors, bond beams, lintels, pilasters, and knockouts, with a minimum unit cutting.

D. Where masonry unit cutting is necessary, Contractor shall utilize a masonry saw making all cuts neat and true.
3.04 JOINTS

A. Starting joints on foundations shall be laid with full mortar coverage on the bed joints except that the area where grout occurs shall be free from mortar so that the grout will be in contact with the foundation.

B. Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled as specified.

C. Contractor shall tool exposed wall joints with a round bar (or V-shaped bar) 2 feet long to produce a dense, slightly concave surface well bonded to the block at the edges.

D. Tooling shall be done when the mortar is partially set but sufficiently plastic to bond. All tooling shall be done with a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

E. Where walls are to receive plaster, Contractor shall strike joints flush.

F. Where joints are to be concealed under paint, Contractor shall fill joints flush and then sack to produce a dense surface without sheen.

G. Unless otherwise specified, horizontal and vertical mortar joints shall be 3/8 inch thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled.

H. Vertical head joints shall be buttered well for a thickness equal to the face shell of the block and these joints shall be shoved tightly so that the mortar bonds well to both blocks. Joints shall be solidly filled from the face of the block to the depth of the face shell.

I. If it is necessary to move a block so as to open a joint, Contractor shall remove block from wall and set in fresh mortar.

J. Intersecting masonry walls and partitions shall be bonded by the use of steel ties at 24 inch centers maximum.

K. Where stack bond is specified, approved metal ties shall be provided horizontally at 24 inch centers maximum.

3.05 REINFORCING

A. When a foundation dowel does not line up with a vertical core, it shall not be sloped at more than one horizontal to six vertical. Dowels shall be grouted into a core in vertical alignment even though it is in an adjacent cell to the vertical wall reinforcing.

B. Reinforcing bars shall be straight except for bends around corners or where bends or hooks are detailed on the Drawings.

C. Reinforcing steel where spliced shall be lapped a minimum of 40 bar diameters.
D. When full length vertical bars are used, they shall be held in position at top and bottom at intervals not exceeding 48 inches along the reinforcement.

E. Horizontal reinforcing shall be laid on the webs of bond beam units and shall be solidly grouted in place. Reinforcing in channel units shall be spaced off the bottom of the unit.

F. Vertical reinforcing shall have a minimum clearance of 1/2 inch from the masonry.

G. Wire reinforcement shall be completely imbedded in mortar or grout. Mortar joints with wire reinforcement shall be at least twice the thickness of the wire.

H. Wire reinforcement shall be lapped at least 8 inches at splices and shall contain at least 1 cross wire at each piece of reinforcement in the lap distance.

3.06 GROUTING

A. Reinforcing steel shall be in place and inspected by Engineer before grouting starts.

B. Unless specified otherwise on drawings, all walls shall be solid grouted. Unless specifically allowed on drawings, height of grout pours shall not exceed 4 feet. All debris and projecting mortar shall be cleaned out before pouring grout. Pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.

C. Contractor shall consolidate grout by mechanical vibration during placement before loss of plasticity in a manner to fill the grout space. Grout pours greater than 12 inches shall be reconsolidated by mechanical vibration after 3 to 5 minutes to minimize voids due to water loss. Grout pours 12 inches or less in height shall be mechanically vibrated or puddled.

D. Vertical cells to be filled shall have vertical alignment to maintain a continuous unobstructed cell area not less than 2 inches by 3 inches.

E. When higher pours are specified, grout lifts shall not exceed 8 feet. A cleanout hole shall be provided at the bottom of each cell to be poured.

F. Contractor shall grout beams over openings in a continuous operation.

G. Contractor shall cover the tops of unfilled cell columns under a horizontal masonry beam with metal lath, or special units shall be used to confine the grout fill to the beam section.

H. Contractor shall install all bolts, anchors, and similar wall inserts prior to grouting and solidly grout them in place.

3.07 TOLERANCES

A. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 feet or more.

C. Maximum Variation from Plumb: 1/4 inch non-cumulative; 1/2 inch in total wall height.
D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.08 CLEANING AND PROTECTION

A. Masonry walls are to be left bare or unpainted unless otherwise specified; Contractor shall prevent mortar splotches.

B. Construction supports shall not be attached to the wall except where specifically permitted by Engineer.

C. All forms shall be made tight (special attention is necessary for bottom form of block bond beams) and concrete and grout spilled on the wall shall be washed off immediately.

D. Walls shall have their surfaces dampened for three days with a light fog spray during the mortar curing period. They shall not be saturated with water for curing or any other purposes.

E. At the conclusion of work, Contractor shall clean down all masonry walls, remove his scaffolding and equipment used in the work, clean up all debris, refuse, and surplus material, and remove them from the premises.

F. After a minimum of 30 days have passed but no longer than 60 days after completing all work, Contractor shall remove all efflorescence that has leached onto the walls from the grout and mortar.

G. After all efflorescence has been removed, Contractor shall seal walls with one coat of water repellent clear sealant in strict accordance with the manufacturer's installation procedures as approved by the Engineer.

END OF SECTION 04200
PART 1 - GENERAL

1.01 SCOPE OF WORK

The CONTRACTOR shall furnish, fabricate, and place all structural steel and make all connections necessary to provide a complete work and in accordance with the Contract Documents.

1.02 REFERENCES

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards."

B. American Institute of Steel Construction (AISC):
   4. Seismic Provisions for Structural Steel Buildings
   5. Code of Standard Practice for Steel Buildings and Bridges, excluding Sections 3, 4, 7.11.3.3, 7.11.4, 7.11.5, and 7.13
   6. AISC Quality Certification Program
   7. AISC Erector Certification Program

C. American Society of Mechanical Engineers (ASME):
   BPVC SEC IX Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing

D. American Society of Nondestructive Testing (ASNT):
   ASNT-TC-IA Personnel Qualification and Certification in Nondestructive Testing

E. American Welding Society (AWS):
   D1.1 Structural Welding Code-Steel
   QC 1 Standard for AWS Certification of Welding Inspectors

F. ASTM International (ASTM):
A36  Standard Specification for Structural Steel
A53  Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A143 Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement
A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A325 Standard Specification for High-Strength Bolts for Structural Steel Joints
A384 Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
A385 Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
A490 Standard Specification for Heat-Treated Steel Structural bolts, 150 ksi Minimum Tensile Strength.
A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
A563 Standard Specification for Carbon and Alloy Steel Nuts
A572 Standard Specification for High-Strength Low Alloy Columbium-Vanadium Structural Steel
A588 Standard Specification for High-Strength Low Alloy Structural Steel with 50 ksi Minimum Yield Point to 4 in. thick
A780 Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A992 Standard Specification for Steel for Structural Shapes for Use in Building Frames
F436 Standard Specification for Hardened Steel Washers
F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
F1852 Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength

1.03 SUBMITTALS

A. Action Submittals:
1. Provide shop drawings showing erection plans, member size and their connections.

2. Anchor bolt layouts.

3. Hardened washer details (if applicable).

4. Joint details for complete penetration welds

5. Schedules for fabrication procedures

6. Primer and other coatings for items in this Section

7. Name and address of manufacturer(s)

8. Product specifications

9. Manufacturers' testing procedures and standards

10. Preparation and installation or application instructions, as appropriate

B. Informational Submittals:

1. Mill Certificates of tests made in accordance with ASTM A6.

2. High-Strength Bolts (Plain Noncoated and Hot-Dip Galvanized):
   a. Certificates of Compliance that products meet chemical and mechanical requirements of standards specified.
   b. Manufacturer's inspection test report results for production lot(s) furnished, to include:
      1) Tensile strength
      2) Yield strength
      3) Reduction of area
      4) Elongation and hardness

3. Certified Mill Test Reports for Bolts and Nuts:
   a. Name and address of manufacturer.
   b. Bolts correctly marked.
   c. Marked bolts and nuts used in required mill tests and manufacturer's inspection tests.

4. Direct Tension Indicators (DTIs): Furnish manufacturer's test report meeting requirements of ASTM F959.
5. Tension Control (TC) Bolts: Furnish manufacturer’s test report meeting requirements of ASTM A325 and ASTM F1852.

6. Methods proposed to resolve misalignment between anchor bolts and bolt holes in steel members.

7. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05050, WELDING.

8. AISC Quality Certification: AISC certificate showing name and address of certified firm, effective date, and category of certification.

1.04 QUALITY ASSURANCE

A. Mill identification marks in accordance with ASTM A6.

B. AISC Quality Certification for Fabricator: Conventional Steel Structures (Sbd).

C. Welding Qualifications:
   1. Welding Procedure Specifications: In accordance with AWS D1.1 (Annex E) or ASME BPVC SEC IX (Forms QW-482 and QW-483).
   2. Welder/Welding Operator Performance Qualifications: In accordance with AWS D1.1 (Annex E), or ASME BPVC SEC IX (Form QW-484).
   3. Certified Welding Inspector: Certified in accordance with AWS QC1, and having prior experience with the welding codes specified.
   4. Testing Agency: Personnel performing tests shall be Nondestructive Testing Level II Certified in accordance with ASNT SNT-TC-1A.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Load structural members in such a manner that they will be transported and unloaded without damage to coatings and without being excessively stressed, deformed, or otherwise damaged.

B. Storage:
   1. Protect structural steel members and packaged materials from corrosion and deterioration.
   2. Store in dry area and not in direct contact with ground.
   3. Protect fasteners from dirt and moisture. Do not remove lubricant from bolts and nuts.
   4. Handle materials to avoid distortion or damage to members or supporting structures.

PART 2 - PRODUCTS
2.01 MATERIALS

A. Rolled Plates, Shapes except W-Shapes, and Bars: ASTM A36, unless indicated otherwise.

A. W-Shapes: ASTM A992, unless indicated otherwise on Drawings.

B. Plate material for frame connections shall be ASTM A572, Grade 50, where indicated on Drawings.

C. Steel Pipe: ASTM A53, Type E or S, Grade B.

D. Square and Rectangular Hollow Structural Sections (HSS): ASTM A500, Grade B ($F_y$ equals 46 ksi).

2.02 FASTENERS

A. Anchor Bolts: As specified in Section 05500, METAL FABRICATIONS AND CASTINGS.

B. High-Strength Bolts: ASTM A325 or ASTM A490, bolt type 1, galvanized. Bolt length and thread length shall be as required for the connection type shown, with hardened washers as required.

C. Direct Tension Indicators (DTIs) or Load Indicator Washers:
   1. ASTM F959, coating type to match bolt finish.
   2. Type A325 or A490, to match bolt type.
   3. Manufacturers and Products:
      a. TurnaSure LLC, Langhorne, PA; DTI's.
      b. Applied Bolting Technology Products, Ludlow, VT; DTI's, regular or Squirter type.

D. Tension Control (TC) Bolts:
   1. High-strength, ASTM A325 and F1852.
   2. Manufacturers:
      a. LeJeune Bolt Company, Burnsville, MN.
      b. Nucor Fastener, Saint Joe, IN.
      c. T.S. Bolts and Tools, Bristol Machine Co., Walnut, CA.
      d. Haydon Bolts, Philadelphia, PA.
      e. Vermont Fasteners Manufacturing, Swanton, VT.

E. Machine Bolts (M.B.): ASTM A307
F. **Nuts:** ASTM A563, type to match bolt type and finish.

G. **Hardened Steel Flat and Beveled Washers:** ASTM F436, type to match bolt finish.

H. **Welded Shear Studs:** As specified in Section 05500, METAL FABRICATIONS AND CASTINGS.

2.03 **ANCILLARY MATERIALS**

A. **Surface Preparation and Primer:** As specified in Section 09900, PAINTING

B. **Grout:** As specified in Section 03600, GROUT.

2.04 **FABRICATION**

A. **General:**

1. Fabricate as shown and in accordance with AISC Specification for Structural Steel Buildings and AISC Code of Standard Practice for Steel Buildings and Bridges.

2. Mark and match mark materials for field assembly.

3. Complete assembly, including bolting and welding of units, before start of finishing operations.

4. Fabricate to agree with field measurements.

B. **Connections:**

1. **Shop Connections:** Weld or bolt, as shown.

2. Meet requirements of AISC Manual of Steel Construction tables for bolted double-angle shear connections, unless indicated otherwise.

3. Meet OSHA requirements for one independent bolt at beams framing in to column web connections.

4. Provide oversized holes for anchor bolts in column base plates in accordance with AISC Manual of Steel Construction, unless indicated otherwise.

C. **Welded Construction:**

1. Conform to governing welding codes for type of weld and material for each weld.

2. **Groove and Butt Joint Welds:** Complete penetration, unless otherwise indicated.

3. Interface with Other Work.

D. **Holes:**
1. As necessary or as indicated for securing other Work to structural steel framing, and for passage of other Work through steel framing members.

2. No flame-cut holes will be permitted without prior approval of ENGINEER.

3. Weld threaded nuts to framing, and other specialty items as shown to receive other Work.

E. Shop Paint Primer:

1. Surface Preparation and painting as specified in Section 09900, PAINTING.

2. Do not shop prime the following surfaces, unless indicated otherwise:
   a. Faying surfaces of slip critical bolted connections.
   b. Within 2 inches of field-welded connections.
   c. Steel members to be completely encased in reinforced concrete or coated with cementitious fireproofing.

F. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143, A384, and A385. Avoid fabrication techniques that could cause distortion or embrittlement of steel.

2. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.

3. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.

4. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123.

5. Hot-dip galvanize A325 bolts, nuts, washers, and hardware components in accordance with ASTM A153.

6. Oversize holes to allow for zinc alloy growth.

7. Shop assemble bolts, nuts, and washers with special lubricant and test in accordance with ASTM A325 and A563.

   1. Tension-control (TC) bolts, nuts, and washers shall be mechanically zinc coated in accordance with ASTM F1852 and B695, Class 50.

   2. Galvanize components of bolted assemblies separately before assembly.

G. Slip Critical Bolted Connections:
1. Mask faying surfaces of slip critical (SC) bolted connections to be shop painted as specified in Section 09900, PAINTING.

2. Roughen galvanized faying surfaces with hand wire brushing.

2.05 SOURCE QUALITY CONTROL

A. Welding:

1. Visually inspect fabrication welds in accordance with AWS D1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
   a. An independent testing agency will be retained by OWNER to perform the following inspection and testing of fabrication welds.
      a. Groove welds:
         1) Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.
         2) Use RT only for butt joint groove welds.
      b. Fillet welds larger than 5/16-inch: Liquid penetrant (PT) or magnetic particle (MT) for 10 percent of randomly selected welds, unless otherwise indicated.
      c. All Welds: 100 percent visually inspected (VT).

2. The Certified Welding Inspector (CWI) shall perform inspection prior and during assembly, during welding, and after welding. CWI duties include:
   a. Verifying conformance of specified job material and proper storage.
   d. Inspecting weld joint fit-up and in-process inspection.
   e. Providing 100 percent visual inspection of all welds.
   f. Supervising nondestructive testing personnel and evaluating test results.
   g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

3. Repair and retest rejected weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.
B. Special inspection of fabrication process and shop welding will be provided by OWNER as indicated on Drawings.

C. Hot-Dip Galvanizing:
   1. An independent testing agency will be retained by OWNER to inspect and test hot-dip galvanized fabricated items in accordance with ASTM A123 and A153.
   2. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three test samples from each lot in accordance with ASTM A123 and A153.
   3. Reject and retest nonconforming articles in accordance with ASTM A123 and A153.

PART 3 - EXECUTION

3.01 STEEL MEMBER ERECTION


B. CONTRACTOR is responsible for design and installation of temporary bracing to support components as erection proceeds.

C. High-Strength Bolted Connections:
   1. Tighten in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
   2. Hardened Washers:
      a. Provide at locations required by Washer Requirements section of AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts, to include slip critical connections using slotted or oversized holes or A490 bolts.
      b. Use beveled style and extra thickness where required by AISC Specification.
      c. Use square or rectangular beveled washers at inner flange surfaces of American Standard beams and channels.
      d. Do not substitute DTIs for hardened flat washers required at slotted and oversize holes.
   3. For bearing-type connections not fully tensioned (N, X), tighten to snug tight condition. Use hardened washer over slotted or oversize holes in outer plies.

D. Fully Tensioned Bolted Connections:
   1. Use DTIs or TC bolts at slip critical (SC) and fully tensioned (FT) bearing-type connections.
2. DTIs:
   a. Position within bolted assembly in accordance with ASTM F959.
   b. Install bolts, with DTIs plus hardened washers as required, in all holes of an assembly and tighten until plies are in firm contact and fasteners are uniformly snug tight.

3. Final tighten bolts, beginning at most rigid part of bolted connection and progressing toward free edges, until final twist-off of TC bolts or until DTIs have been compressed to an average gap equal to or less than shown in Table 2, ASTM F959.

E. Welded Connections:
   1. Welding and Fabrication by Welding: Conform to AWS D1.1 Structural Welding Code based on material and type of weld.
   2. Groove and Butt Joint Welds: Complete penetration, unless otherwise indicated.

3.02 ANCHOR BOLTS

A. Coordinate installation of anchor bolts and other connectors required for securing structural steel to in-place work.

B. Provide templates and other devices for presetting bolts and other anchors to accurate locations.

C. Projection of anchor bolts beyond face of concrete and threaded length shall be adequate to allow for full engagement of all threads of hold-down nuts, adjustment of leveling nuts, washer thicknesses, and construction tolerances, unless indicated otherwise.

D. Placement Tolerances:
   1. As required by AISC Code of Standard Practice for Steel Buildings and Bridges, unless indicated otherwise.
   2. Embedded anchor bolts shall not vary from the dimensions as shown on Drawings by more than the following:
      a. Center to center of any two bolts within an anchor group: 1/8 inch.
      b. Center to center of adjacent anchor bolt groups: 1/4 inch.
      c. Variation from perpendicular to theoretical bearing surface: 1:50.

3.03 SETTING BASES AND BEARING PLATES

A. Clean concrete and masonry bearing surfaces of bond reducing materials and roughen to improve bond to bearing surfaces.
B. Clean bottom surface of base and bearing plates.

C. Set loose and attached base plates and bearing plates for structural members on wedges, shims, leveling nuts, or other adjustable devices. Use leveling plates where indicated on Drawings.

D. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to placing grout. Weld plate washers to base plates where indicated in Drawings.

E. **Grout Under Base plates:** As specified in Section 03600, GROUT, prior to placing loads on structure.

### 3.04 FIELD ASSEMBLY

A. Set structural frames accurately to lines and elevations shown.

B. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.

C. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.

D. Level and plumb individual members of structure within tolerances shown in AISC Code of Standard Practice for Steel Buildings and Bridges.

E. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be completed and in service.

F. Perform necessary adjustments to compensate for minor discrepancies in elevations and alignment.

G. Provide additional field connection material as required by AISC Code of Standard Practice for Steel Buildings and Bridges.

H. Splice members only where indicated and accepted on shop drawings.

### 3.05 MISFITS AT BOLTED CONNECTIONS

A. Where misfits in erection bolting are encountered, immediately notify ENGINEER for approval of one of the following methods of correction:

1. Ream holes that must be enlarged to admit bolts and use oversized bolts.

2. Plug weld misaligned holes and redrill holes to admit standard size bolts.

3. Drill additional holes in connection, conforming with AISC Standards for bolt spacing and end and edge distances, and add additional bolts.
4. Reject member containing misfit, incorrect sized, or misaligned holes and fabricate new member to ensure proper fit.

B. Do not enlarge incorrectly sized or misaligned holes in members by burning or using a drift pin.

3.06 MISFITS AT ANCHOR BOLTS

A. Resolve misalignments between anchor bolts and bolt holes in steel members in accordance with approved submittal.

B. Do not flame cut to enlarge holes without prior approval of ENGINEER.

3.07 GAS CUTTING

A. Do not use gas cutting torches in field for correcting fabrication errors in structural framing.

B. Secondary members not under stress and concealed in finished structure may be corrected by gas cutting torches, if approved by ENGINEER.

C. Finish flame-cut sections equivalent to sheared and punched appearance.

3.08 REPAIR AND CLEANING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer.

B. Remove and grind smooth tack welds, fit-up-lugs, and weld runoff tabs.

C. Remove weld back-up bars and grind smooth where indicated on Drawings.

D. Apply touchup paint primer by brush or spray of same thickness and material as that used in shop application and as specified in Section 09900, PAINTING.
3.09 REPAIR OF DAMAGED HOT-DIP GALVANIZED COATING

A. Conform to ASTM A780.
B. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
C. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
D. Use magnetic gauge to determine that thickness is equal to or greater than base galvanized coating.

3.10 FIELD QUALITY CONTROL

A. High-Strength Bolted Connections:
   1. An independent testing agency will be retained by OWNER to perform the following inspection and testing in accordance with the AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts:
      a. Marking identification and conformance to ASTM standards.
      b. Alignment of bolt holes.
      c. Placement, type, and thickness of hardened washers.
      d. Tightening of bolts.
   2. **Bearing-Type Connections Not Fully Tensioned (N, X):** Snug tight condition with plies of joint in firm contact.
   3. Fully Tensioned (FT) Bearing and Slip Critical (SC) Connections:
      a. Conduct preinstallation test.
      b. Monitor installation and tightening of DTIs or TC bolts.
      c. Monitor condition of faying surfaces for slip critical connections.
   4. Preinstallation Test:
      a. Conduct jobsite test prior to start of work using a bolt tension measuring device.
      b. Select representative sample of not less than three bolts of each diameter, length, and grade.
      c. Include DTIs and flat hardened washers as required to match actual connection assembly.
      d. Conduct test in accordance with Specification for Structural Joints Using ASTM A325 or A490 Bolts.
5. **Nondestructive Testing (NDT) Report:** Prepare and submit a written NDT report identifying location of inspected bolted connections and summary of corrections as required to meet code acceptance criteria.

6. **Defective Connections:** Correct and reinspect defective and improperly tightened high-strength bolted connections. Retest fully tensioned bolts as necessary to demonstrate compliance of completed work.

**B. Welded Connections:**

1. Visually inspect field welds in accordance with AWS D1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.

2. An independent testing agency will be retained by OWNER to perform the following inspection and testing of field welds.

3. Unless otherwise specified, perform nondestructive testing (NDT) of welds at a spot testing frequency as shown below in accordance with the referenced welding codes. Perform ultrasonic on complete joint penetration groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply:

   a. **Complete Joint Penetration (CJP) Butt Joint Welds:** 10 percent random Radiographic (RT).

   b. **Groove Welds:**
      
      1) Radiographic (RT) or ultrasonic (UT) testing for 10 percent of randomly selected welds, unless otherwise indicated.
      
      2) Use RT only for butt joint groove welds.

   c. **Fillet Welds Larger Than 5/16 Inch:** Liquid penetrant (PT) or magnetic particle (MT) testing for 10 percent of randomly selected welds, unless otherwise indicated.

   d. **Partial Joint Penetration (PJP) Groove Welds:** 10 percent random PT or MT.

   e. **All Welds:** 100 percent visually inspected (VT).

4. **Weld Acceptance:**

   a. **Visual Testing:**
      
      1) **Structural Pipe and Tubing:** AWS D1.1, paragraph 6.9, Visual Inspection, Tubular Connections.
      
      2) **All Other Structural Steel:** AWS D1.1, paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
      
      3) **Stud Connections:** AWS D1.1, paragraph 7.8.1.
b. **Ultrasonic Testing:** Perform UT of CJP groove welds in accordance with AWS D1.1, paragraph 6.13.3, Class R Indications.

c. **Radiographic Testing:** Perform RT of CJP butt joint welds in accordance with AWS D1.1, paragraph 6.12.1.

d. **PT or MT:**
   1) Perform on fillet and PJP groove welds in accordance with AWS D1.1, paragraph 6.10.
   2) Acceptance shall be in accordance with VT standards specified above.

5. The CWI shall be present whenever field welding is performed. The CWI shall perform inspections prior and during assembly, during and after welding. CWI duties include:
   a. Verifying conformance of specified job material and proper storage.
   b. Monitoring conformance with approved WPS.
   c. Monitoring conformance of WPQ.
   d. Inspecting weld joint fit-up and in-process inspection.
   e. Providing 100 percent visual inspection of all welds.
   f. Supervising nondestructive testing personnel and evaluating test results.
   g. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

6. Repair and retest rejected weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

C. Special inspection will be provided by OWNER as indicated on Drawings.

END OF SECTION
SECTION 05300
METAL ROOF DECKING

PART 1 - GENERAL

1.01 GENERAL

Contractor shall furnish and install all metal decking, accessories, and complete appurtenant work, as shown on the Drawings and specified herein.

1.02 CONTRACTOR SUBMITTALS

A. All submittals shall be provided in accordance with the General Conditions, Section F – Labor and Construction, and shall include, but not be limited to, the following: manufacturer's specifications, material data sheets, and installation instructions.

B. Prior to commencement of any work, the metal decking manufacturer shall furnish an affidavit to the District certifying to the yield strength, design thickness, and section properties of the metal deck. The decking manufacturer shall also furnish the diaphragm shear values for the deck supplied using the welding pattern shown on the Drawings.

C. The decking manufacturer shall submit to the District an erection layout drawing showing the location of deck sheets, end laps, side laps, types and locations of welds, and details of accessories.

PART 2 - PRODUCTS

2.01 METAL DECK

A. Metal deck shall be manufactured from steel conforming to ASTM A446, having a minimum yield strength of 38,000 psi. All deck units shall be coated with a G-90 galvanized coating in accordance with ASTM A653.

B. The metal deck structural properties shall be as follows:

Deck shall be capable of withstanding a diaphragm shear load of 1,880 plf when welded as specified in Part 3.02 herein. Also, deck shall be capable of withstanding a combined vertical live and dead load of 105 psf when spanning 10'-0" between supports (single span) based on a maximum deflection ratio of L/360.

Minimum deck section modulus shall be as follows:

\[ S^+ = 0.852 \text{ cubic inches/ft} \]
\[ S^- = 1.051 \text{ cubic inches/ft} \]

C. Metal roof deck shall be IMSA Building Products (ASC Steel Decks) Type DGNF-32 (box rib with enclosed bottom) 18/20 gauge; 3" deep x 32" wide, or equal.
**D.** Steel deck accessories shall be fabricated from the same gauge and materials as adjacent steel deck.

**E.** Metal deck shall have a sheet length that covers two or more spans where multiple spans are indicated on the Drawings.

**F.** Metal deck sheets shall be formed at the longitudinal sides in such a manner that they will interlock. Where the end of sheets overlap, they shall be die-formed in such a manner that the sheet in the next row telescopes and snugly overlaps the sheet laid previously.

**G.** All sheet metal flashings necessary to make building weathertight shall be provided, whether or not specifically identified herein or shown on the Drawings. Flashing which is not welded to the metal deck shall be aluminum. Aluminum shall be 0.032" minimum thickness and shall conform to ASTM B209, alloy 3003-H14, with "Mill Finish". Thickness of aluminum to be welded shall be as necessary for welding method being used.

**PART 3 - EXECUTION**

**3.01 GENERAL**

**A.** The Contractor shall inspect supporting members for correct layout and alignment, and shall not proceed with installation until defects are corrected and supporting members are completely installed and secured.

**B.** Metal deck sheets and accessories shall be placed in accordance with manufacturer's recommendations and shop drawings. Roofs having a slope of 1/4" per foot or more and shall be erected starting at the lowside to ensure that end laps are shingle fashion.

**C.** Metal deck sheets shall be positioned on supporting steel framework and adjusted to final position with ends bearing a minimum of 2" on supporting members. Units shall be placed end to end with all ribs aligned over entire length of run, before being permanently fastened.

**D.** Special care shall be exercised not to damage or overload the deck during installation. The deck shall not be used for storage or working platforms until permanently secured in position. Construction load shall not exceed deck carrying capacity.

**E.** All openings in the deck shall be cut and fitted neatly and shall be reinforced with structural steel members to distribute the load.

**F.** Contractor shall provide perimeter closures and flashings at wall ends of all units, open ends and sides of panels, and at columns, and weld to decking to provide tight closures.

**G.** Contractor shall provide all flashing, rubber or metal closure pieces, transition pieces, reinforcement, and accessories required to make decking complete.

**H.** Edges of any cut openings or any minor surface damage areas shall be repaired in accordance with applicable requirements of Specification Section 05101 - Structural Steel and Miscellaneous Metal Work Specifications.
3.02 WELDING

A. Unless specified otherwise on the Drawings, the metal deck shall be welded to all interior supporting (framing) members with 1/2" effective diameter puddle welds at 12" O.C.

B. Unless specified otherwise on the Drawings, side laps shall be DeltaGrip mechanical interlocks spaced at 12" O.C.

C. Unless specified otherwise on the Drawings, attachment of deck to angle ledger shall be made with 1/2" effective diameter puddle welds at 12" O.C. and in every flute where support is perpendicular to direction of deck flutes.

D. All welds shall be free of sharp points or edges. All welds shall be cleaned immediately by chipping or wire bruising and shall be coated with a zinc dust type primer paint.

E. Welding shall conform with the applicable requirements of AISC "Light Gauge Steel Design" and AWS D.1.1 and D.1.3. Welders shall be AWS certified.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

Contractor shall furnish and install the standing seam metal roofing system including rigid insulation, rain removal system, and all appurtenant work, complete, as shown on the Drawings and specified herein.

1.02 SUBMITTALS

The manufacturer's specifications and installation instructions for each roof element, product, or system shall be submitted for acceptance by the District. Submittals shall be provided in accordance with the requirements of the General Conditions, Section F - Labor and Construction.

1.03 QUALITY ASSURANCE

A. Contractor shall comply with all governing codes and regulations. Contractor shall provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Contractor shall use experienced installers. Contractor shall deliver, handle, and store materials in accordance with manufacturer's instructions.

B. The built-up roofing system shall meet the following standards:

1. ASTM International:
   a. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   e. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
Standing Seam Metal Roof System
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l. ASTM E 1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems

m. ASTM E 2140 - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.

2. Factory Mutual (FM):

a. FM 4470 Class 1 internal/external fire exposure.

b. FM 4470 Class I-90 wind uplift.

3. Underwriters Laboratories (UL):


b. UL 580 - Tests For Uplift Resistance of Roof Assemblies.


C. Manufacturer Qualifications

1. Provider of advanced installer training.

2. Minimum of ten years experience in manufacturing metal roof systems.

3. Provider of products produced in a permanent factory environment with fixed roll-forming equipment.
D. Installer Qualifications

1. At least five years’ experience in the installation of structural standing seam metal roof panels.

2. Experience on at least five projects of similar size, type and complexity as this Project that have been in service for a minimum of two years with satisfactory performance of the roof system.

3. Employer of workers for this Project who are competent in techniques required by manufacturer for installation indicated and who shall be supervised at all times when material is being installed.

1.04 DELIVERY, STORAGE AND HANDLING

A. General

Comply with manufacturer’s current printed product storage recommendations.

B. Delivery

Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage

Store materials above ground, under waterproof covering, protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Provide proper ventilation of metal panel system to prevent condensation build-up between each panel and trim or flashing component. Tilt stack to drain in wet conditions. Remove strippable plastic film before storage under high-heat conditions. Store products in manufacturer’s unopened packaging until just prior to installation.

D. Handling

Exercise caution in unloading and handling metal panel system to prevent bending, warping, twisting and surface damage.

1.05 MANUFACTURER WARRANTY

A. Weather Tightness Warranty

For weather tightness in which manufacturer agrees to repair or replace panels that fail within 20 years from date of Substantial Completion.

Manufacturer shall provide a full panel, side-lap, and trim warranty.
B. Exposed Panel Finish Warranty

1. Manufacturer's standard form (PVDF) Fluorocarbon System Warranty for film integrity, chalk rating and fade rating in which manufacturer agrees to repair or replace panels that show evidence of deterioration within specified warranty period.

2. Deterioration shall include but is not limited to:
   a. Color fading of more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling or failure of paint to adhere to bare metal.

3. Warranty Period: Film integrity for 45 years and chalk and fade rating for 35 years from date of Substantial Completion.

4. Manufacturer’s warranty may exclude surface deterioration due to physical damage and exposure to salt air environments.

PART 2 - PRODUCTS

2.01 GENERAL

The standing seam metal roofing system shall be composed of 16" wide, mechanically seamed factory coated roof panels and matching trim with mechanically fastened rigid insulation and underlayment. Roofing system shall be provided with all required clips and Z Purlins required for installation on HDG metal decking.

Contractor shall issue to the District a maintenance bond to maintain the roofing in a watertight condition for a period of 2 years from the date of Contract completion. Manufacturer shall provide the (no dollar limit) warranty on the standing seam roofing system components per Part 1.05 herein.

2.02 RIGID INSULATION

The materials and application of roofing insulation shall conform to the applicable requirement of the Underwriters Laboratories "Fire Resistance Index", Factory Mutual requirements, manufacturer's printed recommendations and specifications, and Federal specifications.

Thermal and acoustical insulation shall have a flame-spread rating of 75 or less and a smoke density not exceeding 450 when tested in accordance with ASTM E84.
Roof insulation shall be a polyisocyanurate rigid insulation board and meet the requirements of ASTM C1289. The "LTTR" value of the board shall be 12 minimum for 2" thickness. Unless shown otherwise on the Drawings, roof insulation shall be a minimum of 2" thick. Insulation shall be Energyguard as manufactured by GAF Materials Corporation, or equal.

2.03 UNDERLAYMENT

Provide a layer of underlayment between ridged insulation and standing seam metal roof panels. Underlayment shall be a single layer of material meeting ASTM D1970 (such as EDPM, Ice and Water Shield, or equal) or two overlapping layers of material meeting ASTM D226 Type II (No. 30 Felt).

2.04 STANDING SEAM ROOFING

A. General

Standing seam metal roof panels shall be 16" wide 22 gauge (min.) AZ50 galvalume steel with 2" high standing seams. Surface shall be smooth. All panels, mounting hardware, and trim pieces shall be of the same materials and by the same manufacturer. Panels shall be mechanically seamed.

B. Coil Material

Coil material shall be aluminum-zinc alloy-coated steel sheet (Galvalume) complying with ASTM A 792/A 792M, Class AZ50/AZ55 coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.

C. Accessories

1. Provide components required for a complete, weather-tight panel system including trim, copings, fasciae, mullions, sills, corner units, panel clips, flashings, sealants, gaskets, fillers, panel closures, and similar items. Match material and finish of metal panels unless otherwise indicated.

2. Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

3. Self-tapping screws designed to withstand design loads.

4. Provide sealant type recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.
   a. Sealant Tape: Buytl
   b. Joint Sealant: One Part Poly
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D. Panel and Trim/Flashing Fabrication

1. Provide factory-formed metal roof panel system complying with ASTM E 1514 requirements.

2. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

3. Form panels in continuous lengths, endlaps are not permitted.

4. Field forming of panels shall be done by factory employees operating the machines.

5. Fabricate metal panel joints with factory-installed butyl sealant that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

6. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer’s recommendations and recommendations in SMACNA’s "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

   a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

   b. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

   c. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

   d. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

   e. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

   f. Fabricate cleats and attachment devices from same material as accessory being anchored, but not less than thickness of metal being secured.

2.05 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
B. Appearance of Finished Work

Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories

Exposed surfaces shall be factory coated with a two coat fluoropolymer finish per American Architectural Manufacturers Association (AAMA) 62. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

D. Concealed surfaces shall be factory coated including pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

E. Color shall be per color schedule on plans. Provide color sample to the District for final selection.

2.06 RAIN REMOVAL SYSTEM

Contractor shall provide a rain removal system as shown on the Drawings and specified herein:

A. All rain removal system components shall be provided by a single manufacturer and constructed of 3105 aluminum with factory off-white coating.

B. All fasteners (screws, nuts, washers, etc.) shall be 304 (or better) stainless steel. Where fasteners are into masonry, use wedge or insert type fasteners. Explosive fasteners are not allowed.

C. Rain gutter shall be 5" K-type constructed form 0.032" thick sheet and secured to the fascia with free floating hangers (not through bolted). Hangers shall be 0.051" thick (min.) and shall provide 50-pounds per linear foot support.

D. Downspouts shall be 3" x 4" square tubing and fittings constructed of 0.024" sheet. Downspouts shall be mounted with two fastener straps.

E. Contractor shall provide all additional materials (sealants, expansion joints, end caps, etc.) recommended by the manufacturer's written instructions to provide a watertight rain removal system.

F. Rain removal system shall be provided with a 20-year manufacturer's warranty against corrosion or defects.

G. Rain removal system shall be an Envoy Rain Removal System as manufactured by ALCOA or equal.
PART 3 - EXECUTION

3.01 INSTALLATION

A. The installation shall conform to applicable codes and standards and the manufacturer's written recommendations, specifications, and installation instructions for the type of work being performed. Metal roof deck shall be smooth, dry, and free of dirt and foreign materials. Decks shall have projections removed, and depressions and holes shall be properly filled before roof is installed.

B. Insulation shall be installed in accordance with the manufacturer's printed installation instructions.

C. Insulation shall be installed to provide maximum thermal benefits for material specified. The insulation shall be installed to completely fill or cover voids, providing a continuous plane of insulation. Insulation shall be cut neatly to snugly fit angles, corners, and irregular areas and carefully fitted around pipes, conduits, etc., to maintain continuity of insulation. Gaps or ridges shall be avoided.

D. Underlayment shall be installed smooth with 1/2 width overlaps to provide a weathertight surface. Penetrations at hatches, pipe, conduit, etc. shall be sealed with roof sealant.

E. Roofing shall be applied by a roofing contractor approved by the roofing manufacturer, with written approval submitted to the District.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Roofing System: This specifies the following adhered roofing system.
   1. 80 mil felt-backed PVC roofing system adhered with a Urethane based adhesive.

1.02 REFERENCES

A. Current Edition of: Identified reference requirements as put forth by the project specification.
   1. 2013 California Building Code
   2. American Society of Testing Materials (ASTM)
   3. National Roofing Contractors Association (NRCA)
   4. Single Ply Roofing Institute (SPRI)
   5. Roofing Manufacturer’s Applicator Handbook
   6. Technical Bulletins

1.03 SUBMITTALS

A. Literature: Copies of current relevant information pertaining to the primary components to be used in the roof system including but not limited to:
   1. Specifications
   2. Roofing’s Warranty
   3. Applicator’s Warranty
   4. Product Data Sheets
   5. Material Safety Data Sheets
   6. FM/UL listings/approvals
   7. UL Environment validation of recycling claims

B. Samples for Verification: Representative samples of primary components to be used in the roof system.
C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of roof deck, orientation of roofing membrane, patterns for insulation attachment, and membrane fastening spacing.
4. Fastening patterns for corner, perimeter, and field-of-roof locations.

1.04 QUALITY ASSURANCE

A. Roofing Qualifications:

1. Demonstrated performance history of producing single ply roof membranes no less, in duration of years, than the warranty duration specified.
2. Manufactured by membrane supplier and not private labeled.

B. Installer Qualifications:

1. A qualified firm that is authorized by the roofing manufacturer to install all work pertaining to product manufacturer's roof system and that is eligible to receive manufacturer's warranty.

C. Pre-installation Roofing Conference: Conduct conference at Project site.

1. Roofing manufacturer’s representative, Owner, Engineer, Testing and Inspecting Agency representative, Roofing Installer, General Contractor, Deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's most current requirements.
3. Review base flashings, special roofing details and transitions, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
4. Review governing regulations and requirements for insurance and certificates.
5. Review temporary protection requirements for roofing system during and after installation.
6. Deviations from the project specifications or the approved shop drawings are not permitted without prior written approval by roofing manufacturer, the owner, the owner’s representative, and the Engineer.

D. Fire Design:

1. Underwriters Laboratories, Inc. (Class A Assembly)
Fully Adhered Polyvinyl Chloride Roofing
Section 07540 - 3

E. Wind Design:
   1. System shall meet minimum requirements in accordance of ASCE 7 per code jurisdiction
      a. Field Pressure 20.1 psf
      b. Perimeter Pressure 27.5 psf (occurs within 20 feet of the edge of the roof)

F. Special Design:
   1. California Energy Commission Title 24
   2. SCAQMD
   3. IECC
   4. ANSI-SPRI ES-1
   5. Energy Star

1.05 DELIVERY, HANDLING, AND STORAGE

A. Deliver roofing materials to project site in original containers with seals unbroken and labeled with product manufacturer's name or product brand name.

B. Comply with most current product data sheet requirements when handling, storing, protecting, or installing roofing materials. Including but not limited to avoiding physical damage, deterioration by sunlight, excessive moisture, or other potentially damaging conditions.

C. Store liquid materials in their original undamaged containers in a clean, dry, protected location; away from direct sunlight; within the temperature range noted on the product data sheet.

D. Handle and store roofing materials and equipment in a manner to avoid permanent deflection of deck.

1.06 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's most current requirements and warranty requirements.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required and confirmed by roofing manufacturer.

1.07 WARRANTY

A. The roofing manufacturer shall warrant to the owner the specified warranty for the specified warranty period as long as the roofing is installed according to roofing
manufacturer written technical instructions. The warranty must be non-prorated and must not exclude coverage due to ponding water.

1. System Warranty:
2. 20 Warranty Period: Number of years from date of substantial completion.

B. Applicator’s Warranty: Signed by installing applicator, covering the work of a System Warranty, including all components of roofing system installation such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period:
1. 5 Warranty Period: Number of years from date of substantial completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE / DESIGN CRITERIA

A. ASTM D4434: Type II

B. NSF/ANSI Standard 347: Platinum

C. Guarantee membrane thickness meets or exceeds specified thickness when tested according to ASTM D751

2.02 ROOFING MATERIALS

A. PVC Sheet:
1. Thermoplastic membrane, fiberglass scrim reinforcement, with a felt backing.

B. PVC Sheet Thickness:
1. Carlisle Sure-Flex FleeceBack FRS, 135 mil,
2. Sarnafil G410, 80 mil (2.0 mm),
3. Approved equal.

C. PVC Sheet Exposed Face Color:
1. Refer to color schedule on plans, subject to final approval by the Owner.

D. Membrane Attachment Component:
1. Urethane based adhesive: Sika Sarnacol OM Feltback Membrane,
2. Carlisle Fast Adhesive
3. Approved equal.

E. Cover Board:
1. 5/8” thick Dens Deck Prime
F. Insulation:
   1. Refer to Section 07210

G. Flashing Materials:
   1. Curb and Perimeter Edge Flashing:
      a. The Contractor shall provide all flashing and sealing materials and labor as required to provide a weather-tight roof system. Locations where flashing may be required include the perimeter of the roof, the curbs at the access hatches and vent. Flashing materials may include, but are not limited to:
         1) Heat-weldable flashing membrane
         2) PVC-coated sheet metal
   2. Misc. Flashing Accessories:
      a. The Contractor shall provide all flashing and sealing materials and labor as required to provide a weather-tight roof system at all penetrations through the roofing membrane, including pipe penetrations through the roof deck and at guardrail posts.

H. Walkway Protection:
   1. Provide 80 mil thick, minimum, textured walkway protection
   2. Carlisle Walkway Tread 80 Mil,
   3. Sika Sarnatred-V,
   4. Approved equal.

I. Vapor Retarder:
   1. Self-Adhering Air and Vapor Barrier:
      a. Carlisle 725-TR
      b. Sarnafil CCW-725
      c. Approved equal.
   2. Primer:
      a. Carlisle Cav Grip
      b. Sarnafil CCW-Primer 702
      c. Approved equal
PART 3 - EXECUTION

3.01  EXAMINATION

A. Applicator shall verify that the work done under related sections meets the following conditions:

1. Roof drains and downspouts have been installed properly.
2. Roof curbs, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.
3. All surfaces are smooth and free of dirt, debris and incompatible materials.
4. For concrete deck, verify that concrete substrate is dry and free of moisture. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
5. Verify that tapered expanded polystyrene overlay conforms to slopes indicated on the contract drawings.
6. All roof surfaces shall be free of water, ice and snow.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02  PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's most current requirements. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and flashings and from spilling or migrating onto surfaces of other construction. Remove roof drain plugs when no work is taking place or when rain is forecast.

3.03  ROOFING INSTALLATION, GENERAL

A. Install roofing system according to product manufacturer's most current requirements including but not limited to roofing applicator handbook, product data sheets, specifications, and or relevant technical bulletins.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.04  VAPOR BARRIER INSTALLATION

A. Over prepared concrete deck apply manufacturer’s primer at the specified rate.

B. Install Self-Adhering Air and Vapor Barrier per manufacturer’s installation instructions.
3.05 COVER BOARD INSTALLATION

A. Coordinate installing roofing system components so cover boards or expanded polystyrene overlay are not exposed to precipitation or other sources of moisture.

B. Comply with product manufacturer's most current written requirements for installing cover boards.

C. Fill gaps exceeding 1/4 inch with insulation. Cut and fit insulation within 1/4 inch of projections, and penetrations.

D. Installation Method:
   1. Urethane Adhered: Install cover board and secure by adhering to substrate by using Urethane board adhesive at the spacing rate and application method according to roofing manufacturer’s written instructions.

3.06 ROOFING MEMBRANE INSTALLATION

A. The surface of the insulation or substrate shall be inspected prior to installation of the roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Apply roofing with side laps shingled with slope of roof deck where possible.

D. Make sure seam areas are free of debris, dirt, and dust, overlap membrane sheets, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer’s most current requirements to ensure a watertight seam installation.
   1. Verify in-field weld strength of seams a minimum of twice daily, repair seam sample areas.
   2. Test lap edges with probe to verify seam weld continuity.
   3. If any tears or voids in lapped seams are found repair using appropriate approved technique.

E. Adhered System:
   1. Urethane Based Adhesive (Feltback):
      a. Dispense urethane adhesive onto approved substrate at spacing rate and application method according to the roofing manufacturer’s written instructions. Unroll feltback membrane into raised adhesive, do not allow adhesive to dry. Membrane sheet shall be pressed firmly in place with a minimum 100 pound steel membrane roller.
3.07 BASE / FIELD FLASHING INSTALLATION

A. Install all membrane and preformed flashings according to roofing system manufacturer's most current requirements.

B. Install membrane base flashing by applying bonding adhesive to substrate and underside of membrane flashing at required rate. Do not apply to seam area of flashing.

C. Flash field penetrations and inside/outside corners with appropriate prefab flashing components or by approved custom in-field fabrication technique.

D. Firmly roll membrane flashing into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of membrane flashings and mechanically anchor to substrate by approved the roofing manufacturer’s detail(s).

F. Spread continuous sealant bead leaving no gaps over deck drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.08 WALKWAY INSTALLATION

A. Install walkway product in locations indicated, adhere (except edges) to deck sheet, and hot-air weld edges.

3.09 FIELD QUALITY CONTROL

A. Arrange for roofing system manufacturer's technical personnel to inspect roofing installation upon completion.

B. Repair or remove and replace components of roofing system that do not comply with specified requirements.

C. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTION

A. Protect new roofing system from damage and wear during construction period. Inspect new roofing for damage if used during construction
PART 1 - GENERAL

1.01 SUMMARY

A. **Work included:** Furnishing and installing factory fabricated roof hatches

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   
   ASTM A 36-93a    Standard Specification for Structural Steel

1.03 SUBMITTALS

A. **Product Data:** Provide manufacturer’s product data for all materials in this specification.

B. **Shop Drawings:** Show profiles, accessories, location, and dimensions.

C. **Samples:** Manufacturer to provide upon request; sized to represent material adequately.

D. **Contract Closeout:** Roof hatch manufacturer shall provide the manufacturer’s Warranty prior to the contract closeout.

1.04 PRODUCT HANDLING

A. All materials shall be delivered in manufacturer’s original packaging.

B. Store materials in a dry, protected, well-vented area. The contractor shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

C. Remove protective wrapping immediately after installation.

1.05 SUBSTITUTIONS

Proposals for substitution products shall be accepted only for products that are equivalent to the specified products in all respects, including: size, materials, weight, load rating, method of operation, weatherproofing, coatings and hardware. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification.

1.06 JOB CONDITIONS

A. Verify that other trades with related work are complete before installing roof hatch(s).

B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
C. Refer to the construction documents, shop drawings, and manufacturer’s installation instructions.

D. Coordinate installation with roof membrane and roof insulation manufacturer’s instructions before starting.

E. Observe all appropriate OSHA safety guidelines for this work.

1.07 WARRANTY/GUARANTEE

Manufacturer’s standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. The BILCO Company, P.O. Box 1203, New Haven, CT 06505,

   1-203-934-6363, Fax: 1-203-933-8478, Web: www.bilco.com

B. Engineer and District approved equal.

2.02 ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatches of the type and size specified on the drawings. Locate the hinged sides of the hatches as shown on the Drawings. The roof hatches shall be pre-assembled from the manufacturer.

B. Performance characteristics:

   1. Cover shall be reinforced to support a minimum live load of 40 psf (195 kg/m²) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m²) wind uplift.

   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

   3. Operation of the cover shall not be affected by temperature.

   4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.

C. Cover: Shall be 14 gauge paint bond G-90 galvanized steel with a 3” (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
D. **Cover insulation:** Shall be fiberglass of 1” (25.4mm) thickness, fully covered and protected by a metal liner 22 gauge paint bond G-90 galvanized steel.

E. **Curb:** Shall be 12” (305mm) in height and of 14 gauge paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2” (89mm) flange with 7/16” (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6” (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

F. **Curb insulation:** Shall be rigid, high-density fiberboard of 1” (25.4mm) thickness on outside of curb.

G. **Lifting mechanisms:** Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

H. **Hardware:**
   1. Heavy pintle hinges shall be provided
   2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
   3. Roof hatch shall be equipped with interior and exterior padlock hasps.
   4. The latch strike shall be a stamped component bolted to the curb assembly.
   5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” (25.4mm) diameter red vinyl grip handle to permit easy release for closing.
   6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
   7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. **Finishes:** Factory finish shall be alkyd based red oxide primed steel.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

Verify that roof hatch installation will not disrupt other trades. Verify that the substrate is dry, clean, and free of foreign matter. Report and correct defects prior to any installation.

**3.02 INSTALLATION**

A. Submit product design drawings for review and approval to the architect or specifier before fabrication.
B. The installer shall check as-built conditions and verify the manufacturer’s roof hatch details for accuracy to fit the application prior to fabrication. The installer shall comply with the roof hatch Manufacturer's installation instructions.

C. The installer shall furnish mechanical fasteners consistent with the Contract Documents and the roof requirements.

END OF SECTION 07720
SECTION 08100
DOORS, FRAMES, AND HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION AND SCOPE

Contractor shall furnish and install all doors, frames, hardware, and related items, complete and operable, as specified herein and shown on the Drawings.

Where electrified locksets and hardware are specified on the Drawings, said locksets and hardware shall be provided by others. Contractor shall coordinate with others to confirm that doors are compatible with the electrified locksets and hardware.

1.02 FIELD MEASUREMENTS

Prior to fabrication, Contractor shall verify all conditions affecting the work specified herein, including obtaining accurate opening dimensions and embedded anchorage arrangements. Discrepancies shall be reported to the District prior to commencing work.

1.03 SUBMITTALS

Complete fabrication, assembly, and installation drawings, together with details and data governing materials used and other accessories furnished, shall be submitted for acceptance in accordance with the General Conditions, Section F – Labor and Construction. Data shall include, but not be limited to, the following:

A. Door and frame details.

B. Hardware reinforcement.

C. Schedules showing sizes, types, and locations of door louvers and glazing, if any.

D. Anchorage details.

E. Manufacturer's literature and any engineering calculations that may be required elsewhere in this section.

F. Complete detailed hardware list, hardware schedule, and manufacturer's literature on each item.

G. Hardware schedule shall indicate type, manufacturer's name, catalog number, location, and finish of each item to be furnished. Schedule shall also include a complete template list showing template references and data for each item requiring preparation of metal doors and frames.
PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Hollow Metal Doors and Frames

Doors and frames shall be as manufactured by Krieger Steel Products Co., Security Metal Products Corp., or approved equal. All doors and frames shall be manufactured by a single manufacturer.

B. Locksets and Hardware

Refer to Hardware Schedule, herein.

2.02 HOLLOW METAL DOOR AND FRAME FABRICATION

A. General

Hollow metal doors and frames shall be manufactured in accordance with the Steel Door Institute.

B. Doors

Doors shall be of hollow metal construction, full flush design, 1-3/4" thick, with no visible seams. Door face sheets shall be formed with seamless 16 gauge steel. Seams at edges shall be continuously and fully welded and ground smooth. Filled joints will not be acceptable. Vertical edges of door shall be reinforced with 14 gauge steel channels the entire height of door. Top and bottom of doors shall have continuous 16 gauge reinforcing channels welded to the face sheets. Doors shall be mortised, reinforced (not less than 8 gauge reinforcement for hinges and 12 gauge for locks and closers), drilled, and tapped in accordance with hardware templates. Reinforcement plates (not less than 14 gauge) shall be provided at all surface applied hardware locations. Reinforcement around openings for louvers and glazing shall be 12 gauge channel reinforcement welded to face sheets. Opening sizes shall be as shown on the Drawings. Louvers shall be mounted in the doors prior to painting. Doors shall be rigid and free from warpage or buckle. Tops of exterior doors shall be provided with flush, water, and weather tight top enclosures.

Doors shall be formed and bonded to a rigid fire proof and moisture proof honeycomb core. Doors and frames specified or shown on Drawings as fire rated shall conform to Underwriters Laboratories listings and shall be UL labeled, indicating the type of certification rating.

C. Double Doors

Double doors shall be provided with a "T" type steel astragal, unless specified otherwise on the Drawings.
D. **Door Frames**

Door frames shall be of type and sizes as shown, formed of 14 gauge steel. Frames shall have integral stops. All seams and joints shall be continuously and fully welded. All exposed welding shall be ground smooth. Frames shall be mortised, reinforced, drilled, and tapped in the shop to receive mortised template hardware as required. Reinforcement shall be 8 gauge at hinges and 12 gauge at strikes and closers.

Provide a minimum of 3 adjustable masonry or steel stud type anchors at each jamb (30" on center, maximum). Provide a minimum of 2 frame head anchors. Spot weld 14 gauge metal clip angles to bottom of each jamb member to provide floor anchorage.

E. **Factory Prime Coating Requirements**

All interior and exterior doors and frames shall be thoroughly cleaned to remove all rust, scale, grease, and oil, then treated with a chemical compound to assure maximum paint adherence, and prime coated with corrosion-inhibiting primer compatible with finish paint specified on Drawings.

### 2.03 DOOR HARDWARE

A. **General**

Refer to spec section 08711.

**PART 3 - EXECUTION**

### 3.01 HOLLOW METAL DOORS AND FRAMES

A. Doors and frames shall be shipped and stored with temporary stiffeners and spreaders to maintain frames in alignment. Storage shall be in a manner that will prevent rusting, damage, or marring of finish.

B. All work shall be shop fabricated to required profiles with edges straight, true, and sharp. Fabricate and fit accurately with hairline joints at corners, surfaces free of warp, wave, buckle, and other defects. Welding "Best Grade Commercial Work", with all exposed beads ground smooth.

C. Door and frame assemblies shall be installed plumb, square, and level, and be securely and rigidly anchored to the adjoining construction. Door and frame assemblies shall be installed in accordance with approved shop drawings and printed recommendations and instructions of the manufacturer.

D. Unless specified otherwise on the Drawings, the area inside each door frame shall be grouted solid to the full height of the jambs and across the head with "Gypsolite" as manufactured by Gold Bond, or "Structo-lite" as manufactured by U.S. Gypsum, or equal. Where split frames occur, each side of the frame shall be grouted separately taking care not to "bridge" the sections of the walls or frames together.

E. *U.S. Gypsum, or equal. Where split frames occur, each side of the frame shall be grouted separately taking care not to "bridge" the sections of the walls or frames together.*

F. Doors shall be installed with a maximum clearance of 1/8" at head, 3/32" at strike jamb, 1/8" at butt jamb, and as required where thresholds are listed, and shall not exceed the manufacturer's specified limits.
G. All work shall be coordinated with the work of related subcontractors and suppliers to assure a proper installation.

H. Protect installed doors against damage during construction.

I. Warranty

All hardware shall be warranted for a period of two (2) years from the date of acceptance of the project. Defects in material and workmanship occurring during the warranty period shall be corrected to the satisfaction of the District.

J. Special Tools

Contractor shall provide two (2) sets of installation and adjusting tools.
PART 1 - GENERAL

1.01 SECTION INCLUDES

Materials and installation of roll-up doors.

1.02 SUBMITTALS

A. Section 01300 - Submittals: Procedures for Submittals.

B. Submit manufacturer's catalog data and descriptive literature. Submit dimensional drawings. Show details for attachment to walls complete, showing door, tracks, hoods, operators, etc.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Overhead Door Corp., North American Door, Cookson, Cornell, or approved equal.

2.02 ROLL-UP DOOR DESIGN

Roll-up doors shall be face mounted.

2.03 CURTAINS

Form curtains of galvanized steel with interlocking slats to resist wind pressure of 20 psf. Slats shall be minimum 22 U.S. gauge. Reinforce the bottom of each curtain with two angles of equal weight. Slat-type curtains shall be Overhead Door Design F265, or equal.

2.04 GUIDES

Fabricate guides of steel structural angles not less than 3/16 inch thick. Provide wind bars.

2.05 HOODS

Fabricate hoods of 24 gauge prime painted galvanized steel.

2.06 COUNTERBALANCE ASSEMBLY

Provide counterbalance assembly with oil-tempered helical torsion springs having a safety factor of 1.25. Fix springs to tapered cast anchors permanently lubricated, mounted on a single solid torsion rod. Attach torsion rod to spring tension adjustment wheel. House assembly in steel pipe shaft, deflection not to exceed .03 inch per foot of span. Design to balance door such that effort to operate door does not exceed 35 pounds.
Overhead Coiling Doors
Section 08331 - 2

2.07 OPERATOR

Operation shall be a hand chain, 35 pounds maximum pull.

2.08 BRACKET PLATES

Bracket plates shall be of steel plate. Provide sealed ball bearings to support the counterbalance assembly. Provide brackets to form end closures and support hoods.

2.09 WEATHER SEALS

Provide neoprene weather seals at sides (external), bottom bar, and internal baffle in hood.

PART 3 - EXECUTION

3.01 INSTALLATION

Install per manufacturer's recommendations.

3.02 PAINTING AND COATING

A. Apply prime coat at factory. Touch up primer after installation.

B. Paint with two coats of paint compatible with primer. Owner to select color and finish.

3.03 TESTING

Operate doors through two full cycles of opening or closing. Assure that doors operate smoothly and do not stick or bind. Repair or replace doors that exhibit binding or sticking.

END OF SECTION 08331
PART 1 - GENERAL

1.01 SUMMARY

Contractor shall furnish and install identification devices consisting of signs for all equipment, instrument control modules, panels, electrical control panels, and room doors. Piping shall be labeled as specified in Section 09900, Painting and Protective Coatings. Electrical MCCs and distribution switchgear shall be labeled in accordance with Section 16480. Instrument primary devices (pressure switches, flow meters, level transducers, etc.) shall be provided with tags similar to those for valves.

1.02 REFERENCES

The editions of standards and specifications published by the following organizations, and referenced herein, apply to the work only to the extent specified by the reference.

A. American Society for Testing and Materials (ASTM)
B. The Aluminum Association (AA)
C. American National Standards Institute (ANSI)
D. Architectural Aluminum Manufacturers Association (AAMA)
E. U.S. General Services Administration (Fed. Spec.)

1.03 SPECIFIC PROJECT REQUIREMENTS

As a minimum, Contractor shall provide the following signs:

A. Identification signs for all building rooms
B. Identification signs for all equipment, instruments, and electrical panels.
C. Identification for all fire extinguishers.
D. Danger signs for all belowgrade electrical pull boxes.
E. Danger signs for all doors to rooms requiring ear protection.
F. Danger signs for all doors to rooms with hazardous contents.
G. Danger signs for all doors to rooms with equipment that starts automatically.
H. Danger signs with chemical hazard "diamond" for sodium hypochlorite tanks.
I. All piping and valves shall be labeled as shown on the Drawings.
1.04 SUBMITTALS

Contractor shall submit shop drawings in accordance with the General Conditions, Section F – Labor and Construction. Contractor shall submit complete information and technical data for all material and components, including, but not limited to, the following:

A. A complete list of all project facilities to receive identification devices and proposed locations for the devices.

B. Manufacturer's descriptive data, technical literature, and catalog cuts for each material item and accessories.

C. Manufacturer's shop drawings showing material types, sizes, identification wordings, fonts, text sizes, colors, and symbols to be approved by Owner prior to fabrication.

D. Submit samples of all materials, finishes and coatings before fabrication. Samples shall also include all hardware and attachments required for mounting and/or assembly. All finishes and coatings shall show color and shall be submitted on the materials to which they are to be applied.

E. Detailed instructions for installation of the identification devices.

1.05 REGULATORY REQUIREMENTS

Except as specified or indicated otherwise, sign work shall conform to the Accessibility Standards of the California Code of Regulations (CCR), Title 24.

A. The international symbol of accessibility shall be used to identify facilities that are accessible to and usable by physically disabled persons, and shall be located where shown on plans.

1. Symbol color shall consist of a white figure on a blue background. The blue shall be equal to Color No. 15090 in Federal Standard 595b.

B. Braille Symbols shall be used where noted or required. Symbols shall be Contracted Grade 2 Braille with dots 1/10" on centers in each cell with 2/10" space between cells. Dots shall be raised a minimum of 1/40" above background and domed or rounded.

C. Letter and number size on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10.

D. Characters and symbol shall contrast with their background, light characters on a dark background.

E. Raised characters shall conform to the following:

1. Letters and numbers on signs shall be raised a minimum of 1/32" and shall be sans-serif characters.

2. Raised characters shall be a minimum of 5/8" and maximum of 2” high.
F. Finish and Contrast: Contrast between character, symbols and their background must be 70% minimum and have a non-glare finish meeting the requirements of CBC Section 1117B.5.2.

1.06 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of five (5) years experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall provide a warranty on all products against defects in materials and workmanship for a period of two (2) years after the date of final project acceptance.

1.07 PRODUCT DELIVERY AND STORAGE

A. Delivery of Materials

Manufactured materials shall be delivered in original packages, containers, or bundles bearing the label of the manufacturer.

B. Storage of Products

All materials shall be carefully handled to prevent abrasion, cracking, chipping, twisting, deformation, and other types of damage.

PART 2 - PRODUCTS:

2.01 INDOOR SIGNS

Identification Signs shall be provided for each building room and equipment item housed therein, as designated on the Drawings and/or specified herein. Signs shall be constructed of tough, multi-layered acrylic capable of withstanding temperatures up to 160ºF. Signs shall resist fading, breakage, and stains. Manufacturer shall submit a list of all print and background color combinations, font, and text options for confirmation by Owner. Unless noted otherwise, text size shall be 3/4” tall and signs shall be sized accordingly. Room Identification Signs and Equipment Identification Signs shall be SETONFLEX Plastic, Style No. M5300 by Seton, or approved equal.

Room Identification Signs:

<table>
<thead>
<tr>
<th>Line 1 Location</th>
<th>Line 1 Location</th>
<th>Line 1 Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;ELECTRICAL ROOM&quot; black letters on white background</td>
<td>Mount on appropriate walls (2 total)</td>
<td>&quot;CHEMICAL ROOM&quot; black letters on white background</td>
</tr>
<tr>
<td>Mount on appropriate wall and mount on interior door to Pump Room (2 total)</td>
<td>&quot;GENERATOR ROOM&quot; black letters on white background</td>
<td>Mount on appropriate walls (1 total)</td>
</tr>
</tbody>
</table>
Identifying Devices
Section 10400 - 4

Typical Equipment Identification Signs:

- **Line 1**: "PUMP NO. 1" black letters on white background
- **Location**: Mount on wall adjacent to designated equipment

Fire Extinguisher Identification Signs:

- **Line 1**: "FIRE" white letters on red background
- **Line 2**: "EXTINGUISHER"
- **Line 3**: Downward Arrow (white arrow on red background)
- **Location**: Mount on wall above each fire extinguisher

Danger Signs (Two (2) required):

- **Line 1**: "DANGER" white letters on red background
- **Line 2**: "EQUIPMENT" black letters on white background
- **Line 3**: "STARTS" black letters on white background
- **Line 4**: "AUTOMATICALLY" black letters on white background
- **Location**: Mount on standby generator where it will be visible upon entering the Generator Room from either door

2.02 OUTDOOR/INDOOR SIGNS

Equipment Identification Signs, Warning Signs, and Danger Signs shall be provided as specified herein. Signs shall be constructed of 40-mil aluminum with rounded corners and mounting holes at each corner. Signs shall resist fading in direct sunlight and be suitable for temperatures ranging from -40ºF to 176ºF. Manufacturer shall submit a list of all print and background color combinations for confirmation by Owner. Unless noted otherwise, text size shall be 3/4" tall and signs shall be sized accordingly. Indoor/outdoor signs shall be Style No. M0719 by Seton, or approved equal.

Danger Signs (Three (3) required):

- **Line 1**: "DANGER" white letters on red background
- **Line 2**: "EAR" black letters on white background
- **Line 3**: "PROTECTION" black letters on white background
- **Line 4**: "REQUIRED" black letters on white background
- **Location**: Mount on outside of each exterior building door and on interior door to Generator Room

Exit Signs (Five (5) required):

- **Line 1**: "EXIT" white letters on red background
- **Location**: Mount on inside building adjacent of each building door
PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to receive adhesively applied identification devices before start of work to ensure that they are free of grease, oil, paint, wax, dust, dirt, or other foreign matter that might inhibit bonding to the substrate.

B. Do not start work until deficiencies have been corrected. Start of work of this section constitutes acceptance of the surfaces.

3.02 INSTALLATION

A. Install signs at locations indicated. Ensure that signs are installed plumb and true, at mounting heights indicated, and by method specified. Do not install signs on doors or other surfaces until finishes on such surfaces have been applied.

B. Mounting location and height shall be in accordance with CBC Section 1117B.5.7.

C. Anchorage: Provide anchorage where necessary for fastening signs securely in place. Anchorage not otherwise specified or indicated shall include expansion shields and powder-driven fasteners, when approved, for concrete and masonry; toggle or molly bolts to stud flanges or steel backing plates in light gauge metal framed partitions; full threaded wood screws to wood doors and machine screws to metal doors. Where required, adhere signage to glass with clear adhesive UV- GP641 manufactured by Matronics Corp. (800-775-0797) or approve equal. All exposed anchor devices to be vandal proof type.

D. All identification devices shall be installed in accordance with manufacturer's published instructions, and as specified herein.

E. Identification signs, danger signs, and warning signs shall be wall mounted, door mounted, stanchion mounted, or equipment mounted, as specified herein or as directed by the Owner. All mounting fasteners and accessories shall be constructed of stainless steel. Door fasteners shall be stainless steel rivets or pan head sheet metal screws. Fasteners for concrete or masonry walls shall be stainless steel wedge anchors (male or female thread). Fasteners for wood or steel stud walls shall be stainless steel lag screws. Adhesive bonding is not acceptable.

F. Signs specified to be stanchion mounted shall be provided with a 14-1/2" diameter cast aluminum post base, 12-gauge steel U-channel vertical post powder coated “safety yellow”, and 3/16” thick anodized aluminum backing plate for bolting to U-channel post with two (2) 3/8" diameter stainless steel bolts. Each corner of the sign shall be attached to the backing plate with stainless steel fasteners. Unless specified otherwise on the Drawings, stanchions shall extend 4'-2" minimum above finished grade. Stanchion post base and U-channel shall be as manufactured by Seton, or equal.

G. Prior to installation, the final location of all signs shall be confirmed with the Owner’s Inspector.
3.03  **ADJUST AND CLEAN**

Repair damage to signs incurred during installation. Replace signs which cannot be repaired to new condition. Clean sign surfaces.

END OF SECTION
SECTION 10520
FIRE EXTINGUISHERS AND BRACKETS

PART 1 - GENERAL

1.01 DESCRIPTION

Provide two (2) fire extinguishers and brackets mounted in the each chemical room and, as specified herein, and as required for a complete and proper installation. Specific locations for mounting fire extinguishers shall be determined by the District.

1.02 SUBMITTALS

Contractor shall submit shop drawings in accordance with the General Conditions, Section F – Labor and Construction, and shall include, but not be limited to, the following:

A. List of material items proposed to be provided under this Section.

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

C. Dimensioned drawings as needed to depict the space required for these items, and their interface with the work of other trades.

D. Manufacturer's recommended installation procedures.

1.03 QUALITY ASSURANCE

Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.01 BRACKET AND EXTINGUISHER

A. At each fire extinguisher location, provide a 4A:60B:C type ABC Dry Chemical Fire extinguisher with appropriate hanging bracket. Fire extinguishers shall be as manufactured by Amerex, Ansul, or equal.

B. Service, charge, and tag each fire extinguisher not more than five calendar days prior to the Date of Substantial Completion of the Work as that Date is established by the Owner.
PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Owner, anchoring all components firmly into position.

C. Locate bracket-mounted extinguishers where directed by the Owner and the Fire Department official.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This specification describes a complete operational system to be furnished by a single responsible Filter System Supplier (FSS or Supplier) for installation by Others (Contractor).

2. The work covered in these specifications includes the design, furnishing and installation supervision of a complete filter system. The filter system will remove iron and manganese from potable water from the Eastern Municipal Water District project. The filter system shall have a total capacity of 4000 gpm.
   a. The system shall consist of two (2) pressure vessels, each containing the surface area and filter media as specified under herein.
   b. The system shall be capable of being expanded in the future by construction of two (2) pressure vessels to treat a maximum of 8000 gpm. The filtrate water quantity and quality specified herein shall be met at startup and throughout the warranty period.
   c. The backwash quantity and frequency specified herein shall be met at startup and throughout the warranty period.

3. The filter system supplier for this project shall coordinate the filter system with the following equipment supplied by the Contractor, and their manufacturers:
   a. Surface Wash Pump and System
   b. Backwash Recycle Tank and Pump
   c. Interconnecting Process Piping and Valves
   d. Instrumentation and Control
   e. Electrical

4. The filter system supplier shall be responsible for furnishing filtration support equipment and appurtenances as listed below and specified herein.
   a. Two pressure vessels
   b. Pressure and Flow Monitoring Panel
c. Backwash Recycle ultrasonic level transmitter and floating decanter

d. One (1) Programmable Logic Controller (PLCs) Panel. Controller shall be Allen Bradley ControlLogix as indicated in the drawings. Control panel design shall be per spec 17010, 16950. The PLC panel shall have sufficient spare space to accommodate the additional of I/O cards and appurtenant wiring for two (2) future filter vessels. The PLC power supply unit shall be sized to accommodate the additional (future) I/O cards.

e. The filter system supplier shall be responsible for engineering selection and purchasing of all motor operated valves (MOVs) and specialty control valves associated with the filter system.

f. The filter system supplier shall be responsible for the purchase and testing of field devices related to the filter monitoring panels noted above. Field devices manufacturers and equipment models shall be coordinated with equipment furnished in other process areas. Like items of equipment shall be the product of one manufacturer to facilitate standardization of performance, operation, spare parts, maintenance and manufacturer’s service.

5. The Filter System Supplier shall be responsible for coordination with the Contractor and shall assume ultimate responsibility in providing all items required to form a complete and operable filter system and treatment plant control system whether specified herein or not.

6. The Filter System Supplier shall be engaged by the Contractor as the Instrumentation and Control Subcontractor (ICS) for the complete treatment plant control system including but not limited to the Filters, Filter Feed Panel, Surface Wash Pumps, the Backwash Recycle Pumps, the Filter Effluent Panel, and the Sodium Hypochlorite Feed System.

7. The proposed filter system shall employ a state-of-the-art, fully automated control system for all normal daily operations including automated sequencing of system start-up, automated control of normal operation at steady state conditions, and automated sequencing of plant shutdowns (both emergency and operator initiated). The filter system supplier shall be responsible for providing filter process control strategies that safeguard the filter system equipment and warranties, and account for specific equipment furnished for the project. The developed control strategies shall be sufficiently detailed to allow use for control system coordination efforts.

8. The filter system PLC and HMI shall be by Allen Bradley ControlLogix and PanelView as specified in section 17010.

B. Related Work Described Elsewhere:

1. 00100 Special Conditions

2. 11931 Horizontal Centrigual Water Pumps
3. 13216 Bolted Steel Tank for Water Storage
4. 13446 Valve and Gate Operators
5. 15103.1 Butterfly Valves
6. 15121 Electric Motor Operators
7. 16010 General Electrical Requirements
8. 16160 Variable Frequency Drives
9. 16950 Custom Control Panels
10. 17005 General Instrumentation and Controls
11. 17210 Magnetic Flowmeters
12. 17010 Programmable Logic Controller

1.02 SUBMITTALS

A. Submittals shall be in accordance with the Special Conditions

B. The filter system supplier shall submit the following:

1. Vessel shop or fabrication drawings with all dimensions indicated. Include identification and catalog cuts for purchases components and details for manufactured components. Identify materials, surface preparation, and finishes. Include ASME calculations of wall thickness for the vessel, manways and nozzles.

2. Flow schematic drawing indicating line sizes of pipes connecting to and from pressure vessels, valving, utility (air, water, drain, electric) line sizes and connections.

3. A list of any and all parameters, ratings or other characteristics where the proposed system deviates from the requirements set forth in these Specifications.

4. Backwash system sizing calculations.
   a. Cross-sectional drawings with detailed construction of each component in the pump/blower along with the ASTM material designations.
   b. Bill of materials.
   c. Shaft seal drawing, shaft coupling and bill of materials.
   d. Certified support and anchor bolt plans and details.
   e. Electrical and instrumentation data as detailed below.
   f. Performance curves.
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g. Data sheets applicable to proposals, purchase, and as-built drawings.

h. Performance information.

i. Certified drawings of auxiliary systems.

5. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of the Special Conditions. In addition, valve manufacturer shall certify in writing that valve design and materials of construction are suitable for the intended service.

6. Affidavits of compliance with referenced standards and codes. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

   
   b. ASME Code for Unfired Pressure Vessels.
   
   c. ASME Boiler and Pressure Vessel Code, Section VIII.
   
   d. ANSI B16.6 – Pipe Flanges and Flanged Fittings.
   
   e. Uniform Building Code (UBC).
   
   f. Certified by NSF 61

7. Applicable certifications and ratings.

8. Shop inspection schedule.

9. Detailed drawings illustrating equipment arrangement, bill of materials, weights (dry and operating), size, and location of all anchor bolts and nuts, and plan view system drawing.

10. Piping arrangement drawings or plans and elevation drawings including details (i.e., flanged etc.) and location of all required connections to utilities and piping.

11. Unloading, storage and installation instructions.

12. List of any extra materials or supplies provided.

13. Delegated-Design Submittal: For design of seismic restraints, including analysis data signed and sealed by the qualified professional engineer in the state of California responsible for their preparations.

   a. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment.
   
   b. Structural and seismic calculations for pressure vessels, backwash pumps and blowers. Include calculations for reactions at anchor bolts and
selection of the size depth and number of bolts required for use with Simpson Set Epoxy anchor system.

14. Interior Tank Lining Data:
   
a. Submit a letter of certification from the manufacturer of the interior lining to verify conformance with ANSI/NSF Standard 61 requirements and compatibility of coating system with the proposed process service.
   
b. The tank lining applicator shall be fully experienced in the application of tank coatings and shall be certified by the interior lining coating manufacturer.
   
c. Submit qualifications for an independent paint testing company to perform testing of the internal lining. At a minimum the paint testing shall include mil thickness and Holiday testing. The paint testing company shall be a NACE certified firm acceptable to the tank manufacturer and the Engineer. The paint testing company shall provide a list of previous experience with at least five (5) previous projects of equal or larger sized tanks in the last five years.
   
d. Submit tank testing procedures and proposed locations where testing will be performed. Included in testing procedures should be the models of proposed testing equipment and testing equipment calibration procedures.
   
e. Notify the Owner and Engineer at least two (2) weeks prior to testing to allow witnessing of the paint testing activities, if desired.
   
f. Submit results of interior tank lining testing to the Engineer prior to shipment of the tank to the job site.

15. Electrical/Instrumentation data including: complete electrical, instrumentation and control, and wiring diagrams in sufficient detail to allow installation of instrumentation and controls and electrical components. The following submittals shall be required:
   
a. Field Instrument Submittal
      
      1) Submit complete documentation of all field instruments using ISA-S20 data sheet formats. Submit separate data sheets for each instrument
      
      2) Certified calibration data for all flow metering devices
      
      3) Refer to all other Division 17 for additional specific submittal requirements.
b. Control System Submittal

1) The Supplier shall coordinate with the Contractor to schedule all control system submittals in a timely manner, such that the plant control system programming schedule will not be delayed.

2) Control System Hardware: This submittal shall provide complete documentation of the proposed hardware (PLCs, OITs, communication equipment, cables, and peripherals). The submittal shall include the following:
   a) System Block Diagram
   b) Complete Bill of Materials
   c) Loop Drawings
   d) Control Panel Layout Drawings
   e) Equipment Data Sheets

3) Filter System Control Narrative Submittal: This submittal shall provide the following information:
   a) System Overview
   b) Mode of Operation
   c) Local Manual Control
   d) Local Automatic Control
   e) Remote Manual Control
   f) Remote Automatic Control
   g) Alarms
   h) Interlocks
   i) Tuning Parameters
   j) Equipment Runtimes
   k) Historical Recording

4) Input/Output (I/O) List Submittal: This submittal shall provide the following information:
   a) Field device tag name
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b) I/O tag
c) Description
d) Physical point address: rack, slot and point for each I/O point
e) Logical point address: I/O address of each point
f) I/O type: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, PO – Pulse Output or Ethernet (serial DI/DO/AI/AO).
g) Range
h) Engineering unit

5) Software Package Submittal:
   a) Submit details of all software packages provided with the PLC and the OIT. Indicate all standard and optional features provided.
   b) Indicate the specific software versions that will be provided for each package.
   c) Submit process control narratives prepared specifically for this project.

6) Control System Standards and Conventions Submittal:
   a) Submit system configuration, including network (TCP/IP) addressing. Network addressing shall be defined to enable the SCADA system to communicate with the Filter System control system via Modbus TCP/IP.
   b) Software tag naming conventions
c) OIT Graphic display standards, including color conventions, equipment symbols, display format, and samples of each proposed type of graphic display.
   d) Alarm configuration standards, including priorities, logging, and resetting
e) Security configuration standards, including user groups and privileges
f) PLC software templates, including equipment control, sequence control and equipment runtime calculations

7) Operator Interface Submittal
   a) Submit all proposed graphic displays, trends, and logs.
   b) Quantity of graphic displays to be submitted shall be as required to depict all monitoring and control requirements, defined herein and in the contract documents. As a minimum, the following graphic displays and types shall be submitted:

   Process Overview Displays
   Unit Process Displays
   Alarm Summary Display

   Key Performance Indicators (KPI): provide dedicated graphic displays for system key performance indicators.

   Control Strategy Setup Displays
   Equipment Control Pop-up Displays
   System Diagnostic Displays

c. Data Transfer Address List Submittal

8) Submit a complete Data Transfer List defining all software points for communication to/from the SCADA.

9) The data transfer points shall be based on the Drawings, the requirements outlined in the Specifications, and coordination meetings with the Owner, Engineer, and General Contractor.

10) The data transfer list shall be submitted in both a Microsoft Excel readable electronic file format and hard copy.

11) As a minimum, the data transfer list shall include the following information:
   a) TAG NAME: The identifier assigned to the software point.
   b) DESCRIPTION: A description of the function of the device
   c) LOGICAL POINT ADDRESS: Software address of each point.
   d) POINT TYPE:
DO - Discrete Output is written to SCADA.

DI - Discrete Input is read from SCADA.

AO - Analog Output is written to SCADA.

AI - Analog Input is read from SCADA.

12) DATA FORMAT: For analog points, the data format shall be either Integer or floating point. For discrete points, the data format shall be either maintained or momentary.

13) RANGE/STATE: The range in engineering units corresponding to an analog 4-20 mA signal; or, the state at which the value of the discrete points are “1.”

14) ENGINEERING UNITS: The engineering units associated with the Analog points.

C. The filter system supplier shall submit the following with delivery of the equipment:

1. The Supplier shall submit operation and maintenance data in accordance with the Special Conditions. Manuals shall include data for the backwash system and include the pump and motors.

2. Submit a Manufacturer’s field report, including a report of installation, inspection, testing, and observations for each pressure vessel, pumping unit, blower package and the media installation in a Letter of Certification.

3. Testing Submittals

   a. Submit the procedures proposed to be followed for each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Include sign-off forms for each testing phase or loop with signoff areas for the Manufacturer, Engineer, and Owner.

   b. Preliminary documentation shall be provided at least 2 weeks prior to the various tests which shall include a Factory Acceptance Test (FAT), pressure test report and site performance test.

   c. Pressure test reports and certificates of inspection for the vessel shall be in accordance with procedures for ASME pressure rating and ASME Boiler and Pressure Vessel Code. Reports shall be furnished prior to shipment of the vessels.

   d. Site Performance Test shall satisfy the requirements specified herein. Included shall be the certified data guaranteeing the backwash volume
generated for each pressure filter per backwash, which shall be measured during performance test.

e. Media Test Submittal: Prior to media shipment, submit signed representative Sample Analysis, (i.e. effective size, uniformity coefficient, specific gravity, acid solubility and MOH hardness for Anthracite only.). All testing shall conform to the requirements of the latest edition of AWWA B100.

1.03 QUALITY ASSURANCE

A. Backwash Waste Production

1. Filter System Suppliers shall provide with their submittal a backwash generation calculation and guarantee.

B. Qualified Filter System Suppliers shall have experience manufacturing pressure filter vessels and filtration systems for manganese removal for at least five (5) years with no less than 10 successful installations in the municipal market, of which 3 must have been 8 MGD or larger. Approved Suppliers are listed below.

1. Loprest Division of WRT.

2. Pureflow Filtration Division.

3. Wigen Water Technologies.

1.04 DELIVERY, STORAGE AND HANDLING

A. System components delivered to the site shall be stored in such a manner that they will not constitute distractions or a safety hazard.

1.05 WARRANTY

The filter manufacturer shall furnish the District with a written guaranty for performance of the iron and manganese removal system. The guaranty shall specify that the system has been designed and manufactured to provide the performance specified in this section and shown on the preliminary drawings. Within a period of 5 years from the acceptance of this Project and as long as the constituents in the raw water do not exceed the limits specified in Paragraph 2.01 C, if the system should fail to produce an effluent with quality within the limits specified in the same paragraph, the manufacturer shall make the necessary repair, adjustment or replacement as necessary at no cost to the District. The guaranty shall be signed by a corporate officer of the filter manufacturer and shall be submitted to the District in triplicate prior to the acceptance of the Project.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials that come into contact with the water being treated or the finished water shall be ANSI/NSF Standard 61 certified for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating ANSI/NSF
Standard 61 conformance for the materials used in products that come into contact with the water.

B. The Filter System Supplier shall confirm in the shop drawing submittal if a chemical for pH adjustment is required to achieve the performance requirements as specified herein and shall include the chemical information and the maximum dose of any such pretreatment chemicals.

C. Filtration System Equipment relevant data for the quality expected of the raw water to be treated and design requirements are as tabulated below:

<table>
<thead>
<tr>
<th>Design rate of flow, gpm</th>
<th>4,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of filters</td>
<td>2</td>
</tr>
<tr>
<td>Number of cells per filter</td>
<td>2</td>
</tr>
<tr>
<td>Filter loading rate at design flow rate, gpm/ft2</td>
<td>7.5</td>
</tr>
<tr>
<td>Maximum clean filter pressure drop, psi</td>
<td>2</td>
</tr>
<tr>
<td>Maximum dirty filter pressure drop, psi</td>
<td>10</td>
</tr>
<tr>
<td>Filter area per filter, ft2</td>
<td>267</td>
</tr>
<tr>
<td>Maximum pressure drop across filter during backwash, psi</td>
<td>12</td>
</tr>
<tr>
<td>Maximum operating pressure, psig</td>
<td>100</td>
</tr>
<tr>
<td>Type:</td>
<td>Horizontal Pressure Vessel</td>
</tr>
<tr>
<td>Pressure Rating, psi:</td>
<td>150</td>
</tr>
<tr>
<td>Backwash Expansion Minimum</td>
<td>40%</td>
</tr>
<tr>
<td>Seismic:</td>
<td>Current IBC requirements</td>
</tr>
</tbody>
</table>

D. Water Filtration Equipment system shall be capable to meet the requirements specified above without exceeding the following limits:

| Influent total manganese, mg/L | ≤ 0.132 |
| Effluent total manganese, mg/L | ≤ 0.03 |
| Influent total iron, mg/L as Fe | ≤ 0.43 |
| Effluent total iron, mg/L as Fe | ≤ 0.05 |
| Maximum backwash cycle volume, gal/ cell | 21,000 |
| Minimum filter runtime between backwashes | 24 hours |
| Normal Filter Surface Waste flow, gpm | 200 |
| Normal Filter Surface Wash Waste Volume, gal/vessel | Included in above |

### 2.02 MATERIALS AND EQUIPMENT

A. Pressure Filter Vessel:

1. All pressure vessels shall conform to the Equipment Schedule and be constructed in accordance with Section VIII of the ASME code requirements for cold fired pressure vessels and shall bear the ASME stamp. Minimum thicknesses shall be furnished in accordance with ASME code requirements. Verification of ASME code design to include calculated head and shell thicknesses. They shall be submitted with the first submittal drawing and be approved by the design engineer prior to
authorization of fabrication. Vessels shall be fabricated in a facility holding a current ASME U-stamp. Facilities holding an ASME R ("repair") or other certification shall not be considered acceptable for vessel fabrication.

2. All flanges, plates, angles, channels, beams, etc., shall be joined by fillet welds, all sides continuous welded per AWS D1.1. Flanges shall be factory welded on split centers prior to shipment.

B. Vessel Interior Construction:

1. Filter Inlet Distributor
   a. Each filter cell shall be furnished with a 8" full-length header inlet distributor/backwash collector system, constructed of 316L S.S. SCH 10 pipe. The distributing system shall be designed for uniform distribution of inlet water over the entire filter bed and for the uniform collection of the backwash water during the backwash operation.

C. Vessel Underdrain System

1. Each filter tank shall be furnished with a header lateral underdrain system designed to uniformly distribute backwash water and for collection of filtered water. The header shall be a 12" SCH 10 316L Stainless Steel. The header shall have 2” 3000 lb 316L Stainless Steel couplings welded in place for lateral connection. The laterals shall be of 316L S.S. constructions and are to be the slotted, wedge wire, pipe based design, 2” laterals on 12” spacing. Slot size shall be a maximum of 0.01 inches.

B. Vessel Miscellaneous Components

1. Each filter shall be equipped with four (4) 14” x 18” elliptical manholes.
   a. Two full opening manway shall be placed in each cell near the top of the vessel for access into the filter for purposes of media loading, and two manway shall be placed below the underdrain to allow for access during painting, welding and inspection. The manways shall conform to the requirements of the ASME code for pressure vessels section VIII, Division 1. The manway weld collar shall be 6” of carbon steel. The manway cover shall be constructed of carbon steel and the wing-nut washer hinge pins shall be 304 stainless steel. Manways shall be furnished with NSF / ANSI 61 certified manway gaskets.

   b. Each cell shall be equipped with one (1) 6” x 8” handholes for observation of backwash functions. The hand hole shall be supplied with a Buna-N gasket.

2. Each filter shall be supplied with two (2) lifting lugs.

3. Each filter shall be supplied with two (2) structural steel I-beam type saddle support legs.
4. 1/2” diameter, threaded full couplings shall be provided as shown on the Drawings for sample taps (two (2) per influent nozzle and two (2) per effluent nozzles to provide separate sample lines to the pressure gauge/sample and the pressure transmitter).

5. Manufacturer shall furnish anchor bolts as required per the manufacturer’s seismic design to be shipped loose with the equipment and installed by the Contractor.

6. Pipe nozzles shall be of the size as shown on the Drawings and shall consist of Sch. 40 steel pipe, projecting and terminating in a flange 6” from the outside face of the sideshell. Flanges shall be Class 150, standard ANSI pattern, welded on split centers and shall be true and plumb.

7. A 2” drain with ball valve and plug shall be provided at the bottom head center consisting of a welded threaded outlet.

8. An air release half coupling shall be provided in the top center of the shell as required per manufacturers design requirements but shall be no less than 2-inches.

9. Gauge taps shall be furnished in the influent and effluent nozzle connections (1/2” NPT half coupling with plug).

D. Support Gravels and Filtration Media

1. Place lean concrete (1000 psi) in the bottom of the vessel up to the base of the gravel support bed (18”). Concrete to be supplied and installed by equipment installer.

2. A support bed shall be incorporated in the bottom of each vessel, consisting of two layers, with the largest size loaded into the filter first and the succeeding smaller sizes placed on top. The gravel graduations shall be as follows:

   a. 8/12 mesh garnet................................. (3.0) inches
   
   b. 1/8” x 1/4” gravel................................. (6.0) inches

3. The gravel shall be "Water Treatment" quality, washed and screened, and shipped in clearly marked one hundred (100#) pound bags. The gravel must meet the requirements of the American Water Works Association (AWWA) Specification number B-100-89 and be NSF/ANSI 61 certified.

4. The bottom layer of the screened support gravel shall be placed by hand to avoid damage to the diffuser assemblies. Each layer shall be placed and leveled before the addition of the next layer is started. A gravel-less underdrain shall not be acceptable.
5. The filter media shall be placed on top of the support gravel and shall be as required to meet the performance requirements specified herein, at a minimum:

<table>
<thead>
<tr>
<th>Filter Media Total Depth</th>
<th>30 inches minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter Manganese Greensand Plus Media</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.4 minimum</td>
</tr>
<tr>
<td>Thickness</td>
<td>18 inches minimum</td>
</tr>
<tr>
<td>Effective Size</td>
<td>0.3 to 0.35 mm</td>
</tr>
<tr>
<td>Uniformity Coefficient</td>
<td>&lt; 1.60</td>
</tr>
<tr>
<td>Capacity</td>
<td>1000 grains Mn/sf to an iron or manganese effluent break through. Where Mn is KMnO₄ demand (ppm Fe + 2xppm Mn) x (1 Grain per gal/17.1 ppm).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Filter Media /Anthracite</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>1.5 minimum</td>
</tr>
<tr>
<td>Thickness</td>
<td>12 inches minimum</td>
</tr>
<tr>
<td>Effective size</td>
<td>0.6 to 0.8 mm</td>
</tr>
<tr>
<td>Uniformity Coefficient</td>
<td>&lt; 1.6</td>
</tr>
</tbody>
</table>

6. Greensand shall be loaded into the filters and conditioned in accordance with the manufacturer’s recommendations. Greensand fines must be removed from the filter prior to loading the Anthracite.

7. The support gravels and filter media shall be procured from a manufacturer that complies with AWWA B-100 standards.

8. Provide media quantities to account for skimming requirements.

9. Material shall be tested as specified in Part 1 of this section prior to shipment.

E. Surface Wash System

1. Each filter cell shall be furnished with a header lateral surface wash system designed to uniformly distribute surface wash water. The headers shall be constructed of 6” 316L Stainless Steel and laterals shall be constructed of 1½” 316L Stainless Steel and shall contain 316 SS spray nozzles.

2. The surface wash supply system needs to be water at a pressure > 30 psi above the backwash supply water pressure. A small booster pump is to be provided in accordance with Section 11931. 3.
3. A rate of flow control valve and backflow preventor shall be provided if required to produce a fully functional system.

F. Backwash System

1. Backwash supply will be sourced from the filtrate. Adequate pressure is available in the filtrate to provide backwash. Therefore, no pumps or tank are required for the backwash supply.

2. The backwash recycle system is designed to store 1 day of backwash volume from the media filters. The solids are settled to the bottom of the tank and the decant is returned to the front of the treatment plant. The backwash recycle tank will be sized to be 165,000 gal or larger depending on selected filter vendor recommendations. The tank will be installed with a floating decanter for the backwash recycle, an ultrasonic level transmitter, and a float and board tank level indicator. Tank shall be provided in accordance with Section 13312.

3. The backwash return pumps are provided with variable frequency drives (VFD) and are automatically controlled to maintain discharge flow rate setpoint based on the feed flow rate to the system. The backwash return pump will be controlled as duty-standby. The pumps will be located at the backwash recycle tank. Pumps shall be provided in accordance with Section 11931.

G. Facepiping

1. Filter facepiping will be supplied and installed by the Contractor. The Filter System Supplier shall confirm all connecting facepiping diameters and locations on the vessel and note any necessary deviations from the Contract Documents in shop drawing submittals for coordination with the Contractor.

H. Process Valves

1. The Filter System Supplier shall furnish all valves as called for in these specifications, or as required for proper operation of the equipment in all operating modes, including rinse to waste. The valve manufacturer shall furnish detailed technical information as required by the Engineer for evaluating the quality of the valves and as required by the Supplier for proper valve installation. The technical information shall include complete dimensions, weights, and material lists. No valve will be approved for installation until the required information has been received and reviewed.

2. The Filter System Supplier shall furnish all incidental materials necessary for installation of the valves such as flange gaskets, flange bolts and nuts, and all other materials required for the complete installation.

3. Remote control stations shall be provided for all valve actuators located more than 60-inches above the finished floor.

4. Filter function valves shall be shipped loose for installation by the Contractor.
5. Valves shall include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories as required for a complete and operable installation.

6. All valves and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.

7. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

8. Unless specified otherwise, all hardware on the valve and actuator including bolts, washers, and nuts shall be at a minimum Type 304 stainless steel for valves with ferrous body materials and Type 316 stainless steel for valves with stainless steel or thermoplastic body materials.

9. Factory Finishing:
   a. Epoxy Lining and Coating:
      1) NSF approved and in accordance with AWWA C550 unless otherwise specified.
      2) Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.
      3) Minimum 7-mil dry film thickness except where limited by valve operating tolerances.
   
   b. Exposed Valves:
      1) In accordance with Section 09900: Painting and Coating.
      2) Safety isolation valves and lockout valves with handles, handwheels, or chain wheels "safety yellow."
   
   c. Stainless Steel Valves:
      1) Pickling & Passivation shall be provided for all stainless steel valves to provide a bright, uniform finish of the valve body interior and exterior surfaces, including the valve trim, and hardware.

10. Approved Materials:
    a. All materials that come into contact with the water being treated or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating approval by the EPA or NSF for the materials used in products that come into contact with the water.
b. Brass and bronze valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

c. Approved alloys are of the following ASTM designations:

   1) B61, B62, B98 (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.

   2) Stainless steel Alloy 18-8 may be substituted for bronze.

I. Butterfly Valves: refer to Section 15103.1 Butterfly Valves.

J. Ball Valve

   1. Valve: Ball valves in sizes 1/4”-3” for Feed Water and high pressure process services shall be 2-piece body ball valves with standard ports and threaded end connections. Valves shall be manufactured of CF8M stainless steel body and wetted internals conforming to ASTM A351 Grade CF8M and ANSI B16 with a solid 316 stainless steel ball and stem. RPTFE seat and seal.

   2. Operator: Handle with Safety Lockout Feature.

   3. Pressure: 300 psi.

   4. Service: instrument isolation

   5. Apollo Series 76F-100-A

K. Instrumentation

   1. Pressure Guages:

      a. Size and location shall be as shown on the Drawings and provided by Filter System Supplier.

      b. Pressure gauges shall conform to requirements of Section 17005, 2.04.

   2. Differential Pressure Transmitters

      a. Four (4) differential pressure transmitters shall be used to measure differential pressure of each cell. Size and location shall be as shown on the Drawings and provided by Filter System Supplier.

      b. The differential pressure transmitters shall conform to requirements of Section 17005, 2.09.
3. **Flow Meters**  
   a. Two (2) flanged in-line magnetic flow meters shall be used to measure filtrate of each vessel. Size and location shall be as shown on the Drawings and provided by Filter System Supplier.  
   b. One (1) flange in-line magnetic flow meters shall be used to measure backwash waste from the system. Size and location shall be as shown on the Drawings and provided by Filter System Supplier.  
   c. The flow meters shall be as specified in Section 17210.  

4. One stainless steel instrumentation panel shall be provided to mount all instrumentation required for a fully functional filtration system.  
   a. Each panel shall be equipped with the following components:  
      1) Two (2) local flow indicator for the filtrate magnetic flow meter. One (1) per filter vessel.  
      2) Four (4) pressure differential transmitters. One (1) per filter cell.  
      3) Six (6) pressure gauges as shown on the Drawings.  
      4) One (1) local flow indicator for the backwash flow rate.  
      5) Flush mounted sample taps for influent and effluent locations as shown on the Drawings.  

L. **Ultrasonic Level Transmitter**  
   1. One (1) Ultrasonic level transmitter is required at the backwash recycle tank.  
   2. Ultrasonic Level Transmitter shall conform to requirements of Section 17005, 2.10.  

M. **Automatic Filter Controls**  
   1. General: The Filter System Supplier shall furnish an automatic control system consisting of an Allen Bradley ControlLogix PLC-based control panel with operator interface terminal (OIT), necessary hardware, components, timers, OIT, enclosure, relays, switches, alarms, I/O, and other items necessary for a complete operational system. The automatic filter control system shall be essentially as described below.  
   2. The automatic filter control system shall provide control and monitoring of all equipment indicating on the Drawings, including the monitoring of the Filter Feed Panel, the control and monitoring of the Surface Wash Pumps, the Backwash Recycle Pumps, the Filter Effluent Panel, the Sodium Hypochlorite Feed System and full valve control.  
   3. The automatic filter control system shall be provided in one (1) PLC cabinet, as shown on the drawings.
4. The PLC for the Pressure Filter System provides control and monitoring for all of the pressure vessels, the backwash recycle system, as well as providing the interface for control and monitoring by the SCADA system (via the Kingfisher RTU). The filter PLC shall. The filter PLC shall be connected to the Kingfisher RTU through the Modbus TCP/IP protocol.

5. Control Architecture

a. System level control will include the following functionality:

1) Pressure Filter Start-up and Shut down commands

2) Management of Pressure Filter backwash priorities and number of Pressure Filters required to be in service based on flow and target requirements

3) Provide System monitoring and operator control functions through a panel mounted operator interface

4) Detect and respond to System level fault conditions including alarm annunciations at the HMI as well as to the SCADA System

6. Control Modes

a. There are two modes of System control that can be selected via the HMI: “Auto” and “Manual”. The Operator must enter a password on the Operator Interface Terminal to change System mode.

1) Remote: With the System in “Remote” mode, Start Up and Shut Down requests are initiated via SCADA commands.

2) Local: With the System in “Local” mode, all SCADA commands are disabled. The Pressure Filters can be operated in “Manual” or “Automatic” mode, selectable via the HMI. Pressure Filters may be manually given start-up and shutdown requests.

3) Off: With the System in “Off” mode, all the Pressure Filters will be placed into “Off” mode. The system will not be functional in “Off” mode. All valves, pumps and blowers will be de-energized. Only local controls at the devices will be operational.

2. Control States and Transitions

a. Each filter can be in one of three different states; “Online”, “Backwash” or “Shutdown”. The entire filter system can be in one of two different state; “Online” or “Out of Service”.

b. Start Up Sequence

1) System is in “Automatic” mode and in the “Offline” state.
2) System receives a start request as determined from the SCADA system. Start shall be selectable at the SCADA.

3) PLC will request to open the filtrate isolation valve, backwash waste flow control valve, and filter supply valves.

4) Individual requests will be sent to all required pressure vessels and they will begin their normal start-up sequences.

5) After all required vessels valve open signals are active and the backwash waste turbidity is below an operator adjustable setpoint ([x.x] ntu) the system will be “Online”.

6) PLC will request to open the filtrate flow control valve. Once closed signal is inactive, the PLC will request to close the backwash waste control valve and place the filtrate flow control valve into PID flow control.

7) During normal operation feed water is diverted to each cell in the vessel where it flows through the dual media system, gravel and into the filtrate collection chamber. The filtrate collection chamber is shared by all cells in the vessel. The filtrate line is flow controlled to maintain a calculated setpoint based on the raw water feed to the plant and the number of vessels online.

c. Shut Down Sequence

1) The System is in the “Online” state.

2) A shutdown request has been made at the SCADA, PLC or a Critical alarm condition occurs.

3) The System status will change to the “Shutdown” state.

4) PLC will request to shutdown all pumps and blowers, and close all filter header valves except the filtrate isolation valve and the backwash waste flow control valve.

5) Once all vessels have transitioned to a “Offline” states, the System will changes from “Shutdown” to “Out of Service” if a critical alarm has triggered the shutdown.

d. Backwash Sequence

1) Filter vessels can issue a backwash request based on a differential pressure setpoint, a run time, or a scheduler that selects which day of the week and time each vessel is to be backwashed.

2) The pressure vessel will begin a backwash sequence when no other backwash sequences are active, and the Backwash Recycle Tank has the capacity to receive an entire backwash sequence, and the Backwash Recycle System is not currently “resting” (see below). If multiple vessels request a backwash they will be placed
into a queue which is prioritized based on the differential pressure of the vessel. Vessels will continue to operate while in the backwash queue.

3) The backwash sequence will be as determined by the Filter System Supplier to provide a successful backwash with the maximum backwash volume produced as required herein. The backwash shall include drain, fill, backwash with air scour and a restratification steps.

e. Backwash Recycle

1) After a backwash cycle has completed the backwash tank will be allowed to “rest” for an operator adjustable period of time. This is the time when the solids are settling before decanting is begun.

2) After a backwash cycle has been rested it will begin to decant and the decant will return the pressure filter feed at a rate of no more than 10% the filter feed flow. The program will automatically calculate a flow setpoint for the backwash recycle pumps and adjust the speed of the pumps to meet the calculated backwash recycle rate. The decant cycle will continue until the tank low level alarm is triggered when the pumps will be called to stop.

3) After a decant cycle is completed the tank will be able to receive a new backwash cycle.

3. Communications Heartbeat

a. A Communications Heartbeat will be utilized to ensure communications is active between the Filter PLC and SCADA. This will be accomplished by monitoring a SCADA signal with its value automatically changing. Should the value received from SCADA stay the same value for a period of time, communications will be deemed lost and an alarm will be generated locally as well as possible control actions as determined and stated earlier in this document.

4. Hardware

a. PLC. The automatic control panel shall be PLC-based as specified in Section 17010: Programmable Logic Controllers.

b. Network and Communications. The automatic control panel shall be provided with the required Ethernet/IP to Modbus TCP gateway devices and equipment for proper communication via Modbus TCP/IP as indicated on the drawings.

2.03 PAINTING
A. Pressure Vessels

1. The tank shall be leak tested and all welding operations completed before preparation of the tank interior to receive the lining. All welded and machined edges shall be ground smooth to a minimum 1/8-inch radius to facilitate application of the lining. All interior surfaces shall be blasted to a SSPC-SP10 Near White Blast Cleaning.

2. Apply all material in strict accordance with manufacturer’s instructions. Apply first coat immediately after surface preparation. Apply each coat to a uniform, even coating; lay material in one direction and finish at right angles. Allow material to thoroughly dry between coats. Scuff, sand and remove all runs, sags, over spray, surface roughness and other defects between each coat.

3. Surface preparation:
   a. Interior - Sandblast to near white blast cleaning (SSPC-SP10).
   b. Exterior - Sandblast to commercial blast cleaning (SSPC-SP6).

4. Interior Coating (factory applied):
   a. All metal components inside the pressure vessel along with the interior vessel wall must be coated according to the requirements herein.
   b. Stripe coating: hand-apply one coat to all welds and hard to reach areas (i.e. interior ribbing, interior pipe nozzle, etc) using high quality natural or synthetic bristle brush, to a dry film thickness of 4-6 mils.

   Tnemec Series N140-15BL, or equal

   c. Prime coating: primer to a dry mil thickness of 4-6 mils before any rust can form.

   Tnemec Series N140-1255, or equal

   d. Finish coating: to a dry mil thickness of 4-6 mils for a total dry film thickness of 12-15 mils.

   Tnemec Series N140-15BL, or equal

   e. The interior lining shall be applied only by an experienced applicator who shall demonstrate previous experience with the application of the specified coating. The interior lining shall extend into all tank nozzles. The intermediate and final coats shall be performed in strict compliance with the coating manufacturer’s recommendations.

   f. The internal lining shall be tested for dry film millage and holidays by the approved independent paint testing company. Testing of the internal lining for dry film thickness shall at a minimum be performed at five (5) equally spaced locations along the length of the tank, including each end and the center of the tank straight shell. Each location shall include
testing of 12 locations along the interior perimeter of the tank starting at the top and equally spaced at increments of 30-degrees. The tank manufacturer shall retain sample coupons from the shell for use by the paint testing firm for calibration of the testing equipment. The testing shall be performed using a wet sponge type electric holiday tester and magnetic dry film thickness gauge, both of acceptable manufacturer by the Engineer. The tank manufacturer shall repair all holidays and low millage areas in strict accordance with the lining manufacturer's established repair procedures. The tank shall then be retested to determine if all lining defects have been successfully repaired.

5. Exterior Coating
   a. The exterior surface shall be blasted to a SSPC-SP6/NACE 3 commercial blast grade and one coat of shop applied epoxy primer.
   b. Prime Coat (factory applied): Two component, cross-linked epoxy primer. Tnemec Series 69 epoxy primer.
   c. Finish coating: The exterior finish coat shall be field applied by the Contractor upon installation.

6. The total exterior coating system shall be the product of and be applied in accordance with the recommendations of one manufacturer. Alternate coating systems must be pre-approved by Engineer.

7. Exterior Finish
   a. Units shall receive finish coating in the field by the Contractor.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install in accordance with manufacturer’s recommendations.

B. Initial Conditions: Manganese greensand is not shipped in a regenerated form; therefore, it is necessary prior to use, to regenerate with a solution of potassium permanganate solution contacting the bed for a minimum of three hours. A regeneration level of two ounces of potassium permanganate per cubic foot is recommended. Before placing in service, the filter must be rinsed of all remaining traces of potassium permanganate. Depending on filter system supplier recommendations, initial regeneration may be accomplished with high concentrations of a chlorine solution.

C. Prior to placing a filter into service, manganese greensand should be thoroughly backwashed and the top layer of finer material removed by undercutting. Each bag of manganese greensand as shipped contains sufficient material to compensate for removing one inch of finer material.

3.02 FACTORY SERVICES AND START-UP

A. The filter manufacturer shall assist in the start-up and commissioning the water treatment system.

B. The filter manufacturer shall provide instructions on the placement of the filter media, after a site visit to confirm correct concrete sub fill addition.

C. A qualified factory service technician shall sample the greensand media to confirm media fines removal prior to filter final assembly.

D. A minimum of five trips and seven days of on-site field assistance is required.

E. System Start-Up and Training

1. The Contractor will verify that the project is ready for manufacturer’s field services.

2. The Filter System Supplier shall provide the services of a factory representative during start-up of the equipment. At a minimum, the Filter System Supplier’s technician shall perform the following start-up functions:

   a. Inspect the final installation to assure proper installation, connection and wiring of all equipment of the Filter System Supplier’s scope of supply.

   b. Testing of internal pipes for clogging and uniform flow.

   c. Placement of concrete fill, support gravel, and filter media, including washing and skimming of all media fines.

   d. Conducting performance tests.

   e. Start-up of the equipment in the presence of the Contractor and Owner’s operating personnel. The filter manufacturer shall be responsible for original startup of equipment furnished. A certificate of "operational readiness" shall be issued prior to owner operation.
f. Submit certifications from the manufacturer stating that the complete filtration system and associated equipment has been properly sized, installed, seismically restrained, adjusted and tested, and ready for full time operation.

g. Training of Owner’s operating personnel in proper operation and maintenance procedures, start-up/shutdown procedures, response to emergency conditions, and troubleshooting. The responsibility of the Contractor and the factory service representative with regard to startup shall be fulfilled when the start-up is complete, the equipment is functioning properly, operating personnel have been trained and the equipment has been accepted by the Owner.

F. Manufacturer’s Instructions. Installation shall be as shown on the Drawings and in accordance with the manufacturer’s recommendations, installation instructions and assembly drawings. Manufacturer’s installation instructions and assembly drawings shall be submitted and approved by the design engineer prior to shipment of equipment. Installation of the filtration system shall be in strict accordance with the details shown on the drawings and in complete conformance to manufacturer’s instructions and procedures.

G. Filter Effluent Performance Testing (72 hours)

1. A detailed filter system performance test shall be prepared by the Filter System Supplier and submitted as specified in Part 1 of this section.

2. During start-up, the Filter System Supplier’s representative shall perform feed water and filtered effluent field turbidity and iron tests to confirm performance of the equipment.

3. Analytical methods employed for field testing shall be performed by a digital colorimeter.

4. Sampling for conformance shall be taken during the middle of a filter run.

3.03 Manufacturer’s Certificate(s)

The Contractor shall obtain written certification from the manufacturer, addressed to the District, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with these specifications and as indicated on the Drawings, and that the pump manufacturer accepts joint responsibility with the Contractor for coordination of all equipment, including motors, controls, and services required for proper installation and operation of the completely assembled and installed unit. The Contractor shall submit all such certificates to the Engineer.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to install all in-line static mixer as shown on the Drawings and specified herein.

B. The mixers are intended to rapidly mix chemical solutions into the process water to provide a homogeneous stream at the mixer outlet.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Protective Coatings: Section 09900

B. Chemical Metering Pumps: Section 11246

C. Division 15 as applicable

1.03 QUALITY ASSURANCE

The static mixing equipment manufacturer shall have experience in the design and manufacturer of equipment of similar size and capacity and shall present proof of successful operations involving each piece of equipment furnished. All equipment shall be as manufactured by Chemineer, Komax Systems, Inc., or Sulzer Chemtech.

1.04 SUBMITTALS

A. Provide a copy of this specification section with all addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate the requested deviations from the specification requirements in accordance with Section 01300.

B. Materials and Shop Drawings

1. Submit shop drawings and product data for equipment furnished under this section.

2. Submit mixing calculations for each static mixer demonstrating the mixing achieved at the minimum and maximum conditions as listed in Table 11224.

C. Additional Information

1. Equipment Installation Certificate: The manufacturer shall provide a written report, endorsed in writing by the CONTRACTOR, certifying that the equipment has been properly installed and checked and is ready for placement into routine permanent service.
1.05 OPERATIONS AND MAINTENANCE DATA
   A. Operating and Maintenance Instructions
      1. Furnish Operation and Maintenance Manuals

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING
   The equipment provided under this section shall be shipped, handled, and stored in accordance with
   the manufacturer’s written instructions.

PART 2 - PRODUCTS

2.01 GENERAL
   A. The one (1) Filter feed system static mixer (SM-1001) will be used to blend sodium
      hypochlorite into a process stream for Filter Feed. The mixer shall be capable of blending
      the chemical and the raw water into a homogeneous solution over the process water flow
      range listed in Table 11224. The specified CoV should be achieved within three (3) diameters
      downstream of the mixing elements. The pressure drop across the mixer shall not exceed
      the values listed at the maximum flow rate.

   B. The one (1) effluent system static mixer (SM-7001) will be used to blend sodium
      hypochlorite into a process stream. The mixer shall be capable of blending the chemical and
      the treated water into a homogeneous solution over the process water flow range listed in
      Table 11224. The specified CoV should be achieved within three (3) diameters downstream
      of the mixing elements. The pressure drop across the mixer shall not exceed the values listed
      at the maximum flow rate.

2.02 MATERIALS AND EQUIPMENT
   A. The mixers shall be furnished complete with 10S 316 stainless steel components, including
      the flanged end body, internal baffle elements, and all other necessary appurtenances for
      each static mixer.

   B. The mixer housing and mixing elements shall be constructed of 10S 316 stainless steel. The
      mixer housing shall have an diameter as shown on the Drawings and be constructed with
      10S 316 stainless steel with Class 150-pound flat faced flanges. Teflon fullface gaskets, 1/8-
      inch thick, shall be provided for raised-face flanges. The mixer shall be able to withstand an
      internal pressure of 150 psi. The mixer housing, mixing elements and injectors shall be able
      to withstand a temperature of 200°F and a minimum pH of 5.0.

   C. The number of mixing elements shall be as recommended by the mixer manufacturer for
      the use intended. A minimum of two (2) elements shall be provided. Overall length shall not
      exceed the criteria listed in Table 11224. Tab-style mixers or mixing elements shall not be
      allowed.

   D. SM-1001: Mixer shall be used to add 12.5% sodium hypochlorite directly into the mixer.
      Mixer shall be equipped with two (2) additive port with 1-inch flanged connections for
      chemical injection.
E. SM-7001: Mixer shall be used to add 12.5% sodium hypochlorite directly into the mixer. Mixer shall be equipped with one (1) additive port with 1-inch flanged connections for chemical injection.

2.03 SPARE PARTS

A. All of the manufacturer's recommended spare parts necessary to maintain the unit in operation for a period of one (1) year shall be provided.

B. All tools and spare parts shall be furnished in containers clearly identified with indelible markings as to their contents. Each container shall be packed with its contents protected for storage. All tools shall be furnished in steel tool boxes.

C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The CONTRACTOR shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the CITY.

2.04 QUALITY CONTROL

Perform Manufacturer's and Supplier's product quality control specifics as required for this project.

PART 3 - EXECUTION

3.01 INSTALLATION

Installation shall be in strict accordance with the manufacturer's instructions and recommendations using proven construction techniques in the location shown on the Drawings.

3.02 INSPECTION AND TESTING

A. Upon completion of installation, the CONTRACTOR, in the presence of a qualified manufacturer's representative, shall perform a preliminary test on the system to ensure that all component parts are functioning to the satisfaction of the CITY.

B. Approval of the preliminary test by the CITY shall not constitute final acceptance of the equipment furnished.

C. After the system is in full operation, a full operating test shall be performed in the presence of the CITY and a qualified manufacturer's representative.

3.03 START-UP AND INSTRUCTION

Furnish services of manufacturer's technical representative to inspect the completed installation, correct or supervise correction of any defects or malfunctions, and instruct operating personnel in proper operating and maintenance procedures as described in this section.
### TABLE 11224
IN-LINE STATIC MIXER SCHEDULE

<table>
<thead>
<tr>
<th>Item/Design Condition</th>
<th>Filter Influent</th>
<th>Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity:</strong></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mixer Finish:</strong></td>
<td>Pickled &amp; Passivated</td>
<td>Pickled &amp; Passivated</td>
</tr>
<tr>
<td><strong>Mixer Type:</strong></td>
<td>Corrugated Plate or Triple Action Design</td>
<td>Corrugated Plate or Triple Action Design</td>
</tr>
<tr>
<td><strong>Diameter (inch):</strong></td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td><strong>Design Working Pressure (psi):</strong></td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td><strong>End Connections:</strong></td>
<td>150# FLG</td>
<td>150# FLG</td>
</tr>
<tr>
<td><strong>Water Rate of Flow (gpm):</strong></td>
<td>2,000 – 18,930</td>
<td>4,000 – 18,930</td>
</tr>
<tr>
<td><strong>Maximum Length (inch):</strong></td>
<td>72</td>
<td>84</td>
</tr>
<tr>
<td><strong>Maximum Pressure Loss at Maximum Flow (psi):</strong></td>
<td>5.5</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Percent Mixing Efficiency (Coefficient of Variation, CoV):</strong></td>
<td>90%(0.10)</td>
<td>90%(0.10)</td>
</tr>
</tbody>
</table>

**END OF SECTION**
SECTION 11246
CHEMICAL METERING PUMPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Supply and testing of completely functional, skid-mounted chemical metering pump feed systems.

B. Related Sections:
   1. Division 15: Mechanical.
   2. Refer to Divisions 16 and 17 of the specifications for additional requirements.

1.02 SYSTEM DESCRIPTION

A. Scope: Each individual chemical feed system shall include a field assembled system or manufacturer fabricated skid assembly containing the chemical metering pumps, all necessary piping, valves, fittings, supports, electrical controls and accessories as indicated in the Process and Instrumentation Drawings and specified herein.

B. Design Requirements: All chemical metering pumps and skid-mounted components shall be designed, adapted and fully guaranteed for the respective intended use and shall be constructed of materials compatible with the chemicals indicated in the service requirements and with the environment in which they are installed.

C. The metering pump skid shall contain the following:
   1. Provide HDPE skid with drip lip and back wall for mounting of piping and accessories.
   2. Plexi-glass splash screen
   3. Metering pumps.
   5. Pulsation dampeners (if required).
   6. Pressure gauges.
   7. Ball valves and unions.
   8. Pressure relief valves.
1.03 SUBMITTALS

Submittals shall be provided as required in Section F of the General Conditions. In addition, complete fabrication, assembly, foundation, and installation drawings, together with detailed specifications and data covering material used, power drive assemblies, parts, devices, pumps, supports, panels, and other accessories forming a part of the equipment furnished as well as schematics, diagrams, and panel layouts.

1.04 QUALITY ASSURANCE

All pumps and components shall be assembled onto a skid-mounted system and shop or field-tested for capacity and pressure prior to start-up with documented results of testing submitted with shop drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site as specified in the Specific provisions.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Contractor.

D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.

G. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.06 WARRANTIES

All pumps, chemical analyzers and motor operated valve actuators shall carry an extended warranty for a two-year period from the date of Functional Acceptance testing. All warranties shall be turned into the District prior to project completion. Contractor shall provide a two-year warranty on the liquid end, pump accessories, and the skid-mounted system, in accordance with the Special Conditions.

1.07 MAINTENANCE

A. Special Tools: Deliver 1 set of any special tools needed to assemble and disassemble the metering pump.
B. Extra Materials: Spare parts shall include a complete set of ball check valves (balls, seats and gaskets), peristaltic hoses, and a diaphragm for each pump.

PART 2 - PRODUCTS

2.01 DIAPHRAGM METERING PUMPS

A. Diaphragm pumps will be used for the services described on Table 11246-A

B. Manufacturer will be:
   1. Encore 700 by UGSI Chemical Feed, Inc.
   2. Grundfos DDA
   3. or approved equal.

C. The metering pump shall be of modular design such that the reagent head, transmission, gear reducer, and hydraulic drive mechanism are each independent sub-components allowing for field modifications and major capacity modifications without complete unit replacement. All non-chemically wetted component housings shall be of cast aluminum construction with epoxy paint on all exposed surfaces. The reagent head shall be fastened to a replaceable intermediate housing between the transmission and the wetted chemical path such that in the event of degradation of the diaphragm mating surface, only the intermediate component requires replacement, not the entire pump housing. Material of construction for the wetted parts shall be resistant to the chemicals being pumped and shall be of the materials shown in Table 11246-B. Wetted parts in contact with the chemical shall be protected from and left clean of all coatings applied to the non-wetted components.

D. The pump shall be of the hydraulically balanced diaphragm type wherein a measuring piston reciprocates within a cylinder and causes hydraulic oil to deflect a flat PTFE/elastomeric bonded diaphragm. The process flow path shall be designed to operate without the limitation imposed by a contour plate. A mechanically-actuated refilling system shall maintain the synchronization of the diaphragm with the measuring piston. A hydraulic (oil side) contour plate shall prevent excessive stretching and stress to the diaphragm material. The pump shall be of the simplex (single) head design.

E. The metered liquid will enter the metering head at the bottom and exit at the top through gravity seating ball valves. These valves shall be free-seating type to meet service conditions with valve seats having knife edge contact and will be guided to accurately control vertical and sideward movement. Valves and seats shall be mechanically retained by a four-bolt tie-bar configuration allowing for individual replacement of components without disturbing the process piping. Valve assemblies will not incorporate any threading other than the process pipe connection isolated by the four-bolt tie-bar.

F. The pump shall incorporate a non-vented gear box and eccentric design to protect the pump from the ingress of water, dirt, sand or other debris. A rotary type lip seal arrangement shall positively seal and separate the oil of the gear box and eccentric (transmission) box. Reciprocating seal designs will not be accepted.
G. The pump shall include a hydraulics diagnostics package, which shall provide instant visual indication of normal hydraulic operations, system over-pressure, diaphragm Integrity and proper oil level. A hydraulic bypass (internal pressure relief) valve shall be provided with an externally accessible adjustment device.

H. Pumps shall be equipped with a manually actuated hydraulic purge valve that can be used to validate air-free hydraulics, or so that diaphragm integrity can be easily verified without pump disassembly.

I. The chemical metering pumps shall be a simplex, motor-driven, reciprocating, hydraulically actuated diaphragm type. The pump shall include motor, oil-lubricated gear reducer and drive mounted in an aluminum housing.

J. The pump shall be fully tested to meet rated flow and pressure by the manufacturer.

K. Materials:

   1. Diaphragm, all services: constructed of a steel core, vulcanized into nylon-reinforced EPDM, with PTFE-faced fluid contact surface. The diaphragm shall be of a convex design fitting into a concave liquid end to minimize dead volume and promote flow of solids in suspension.

   2. Wetted Materials of Construction: PVDF

2.02 SKID-MOUNTED FEED SYSTEM

A. The skid mounting of the metering pumps shall conform to the following requirements:

   1. Each chemical feed system shall be completely assembled, mounted, calibrated, tested, and delivered to the site on a single skid. Components to be mounted on the skid are as indicated on the Process and Instrumentation Drawings and shall include where shown the metering pump, calibration column, piping, valves, piping accessories (pulsation dampeners, pressure relief valves, etc.), and wiring integral to the skid. The skid supplier shall be responsible for providing all equipment, valves and piping within the skid boundary.

   2. The skids shall be constructed of HDPE with adequate supports for all equipment and piping and a ½” drip lip. Forklift truck cut outs shall also be provided. Skids shall have a horizontal surface form mounting the pump and a vertical back wall for mounting piping and other accessories. Flat skids with no back wall are prohibited. Side walls that restrict pump access are also prohibited. All piping and other accessories shall be supported using FRP channel supports.

   3. Equipment shall be arranged for ease of maintenance and operation. Pumps shall be oriented so that both the display panel and pump head are accessible from the front of the pump skid (i.e. rotated sideways). Suction and discharge piping shall be oriented so that it does not impede access to the pump or motor. No piping, pulsation dampeners, supports, etc. shall be within 1-ft on any side or on top of the motor.
4. All components of the skid-mounted system (pumps, piping and controls) shall be tested prior to start-up. If skids are fabricated in shop by pump supplier they shall be tested at the shop prior to shipping.

B. Skid-mounted accessories to include the following:

1. Calibration Column:
   a. Provide one, clear plastic calibration column with vent for use in calibrating the metering pumps.
   b. The chamber shall be sized to give adequate capacity for a minimum 30 second draw down test at maximum pump capacity.
   c. The scale shall give direct readings in both mL/s and GPH without the need for calculations.
   d. The top of the chamber shall have a threaded fitting to allow for piping to a vented drain system.

2. Pulsation Dampeners:
   a. Shall be of the single diaphragm design, capable of arresting water hammer in the pump discharge lines created by the metering pumps. Peristaltic pumps do not require pulsation dampeners.
   b. Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped.
   c. Provide one dampener on the discharge side of each metering pump or on the metering pump discharge header as shown on the Drawings.
   d. Each pulsation dampener shall include an integral pressure gauge.
   e. Pulsation dampeners shall be sized appropriately for each pump to remove a minimum of 95 percent of the pulsations. The pump supplier shall provide calculations to verify sizing.

3. Backpressure and Pressure Relief Valves
a. Backpressure Valves: Adjustable diaphragm backpressure sustaining valve, Type PRV740, installed at point of connection and field adjusted. Materials to be suitable for rated chemical service. Chemical metering pump supplier to provide all backpressure and pressure relief valves shown for chemical feed service.

b. Pressure Relief Valves: Adjustable diaphragm pressure relief valve, Type PRV740, installed externally on pump discharge header and factory adjusted to pressure recommended by manufacturer. Materials to be suitable for respective chemical service.

C. Pressure Gauge and Diaphragm Isolators: Provide a pressure gauge and diaphragm type chemical isolation suitable for each chemical service. Range of pressure gauge as indicated on the Drawings.

D. Sight Glass: Provide a clear sight glass with visual flow indicator on the pressure relief discharge. Materials to be suitable for each chemical service.

E. Valves: Ball valves provided are to be as indicated on the Process and Instrumentation Drawings. For sodium hypochlorite, ball valves are to be vented via a factory-drilled hole in the downstream side of the ball. Field drilling of vent holes is prohibited.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall satisfy written instructions of the supplier. Pumps shall be arranged so that flooded suction is achieved when tank level is greater than 1.0 feet full.

B. A factory trained field representative shall supervise the start-up, adjustment, and testing of the units.

3.02 START-UP AND INSTRUCTION

A. Manufacturer’s Representative:

1. The training time shall not be included in the start-up, adjusting and testing time.

B. Manufacturer’s Field Services

1. Manufacturer shall inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up.
### Chemical Metering Pumps
Section 11246 - 7

#### Minimum Requirements

<table>
<thead>
<tr>
<th>Duties/Description</th>
<th>Man Days</th>
<th>Trips to Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruct Installation Contractor and Inspect Work</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Start-up Testing</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Training</td>
<td>0.5</td>
<td>Incl. in Start-Up</td>
</tr>
<tr>
<td>TOTALS</td>
<td>1.5</td>
<td>2</td>
</tr>
</tbody>
</table>

#### TABLE 11246-A
CHEMICAL PUMP SCHEDULE

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Application 1</th>
<th>Application 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Solution Pumped</td>
<td>12.5% sodium hypochlorite</td>
<td>12.5% sodium hypochlorite</td>
</tr>
<tr>
<td>Service Location</td>
<td>Filter Feed</td>
<td>Blended Filtrate</td>
</tr>
<tr>
<td>Number of Units</td>
<td>1 Duty, 1 Standby (shared)</td>
<td>1 Duty, 1 Standby (shared)</td>
</tr>
<tr>
<td>Maximum Capacity – Each Pump</td>
<td>20 gph</td>
<td>20 gph</td>
</tr>
<tr>
<td>Operating Range</td>
<td>0.5- 15 gph</td>
<td>0.1-6 gph</td>
</tr>
<tr>
<td>Operating Backpressure</td>
<td>90 psi</td>
<td>80 psi</td>
</tr>
<tr>
<td>Suction and Discharge Port Size</td>
<td>½-in</td>
<td>½-in</td>
</tr>
<tr>
<td>Maximum Motor Horsepower</td>
<td>½ hp</td>
<td>½ hp</td>
</tr>
</tbody>
</table>
3.03 MANUFACTURER’S CERTIFICATE(S)

The Contractor shall obtain written certification from the manufacturer, addressed to the District, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with these specifications and as indicated on the Drawings, and that the pump manufacturer accepts joint responsibility with the Contractor for coordination of all equipment, including motors, controls, and services required for proper installation and operation of the completely assembled and installed unit. The Contractor shall submit all such certificates to the Engineer.

END OF SECTION
SECTION 1193.1
HORIZONTAL CENTRIFUGAL WATER PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section provides specific details regarding the centrifugal pumps at the Backwash Recycle System (PMP-5100, PMP-5200) and the Surface Wash Pumps located at the Filtration System (PMP-5600, PMP-5700) and is to be utilized in conjunction with Specification Section 11931, Horizontal Centrifugal Water Pumps. Data included herein, including specified materials, shall supersede data specified in Specification Section 11931.

B. Related Specification Sections

1. Section 11200 – Water Filtration and Equipment
2. Section 11931 – Horizontal Centrifugal Water Pumps
3. Section 16150 - Induction Motors
4. Section 16160 - Variable Frequency Drives
5. Special Conditions

1.02 SUBMITTALS

A. Materials and Shop Drawings

B. Submittals shall include at least the following:

1. Manufacturer’s literature and illustrations, including the total weight of the equipment and the weight of the single largest item.

2. Manufacturer’s certified curves showing pump characteristics of head, discharge, brake horsepower and efficiency.

3. Shop Drawings, including details of pump assembly and installation layouts and procedures, motor control wiring diagrams, types of materials used in pump construction, details of all pump accessories, drive guards and dimensions of major components.

4. A list of manufacturer’s recommended spare parts to be supplied.

5. Motor: Include the following information on the motor datasheet.

a. Manufacturer.

b. Rated full load horsepower.
Horizontal Centrifugal Water Pumps
Section 11931.1 - 2

c. Rated volts.
d. Number of phases.
e. Frequency in hertz.
f. Locked rotor amperes (LRA) at rated voltage or NEMA code letter.
g. NEMA design letter.
h. Bearing type.
i. Service Factor.
j. Nominal speed at full load.
k. Full Load Amperes (FLA).
l. Efficiency at ½, ¾ and full load.
m. Power factor at no load, ½, ¾ and full load.
n. NEMA insulation system classification.
o. Corrosion duty rating.
p. Fan, end bell cast evidence.
q. No load amperes.
r. Safe stall time.
s. Maximum guaranteed slip at full load.
t. Motor damage curves for motors larger than 100 Hp.
u. Motor manufacturer recommended maximum power factor correction capacitor kVAR.

6. Submit a letter certifying full and complete compliance with the Specifications, Drawings and other project requirements. The letter shall list any exceptions or deviations from specified requirements, if any and reasons for same. Exceptions or deviation shall also be clearly marked in a separate color in submittals.

7. The motor manufacturer shall provide in writing that the motor is suitable for VFD or RVSS application (if applicable).

1.03 PUMP REQUIREMENTS

A. The following criteria shall be used for final sizing and selection of the backwash recycle pumps (PMP-5100, PMP-5200):

1. Fluid Pumped: Decanted Backwash Waste
2. Specific Gravity: 1.0

3. Conditions of Service:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Motor HP</th>
<th>Design Flow (gpm)</th>
<th>Design TDH (ft H2O)</th>
<th>Min. Eff. (%)</th>
<th>Motor Speed (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+1</td>
<td>40</td>
<td>400</td>
<td>215</td>
<td>75</td>
<td>≤ 3600</td>
</tr>
</tbody>
</table>

B. The following criteria shall be used for final sizing and selection of the surface rinse pumps (PMP-5600, PMP-5700):

1. Fluid Pumped: Well Water

2. Specific Gravity: 1.0

3. Conditions of Service:

<table>
<thead>
<tr>
<th>Qty</th>
<th>Motor HP</th>
<th>Design Flow (gpm)</th>
<th>Design TDH (ft H2O)</th>
<th>Min. Eff. (%)</th>
<th>Motor Speed (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+1</td>
<td>7.5</td>
<td>250</td>
<td>69</td>
<td>70</td>
<td>≤ 3600</td>
</tr>
</tbody>
</table>

C. Motor Design

1. Provide 3 phase, 480 volts, NEMA Design B, induction motors. The motor shall be non-overloading, without use of the service factor, at all anticipated conditions of service.

   a. Frequency: 60 Hertz.

   b. Speed: 1800 rpm

   c. Service factor: 1.15 for all motors.

2. The motor shall be non-overloading, without use of the service factor, at all anticipated conditions of service and Pump Schedule listed above.

3. Motors shall be inverter duty rated for use with reduce voltage soft starters. Insulation for inverter duty motor shall meet or exceed the Pulse Endurance Index for magnetic wire and shall not be damaged when exposed to repeated pulse type wave forms, repetitive high voltage transients, switching frequency and rate of rise of the pulse. All bearings on the non-drive end shall be insulated and the drive end bearings shall be provided with shaft ground rings.

4. All motors shall be built in accordance with latest NEMA, IEEE, ANSI, and AFBMA standards where applicable.

---

1 Quantities listed as Duty + Standby
5. **Motor Insulation and Winding:**
   
a. **Class:** Use a class F insulation with temperature Rise of Class B or better, meeting the requirements of NEMA MG 1 and made of non-hygrosopic materials. The insulation shall be manufacturer’s premium grade, resistant to attack by moisture, acids, alkalis, and mechanical or thermal shock for 480-volt motors.

b. All insulated winding conductors shall be copper.

6. **Provide space heaters in all motors.** Use heaters hermetically sealed in stainless steel or equivalent corrosion-resistant sheaths. Heaters shall be rated for 240V, but will be operated at 120 volts. Use heat-resistant insulated leads to the heater or supply heater with leads and extend to the conduit box.

7. **Enclosure type shall be totally enclosed, fan cooled (TEFC).** Motors shall have drain openings and plugs suitably located for the type assembly being provided. Motor shall be corrosion resistant and severe duty rated. TEFC motors shall have a cast iron frame, cast iron end brackets, cast iron bell frame, gasketed cast iron conduit box, tapped drain holes, erosion resistant plug for frames 286T(20HP) and smaller and automatic breaker/drain devices for frame 324T(25HP) and larger, and upgraded insulation by additional dips and baked to increase moisture resistance.

D. **Testing**

1. Prior to final acceptance, the Contractor shall perform field pumping unit performance testing in the District's presence.

2. Motor vibration shall be measure with and without pump shaft disconnected to verify motor vibration performance.

3. Pump manufacturer shall perform a two plane dynamic balance test on pump bowl assembly prior to factory testing.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**
MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER: ___________________________ EQPT SERIAL NO: ___________________________
EQUIPT TAG NO: ___________________________ EQPT/SYSTEM: ___________________________
PROJECT: ___________________________ SPEC. SECTION ___________________________

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: ____________________________________________

Manufacturer: _______________________________________________

By Manufacturer's Authorized Representative: ___________________________

(Authorized Signature)
PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This section covers the furnishing and installation of two (2) FRP tanks for the bulk storage of chemicals.

2. Tanks furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the fabricator unless exceptions are noted by the Engineer.

3. The Contractor shall coordinate the work between the suppliers of equipment to be used with or connected to the membrane cleaning system mixing tanks to ensure that all required provisions for mounting the accessories are included.

B. Related Work Described Elsewhere:

1. Double Containment Piping System: Section 15260.

2. Mechanical - General Mechanical and Equipment: Section 11005.

3. Instrumentation and Control Components: Section 17005.

1.02 SUBMITTALS

C. Materials and Shop Drawings:

1. The data shall include full information on basic materials and test data confirming the chemical resistance of the proposed resins to the intended tank contents.

2. The data shall also indicate the sizes of all major tank components including tank diameter, wall thickness, overall length, nozzle details and locations, supports and brackets, anchor bolt locations and details, and full information and details concerning field assembly and installation.

3. Fabricator's catalog information, descriptive literature, specifications, and identification of materials of construction. Include complete resin system information.

4. Detailed fabrication drawings.

5. Complete design calculations for tanks, supports, and appropriate accessories.

6. Tank capacity chart indicating gallons for each inch of depth and cumulative total from bottom.

7. Recommended bolt torques for all bolted FRP connections.
8. Recommendations for tank material selection and fabrication methods for services indicated on the Tank Schedule Table 13216-1.

9. Certified test data on representative samples of standard laminate materials which verify that their physical properties meet the requirements and service conditions specified. Include verification of structural design parameters.

10. Complete catalog information, descriptive literature, specifications, and materials of construction for tank heating panels, temperature controllers, and other components of the tank heating system.

11. Power and control wiring diagrams for heating panel system, including terminals and numbers.

12. Suggested spare parts list to maintain heating panel system for a period of 2 years. Include a list of any special tools required for checking testing, parts replacement, and maintenance.

13. Final Configuration of Tank Appurtenances: The final locations of tank appurtenances including, but not limited to, nozzles, manways, pipe supports, anchor lugs, ladder, and handrail will be confirmed by the DBE during review of the manufacturer's drawing submittals.


D. Quality Control Submittals:

1. Fabricator's Certificate of Compliance with fabrication requirements.

2. Qualifications of fabricator's Quality Assurance Supervisor.

3. Copy of the fabricator's Quality Assurance Program.

4. Certification of Factory Testing. Submit factory test reports to the DBE.

5. Certification that the tank supports, and access nozzles have been coordinated with the actual equipment being furnished.

6. Special shipping, storage and protection, and handling instructions.

7. Fabricator's written/printed installation and tank support instructions.

8. Manufacturer's Certificate of Proper Installation.

9. Contract Closeout submittals: Service records for any repairs performed during construction. Examples include repairs to fittings, manways, ports and minor surface cracks that do not penetrate the wall.

10. Additional Information: In the event that it is impossible to conform with certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects. Contractor shall obtain approval for non-conforming details from the Engineer prior to fabrication of the tank.
E. Operating Instructions

1. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

2. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided to instruct representatives of the District and the DBE on proper operation and maintenance. With the District's permission, this work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3-EXECUTION. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the District.

1.03 QUALITY ASSURANCE

A. Governing Standards: Except as modified or supplemented herein, all materials and construction methods shall comply with the applicable provisions of the following standards:


5. Fabricator's quality Assurance Supervisor: Minimum of 3 years’ experience in the fabrication of fiberglass structures.

6. Designer: Registered Professional Engineer in California.

7. The tanks shall be furnished, coordinated, and tested by one supplier. The system shall be completely shop-assembled, and shop-tested prior to shipment.

1.04 DELIVERY, STORAGE AND HANDLING

The tanks and components shall be adequately protected during transportation, in storage at the job site, and during subsequent installation and construction activities. Damaged units including tank fracture, delamination, punctures, geometric distortion, local bucking, will be rejected and shall be replaced with new undamaged units.
PART 2 - PRODUCTS

2.01 GENERAL

Acceptable Manufacturers: The tanks shall be manufactured by an established manufacturer for fiberglass reinforced polymer vessels. The manufactured tanks shall be fabricated for compliance to the ASME design code and standards. The tanks shall be as manufactured by Daniel Company, Diamond Fiberglass, Xerxes, Belco Manufacturing Company, or Augusta Fiberglass.

2.02 MATERIALS AND EQUIPMENT

A. Basic materials shall be as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin</td>
<td>Bisphenol-A polyester or vinyl ester Resins suitable for use with the specified chemicals.</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>Glass fiber with a suitable coupling agent.</td>
</tr>
<tr>
<td>Plastic Laminate</td>
<td>In conformity with the applicable governing standards.</td>
</tr>
<tr>
<td>Minimum Corrosion Liner</td>
<td>1 “C” or synthetic veil.</td>
</tr>
<tr>
<td></td>
<td>For sodium hypochlorite, the inner surface exposed to the chemical environment shall be a resin rich layer 15 to 30 mils thick, reinforced with 2 ply of synthetic fiber surface mat.</td>
</tr>
<tr>
<td></td>
<td>Remainder 1-1/2 ounce per square foot mat to a total minimum thickness of 0.096 inches on surface exposed to the service environment.</td>
</tr>
<tr>
<td>Ultra Violet Stabilizer</td>
<td>Add to the resin used in the wax coat for exterior surfaces in the type and amount recommended by the resin manufacturer for continuous outdoor exposure.</td>
</tr>
<tr>
<td>Exposed Metal</td>
<td>ANSI Type 316 stainless steel.</td>
</tr>
<tr>
<td>Exposed Assembly and Bolts, Nuts</td>
<td>ANSI Type 316 stainless steel.</td>
</tr>
<tr>
<td>and Washers</td>
<td>Protected Metal</td>
</tr>
</tbody>
</table>

B. Performance and Design Requirements

1. Design Criteria:

Each tank shall be designed to withstand the hydrostatic head which would result with the tank and fill line surcharged with the liquid chemical to 6 inches above the top of the tank.
Fiberglass Reinforced Plastic Tanks and Accessories
Section 13216 - 5

The tanks shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Equipment Number</th>
<th>Service</th>
<th>Type</th>
<th>Qty</th>
<th>Volume (gal)</th>
<th>Diameter (ft)</th>
<th>Height (ft)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNK-6100</td>
<td>Sodium Hypochlorite (12.5%)</td>
<td>Vertical</td>
<td>2</td>
<td>5,000</td>
<td>12</td>
<td>8'-6&quot;</td>
<td>Interior</td>
</tr>
</tbody>
</table>

2. Each exterior located tank shall be designed in accordance with the applicable design standards referenced herein. Design calculations shall be provided for each tank and shall be signed and sealed by a professional engineer registered in the State of California.

Wind Loads: ASCE 7-10
Category: per local building code
Basic Wind Speed (mph): per local building code
Exposure: per local building code
Importance Factor: I=1.15

C. Fabrication and Manufacture

1. Vertical Tanks:

Vertical tanks shall be of the vertical type with flat outer bottoms for mounting on a concrete base as indicated on the drawings integrally molded to the tank.

FRP tanks for the membrane cleaning system shall be equipped with a 2-foot by 2-foot FRP hatch for access during addition of chemicals. Each tank shall be provided with a suitable overflow connection and a flanged connection.

2. Manufacture

The tanks shall be hand lay-up, spray-up, or filament wound construction in accordance with the applicable governing standard. All tank shells shall be shop fabricated in a controlled environment by the manufacturer and no vertical seams shall be allowed. The finished laminate shall be constructed using a single generic type of thermoset resin throughout and shall not contain colorants, dyes, fillers, or pigments unless otherwise specified. Ultraviolet absorber shall be added to the resin used in the fabrication of tanks indicated on the drawings or specified to be suitable for installation in exposed, exterior locations. After installation and testing, the tanks shall be coated or painted to shield the chemical contents from light.

The inner surface layer of the mixing tanks shall consist of two resin rich layers reinforced with surfacing mat and having a total combined thickness of not less than 110 mils.

Bracketed flat surfaces shall be provided on each tank for the installation of a nameplate, and a certification plate.

A Minimum of three lifting lugs shall be provided on each tank as required for handling and installation.
All finished tanks shall be factory leak tested for a duration of one hour. Any leaks detected during the testing shall be repaired by the manufacturer and the tank retested until no detectable leakage is observed.

3. Concrete Bases:

The concrete bases for the tanks shall be level and smooth to the tolerances recommended by the tank fabricator.

2.03 ACCESSORIES

A. Accessories shall be provided on each tank as indicated on the drawings and as specified herein.

1. Nozzles:

Nozzles for connecting piping and accessories shall be provided on each tank at the locations and of the sizes indicated on the drawings or specified herein.

Each nozzle shall be flanged, unless otherwise noted, with flange diameter and drilling conforming to ANSI B16.5, Class 150. Nozzles shall extend at least 4 inches from outside face of tank to face of flange.

The level gauge mounting flange shall be above the maximum liquid level recommended by the level sensor manufacturer. The length of the nozzle shall be as recommended by the level sensor manufacturer. The center line of the nozzle shall be at least 24 inches from the tank sidewall, fill nozzle, and other obstructions.

Nozzles shall be fabricated of the same material as the tank and shall be gusseted to the tank or otherwise reinforced in accordance with the governing standard.

Each tank shall be provided with the following nozzles:

<table>
<thead>
<tr>
<th>Qty./Tank</th>
<th>Connection</th>
<th>Nozzle Size (in)</th>
<th>Location on Tank (to nozzle centerline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Access Manway</td>
<td>30&quot;</td>
<td>Top (1’ from tank side shell). Location as shown in drawings</td>
</tr>
<tr>
<td>1</td>
<td>From Truck Fill</td>
<td>2</td>
<td>Top</td>
</tr>
<tr>
<td>1</td>
<td>From Chemical Feed Pump</td>
<td>2</td>
<td>Top</td>
</tr>
<tr>
<td>1</td>
<td>To Chemical Feed Pumps</td>
<td>2</td>
<td>Bottom Sidewall</td>
</tr>
<tr>
<td>1</td>
<td>Overflow</td>
<td>2</td>
<td>Top Sidewall (6” from top)</td>
</tr>
<tr>
<td>1</td>
<td>Drain</td>
<td>2</td>
<td>Bottom Sidewall</td>
</tr>
<tr>
<td>1</td>
<td>Vent</td>
<td>6</td>
<td>Top</td>
</tr>
</tbody>
</table>

2. Overflow and Drains: Each tank shall be provided with an overflow and drain line of the size recommended by the manufacturer to provide means for draining the tank and to prevent spills in the event of an overflow.

3. Vents: The tanks shall be provided with a vent as shown on the Drawings to prevent drawing a vacuum inside the tank during pumping or draining.
4. **Nameplates:** Each tank shall be provided with a nameplate to identify the use of the tank. The nameplates shall be of orange phenolic material with black engraved lettering one inch high and shall be mounted on the tank at a location acceptable to the DBE.

5. **Certification Plates:** A stainless steel certification plate shall be installed below each storage tank nameplate. The following data shall be included on the certification plate:
   - Name of tank fabricator.
   - Date of manufacture.
   - Product to be stored
   - Maximum allowable concentration, specific gravity and temperature of the specified chemical solution that can be stored safely.
   - Mechanical properties of the laminate.
   - Resin designation.
   - Equipment identification number as listed herein.

6. **Lifting Lugs:** Provide suitably attached for all tanks weighing over 100 pounds, empty weight.

7. **Anchor Bolts:** Type 316 stainless steel bolts, at least 1/2-inch in diameter, or as shown on the drawings and as specified in Division 5.

8. **Anchor Lugs:** Anchor lugs shall be provided and shall be designed to withstand all specified wind and seismic load conditions. Details of anchors shall be shown on fabrication Drawings. Anchor lugs shall be Type 316 stainless steel.

9. **Bulk Tank Access:** Each tank shall be furnished with a tank access system consisting of an OSHA compliant, tank-mounted access ladder with safety cage and handrail with a self-closing safety gate for access to the tank manway and level sensor connection at the top of the tank. The access ladder and platform shall be yellow in color and shall be fabricated from chemical and UV resistant FRP structural shapes and grating. Support brackets to accommodate the tank access system shall be fabricated on the external tank wall and shall be gusseted with sufficient strength to sustain design wind loads. Hardware for attachment shall be 316 stainless steel.

10. **Vents Fume Scrubber:** Both Sodium Hypochlorite Tanks shall be equipped with a single, shared vent scrubber comprised of a water bath tank and a submerged plenum which allows fumes to bubble through a water bath as shown on the drawings. Fume scrubber shall be sized by equipment vendor. A tank drain line and valve shall also be provided.

11. **Internal Piping**
   - **Downcomer Piping:** Provide downcomer piping for the truck fill line. Downcomer piping shall be properly supported. Downcomer piping shall be provided with a ¼” hole within 6” from the top of the tank for siphon break.
A. Inspection of all products fabricated to this Specification is required prior to shipment unless specifically waived in writing by the Engineer. This shall include:

1. Visual inspection to the requirements of ASTM C582-87 and ASTM D2563-87.
2. Barcol Hardness measurements per ASTM D2583-87.
3. Acetone sensitivity test for all internal secondary bonds.
4. Glass content by ignition loss on three cutouts per ASTM D2584.
5. Hydrostatic Leak Test:
   Perform on each tank.
   Fill to top nozzle; allow to stand for 2 hours with no visible leakage.

B. Repairs authorized by the Engineer shall be reinspected before final acceptance unless specifically waived.

C. Identify and retain all cutouts. Engineer may select certain cutouts for testing for physical properties of the laminate.

D. Factory Test Reports: Certify, by signature, results of the following:
   Inspections.
   Results of hydrostatic testing.
   Test reports of physical properties of standard laminates.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. The tanks shall be installed at the locations as indicated on the drawings. The tanks shall be installed in accordance with the fabricator's recommendations, the requirements of the applicable governing standard, and to the satisfaction of the Engineer, and made ready for the installation of piping and other appurtenances as indicated on the drawings and specified under other sections.

B. Tank foundation shall be level and even.

**3.02 INSPECTION AND TESTING**

A. After completion of installation, the tanks shall be filled with water to the top access manhole opening and allowed to stand full for a period of not less than 48 hours. During testing, flanged connections may be plugged by the installation of temporary blind flanges on the outside of the tank but shall not be blocked or plugged on the inside. All leaks or indications of leaks shall be repaired by the fabricator and made completely watertight. A leaking tank, upon repair, shall be retested to the satisfaction of the Engineer.

**3.03 START-UP AND INSTRUCTION**

A. When installation has been completed and all connections have been made, all tank surfaces, interior and exterior, shall be thoroughly cleaned as recommended by the fabricator and to
the satisfaction of the Engineer. Abrasive cleaning agents shall not be used. The tank and wetted accessories shall be completely dried before being placed into service.

B. Provide fabricator’s representative at site for installation assistance, inspection and certification of proper installation and start-up assistance for specified component, subsystem, equipment, or system.

C. Manufacturer’s Authorized Representative: Present at Work site designated by the Engineer for the minimum person-days listed below, travel time excluded.

1. Services to include but may not be limited to:

   One (1) person-day for installation assistance, inspection, and certification of installation for each type of tank.

2. Furnish assistance, inspection, and certification services at such times as requested by the Engineer.

3.04 MANUFACTURER’S CERTIFICATE(S)

The Contractor shall obtain written certification from the manufacturer, addressed to the District, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with these specifications and as indicated on the Drawings, and that the pump manufacturer accepts joint responsibility with the Contractor for coordination of all equipment, including motors, controls, and services required for proper installation and operation of the completely assembled and installed unit. The Contractor shall submit all such certificates to the Engineer, reference Appendix F Manufacturer’s Certificate of Proper Installation.

END OF SECTION
SECTION 13312.1
BOLTED STEEL TANKS FOR BACKWASH RECYCLE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section provides specific details regarding the Backwash Recycle Tank (TNK-5000) located at the Filtration System and is to be utilized in conjunction with Specification Section 13312, Bolted Steel Tanks for Water Storage. Data included herein, including specified materials, shall supersede data specified in Specification Section 13312.

B. Related Specification Sections

1. Section 11200 – Water Filtration and Equipment
2. Section 13312 – Bolted Steel Tanks for Water Storage
3. Special Conditions

PART 2 - PRODUCTS

2.01 TANK

A. The materials, design, fabrication and erection of bolted steel tanks shall be in accordance with the requirements of the latest revision of API (Std. 12B) Specification for Bolted Production Tanks and AWWA D-103 Factory-Coated Bolted Carbon Steel Tanks for Water Storage. The tank roof shall be of steel plate supported by steel beams, and column(s) of steel pipe. All gaskets shall be made from new material, approved by the Engineer, suitable for use with storage of potable water. No vents will be permitted in the tank shell or roof except as required in these detailed specifications. Testing of the tank after erection shall be done in accordance with the requirements of these specifications.

B. The tank shall be custom fabricated with diameter and height as shown on the Drawings if it does not match the Contractor’s standard size tanks. If the freeboard provided is less than the design required freeboard, the effective water impulsive masses (Wi) and Convective masses (Wc) shall be adjusted to include the confined portion of the sloshing mass as additional impulsive mass and the roof and supporting members shall be designed to contain the sloshing liquid and to resist the equivalent hydrostatic pressure for a water column equal to the design freeboard less the actual freeboard as required by AWWA D-103. The capacity of each tank shall be the rated capacity at the top of the overflow.
2.02    ACCESSORIES

A.    The gauge board shall be equipped with a level transmitter.

1.    The level transmitter will convert mechanical level measurement into electronic data utilizing absolute magnetic encoding.

2.    Accuracy: resolution of 1/32” for up to 85 feet of product.

3.    Output: 4-20Ma.


5.    Enclosure Rating: UL, NEMA 4X.

6.    Provide with 2 CAM Switches (DPDT) where indicated on the drawings.

7.    The transmitter shall be MCG 2420 by L&J Engineering or approved equal.

PART 3 - EXECUTION (NOT USED)

END OF SECTION
SECTION 15041
DISINFECTION OF PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes requirements for disinfection by chlorination of plant piping, potable and recycled water mains, services, pipe appurtenances and connections.

1.02 SCOPE

Unless specified otherwise, all piping, fittings, and appurtenances for the following service applications shall be disinfected in accordance with the requirements herein prior to being placed into operation or connected to existing piping.

A. All new or modified treatment plant, well pumping plant, or booster pumping plant piping in contact with raw water, potable water, or recycled water.

B. All new or modified piping in contact with chemicals for water treatment and/or disinfection.

C. All new pipelines, water mains, and temporary high lines shall be disinfected prior to connection to the Owner's existing system.

D. All components incorporated into a connection to the Owner's existing system shall be disinfected prior to installation.

E. All piping and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.

Contractor shall furnish all equipment, labor, and materials for the proper disinfection (chlorination and flushing) of all specified piping and appurtenances and for the proper neutralization of the test water solution. As part of the Work, Contractor shall install, at his expense, piping outlets for required disinfection and sampling.

1.03 REFERENCED STANDARDS

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

American Water Works Association (AWWA)

B300 Standard for Hypochlorites
B301 Standard for Liquid Chlorine
C651 Disinfecting Water Mains
1.04  SUBMITTALS

Contractor shall provide submittals in accordance with General Conditions, Section F - Labor and Construction. Submittal information and data shall include, but not be limited to, the following:

A. A written disinfection and dichlorination plan signed by a certified chlorinator shall be submitted to the Owner for review and approval prior to commencing disinfection or dichlorination activities. Plan shall provide details of proposed disinfection method and procedures, and shall include, but not be limited to, the following:

1. Equipment for storage of chlorine.
2. Equipment for supply and injection of chlorine solution.
3. Gauges or scales to measure the rate at which chlorine is injected.
4. Analyzer(s) for monitoring chlorine residual.
5. Drawings and/or diagrams showing piping segments to be disinfected, chlorine injection locations, sample locations for testing, source water location(s), dichlorination location(s), and water disposal location(s).
6. Detailed schedule of all disinfection activities.
7. Equipment for storage of dichlorination chemicals.
8. Equipment for supply and injection/addition of dichlorination chemicals.
9. Material Safety Data Sheets (MSDS) for proposed chlorination and dichlorination chemicals.
10. Qualifications of field personnel. Personnel performing the disinfection shall demonstrate a minimum of five years’ experience in the chlorination and dichlorination of pipelines.

B. Emergency Response Plan.

C. Qualification of certified testing laboratory.

D. Bacteriological test results to the Owner upon completion of each test.

E. Affidavit of Compliance evidencing satisfactory disinfection.

1.05  DELIVERY, STORAGE AND HANDLING

Chlorination and dichlorination shall be performed by competent individuals knowledgeable and experienced in the transport, storage, handling and use of hazardous chemicals, and operation of all related application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of these materials shall be performed in accordance with Code of Federal Regulations (CFR) 1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.
1.06 DISINFECTION AND HYDROSTATIC/LEAKAGE TESTING

Contractor may disinfect piping and appurtenances either before or after they have been subjected to hydrostatic and leakage tests. If Contractor elects to disinfect before hydrostatic and leakage tests, he shall be required to again disinfect all or portions of tested piping if repairs or replacement are found necessary after said tests. Contractor shall be completely responsible for providing adequately disinfected piping before it shall be accepted.

1.07 CONNECTION TO EXISTING PIPING

Prior to connection to existing system piping, disinfection and bacteriological testing shall be completed in accordance with this specification, and hydrostatic testing shall be completed in accordance with Pipeline Technical Specifications or Technical Provisions. A Connection Permit issued by the Owner is required authorizing connection to an existing system and shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results.

PART 2 - PRODUCTS

2.01 CHLORINE (GAS)

A. Liquid chlorine contains 100-percent available chlorine and is packaged in steel containers in net weights of 150 lb. or 1 ton.

B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled, high-concentration solution feed to the water. The chlorinators and injectors shall be the vacuum-operated type.

2.02 SODIUM HYPOCHLORITE (LIQUID)

Sodium hypochlorite is available in liquid form in plastic containers, ranging in size from 1 gal. to 5 gal. The solution concentration varies depending on the source of supply, ranging from approximately 5% to 12.5% available chlorine.

2.03 TABLET OR GRANULAR HYPOCHLORITE

Tablet or granular hypochlorite may be used if a solution container is utilized to provide a continuous feed of chlorine solution.

PART 3 - EXECUTION

3.01 GENERAL

A. Disinfection of piping shall not proceed until all appurtenances and any necessary injection or sample ports have been installed, and the Owner provides authorization.

B. During the installation of new piping or modification of existing piping, every effort shall be made to keep the piping and its appurtenances clean and dry.

C. All piping, valves, fittings, and appurtenances which become contaminated during installation shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite disinfecting solution prior to installation.
Disinfection of Piping and Appurtenances  
Section 15041 - 4

D. Piping under construction that becomes flooded by storm water, runoff, or groundwater shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire pipeline or main shall be disinfected as specified herein.

3.02 METHODS

The method of chlorination shall conform to the provisions of AWWA C651 (latest), and the requirements specified herein.

A. Chlorine (Gas)

1. Only vacuum-operated equipment shall be used. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be permitted. The equipment shall incorporate a backflow prevention device at the point of connection to the potable water source used to fill the line being tested.

2. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.

3. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. The chlorination contractor must also possess a Grade II (minimum) Treatment Plant Operator Certification from the State of California.

B. Sodium Hypochlorite Solution (Liquid)

1. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the Owner’s existing system.

2. Sodium hypochlorite solution may be used for the initial disinfection of newly installed piping. The solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be used and connected to the potable water supply.

3. Water trucks, pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.

4. Sodium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to ensure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.

3.03 PROCEDURE FOR DISINFECTING PIPING AND APPURTENANCES

A. The piping shall be filled with potable water from a source designated by the Owner at a rate not to exceed 300 gpm or a velocity of 1 foot per second, whichever is less.
B. The lines supplying potable water for chlorinating, flushing, and testing shall be protected from reverse flow by testable approved backflow prevention devices. Backflow prevention devices shall be provided by the Contractor and shall be reduced pressure principle devices as approved by the State Water Resources Control Board, Division of Drinking Water (DDW).

C. The chlorinating agent, chlorine gas or chlorine solution, shall be applied or injected as approved by the Owner at locations no more than 10 feet from the existing system, as selected by or designated by the Owner. Concentration of the dosage applied to the water within the piping shall be at least 50 mg/l and it shall not exceed 200 mg/l. This concentration shall be evenly distributed throughout the system to be disinfected, using a continuous feed method of chlorination.

D. All valves shall be operated with the disinfection solution present in the pipeline. All appurtenances such as air-vacuum relief valves, blowoffs, hydrants, backflow prevention devices, and water service laterals shall be flushed with the treated water a sufficient length of time to ensure a chlorine concentration within the specified range in all components of each appurtenance. (Note the limitations for discharge of chlorinated water in Section 3.04 below).

E. The Owner will verify the presence of the disinfection solution throughout the system by sampling and testing for acceptable chlorine concentrations at the various appurtenances and/or at the test ports provided by the Contractor. Areas of the system found to be below the specified chlorine concentration level shall receive additional flushing as noted above and/or additional disinfection solution as necessary. (Note the limitations for discharge of chlorinated water in Section 3.04 below). Addition of disinfection solution after the initial charging of the line shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method as directed by the Owner.

F. The chlorinated water shall be retained in the system for a minimum of 24 hours. The Owner will test the total chlorine residual. The system shall contain a total chlorine residual of not less than 25 mg/l at the piping system extremities and at other representative locations. If the total chlorine residual has decreased to below 25 mg/l, the system shall be flushed in accordance with the procedure detailed herein, and shall be re-disinfected.

G. Following a successful retention period as determined by the Owner, the chlorinated water shall be flushed from the system at its extremities and at each appurtenance, using potable water. If so directed by the Owner, Contractor shall remove portions of certain appurtenances such as air valve installations, blowoff installations, and service installations in order to accomplish complete flushing; Contractor shall replace same without adversely affecting disinfected piping and appurtenances.

H. During flushing, all valves shall be in the full open free discharge position. The minimum water velocity in the piping during flushing shall be 3 feet per second, or as directed by the Owner. Flushing shall continue until the replacement water in the new system is equal in chlorine residual to the potable source of supply as verified by the Owner. (Note the limitations for discharge of chlorinated water in Section 3.04 below).
Disinfection of Piping and Appurtenances
Section 15041 - 6

I. Unless specified otherwise, the Contractor shall arrange and pay for chlorine residual and bacteriological quality tests. Contractor shall obtain the Owner's prior approval of the times, places, locations, and numbers of samples and tests. The Owner will witness all sampling. Contractor shall provide an Affidavit of Compliance to the Owner evidencing satisfactory disinfection.

J. Following disinfection, piping and appurtenances shall remain isolated from any operational system facilities until evidence has been submitted to the Owner demonstrating that said piping and appurtenances have been adequately and properly disinfected. Said evidence shall consist of aforementioned Affidavit of Compliance together with bacteriological test results, as submitted by the approved certified laboratory. Normally, said piping and appurtenances shall be isolated for at least 48 hours, longer if so determined by the Owner.

3.04 DISCHARGE OF CHLORINATED WATER

A. Indiscriminate onsite disposal or discharge to sewer systems, storm drains, drainage courses or surface waters of chlorinated water is prohibited.

B. All discharge of chlorinated water shall require the neutralizing of the chlorine residual by means of a reducing agent in accordance with AWWA C651 and the requirements specified herein.

C. The reducing agent shall be applied to the water as it exits the piping system. The Contractor shall monitor the chlorine residual during the discharge operations.

D. The dichlorination shall remove residual chlorine to concentrations below standard analytical methods of detection (0.02 mg/l), which will assure compliance with the effluent limit. Contractor shall perform all necessary tests and keep records to ensure that the total residual chlorine effluent limitations listed above are met.

E. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

3.05 BACTERIOLOGICAL TESTING

Unless specified otherwise, the Contractor shall employ a State certified laboratory to perform bacteriological sampling and testing of all new system installations. The testing methodology employed by the laboratory shall be as set forth in "Standard Methods for the Examination of Water and Waste Water" (current edition). Testing requirements shall be as set forth in the California Domestic Water Quality and Monitoring Regulations and commensurate with current requirements for surface water testing. The testing laboratory shall analyze the samples for the presence of coliform bacteria and heterotrophic-type bacteria (heterotrophic plate count). The evaluation criteria employed by the Owner for a passing test sample shall be as follows:

A. Coliform bacteria: no positive sample, and

B. Heterotrophic plate count (HPC): 500 colony forming units/ml or less.
3.06 **RE-DISINFECTION**

If the initial disinfection fails to produce satisfactory bacteriological test results, the piping system shall be re-flushed, re-sampled, and re-tested. If the second set of samples does not produce satisfactory results, the piping system shall be re-chlorinated, flushed, re-sampled, and re-tested. The chlorination, flushing, sampling, and testing procedure shall continue until satisfactory results are obtained. Re-chlorination, flushing, re-sampling, and re-testing shall be at the Contractor's expense.

3.07 **DISINFECTING TIE-INS AND CONNECTIONS**

Piping, fittings, valves and all other components incorporated into connections with the Owner's existing system shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651, and as specified herein. Upon connection to the existing system, the line shall be flushed as directed by the Owner. Disinfection by this method is generally limited to assemblies of 20' or less in length. Alternate methods such as "pre-disinfection" prior to installation in accordance with AWWA C651 may be required at the discretion of the Owner.

END OF SECTION
LEAKAGE AND INFILTRATION TESTING OF NON-PRESSURE PIPELINES

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the requirements and procedures for leakage and infiltration testing of gravity drain lines.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02715 PVC Gravity Drain Pipe

1.03 TESTING

A. General: All tests shall be made in the presence of the District.

B. Leakage: Each section of drain between two successive manholes shall be tested for leakage and the leakage test shall be made on all sections of sewer.

C. Infiltration: The infiltration test shall be made where excessive groundwater is encountered.

D. Retesting: Even though a section may have previously passed the leakage or infiltration test, each section of drain shall be tested subsequent to the last backfill compacting operation if, in the opinion of the District, heavy compaction equipment or any of the operations of the contractor or others may have damaged or affected the structural integrity or watertightness of the pipe, structure, and appurtenances.

E. Other Utilities: Official District tests will not be made until after all the other utilities have been installed and their trench compaction verified.

F. Excessive Leakage or Infiltration: If the leakage or infiltration rate is greater than the amount specified, the pipe joints shall be repaired or, if necessary, the pipe shall be removed and relaid by the contractor.

G. Acceptance: The drain will not be accepted until the leakage or infiltration rate, as determined by test, is less than the maximum allowable.
PART 2 - MATERIALS

The contractor shall furnish all equipment and materials required for testing.

PART 3 - EXECUTION

3.01 AIR TEST FOR GRAVITY DRAIN

A. Test Section: Each section of drain between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs.

B. Addition of Air: Air shall be slowly added until the internal pressure is raised to 4.0 pounds per square inch gage (psig). The compressor used to add air to the pipe shall have a blowoff valve set at 5 psig to ensure that at no time the internal pressure in the pipe exceeds 5 psig.

C. Internal Pressure: The internal pressure of 4 psig shall be maintained for at least two minutes to allow the air temperature to stabilize, after which the air supply shall be disconnected, and the pressure allowed to decrease to 3.5 psig.

D. Minimum Duration for Allowable Pressure Drop: The time in minutes that is required for the internal air pressure to drop from 3.5 psig to 3.0 psig shall be measured. The results shall not be less than the minimum permissible duration per ASTM F1417 for air test pressure drop shown below:

<table>
<thead>
<tr>
<th>Pipe Size (Inches)</th>
<th>Length of Test Section</th>
<th>Time (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>100 ft</td>
<td>8:30</td>
</tr>
<tr>
<td>18</td>
<td>500 ft</td>
<td>32:00</td>
</tr>
<tr>
<td>18</td>
<td>1000 ft</td>
<td>64:00</td>
</tr>
</tbody>
</table>

E. Retest: If the pressure drops from 3.5 psig to 3.0 psig occurs in less time than the above-tabulated or calculated values, the pipe shall be overhauled and, if necessary, replaced and relaid until the joints and pipe shall hold satisfactorily under this test.

3.02 INFILTRATION TEST

A. Preparation of Test Section: The end of the drain at the upper structure shall be closed to prevent the entrance of water and pumping of groundwater shall be discontinued for at least three days, after which the section shall be tested for infiltration.
B. Allowable Infiltration Rate: The infiltration shall not exceed 0.025 gpm per inch of diameter per 1,000 feet of drain line being tested.

C. Excessive Infiltration: Where infiltration in excess of the allowable amount is discovered before completion and acceptance of the drain, the drain shall be immediately uncovered and the amount of the infiltration reduced to a quality within the specified amount of infiltration, before the drain is accepted.

D. Individual Leaks: Even if the infiltration is less than the allowable amount, any individual leaks that may be observed shall be stopped as ordered by the District.

3.03 DEFLECTION TEST

A. General: The entire length of PVC drain pipeline shall be tested for deflection, joint displacement, or other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30 days after completion of the trench backfill, but prior to permanent resurfacing. The mandrel shall be a full circle, solid cylinder, or a cylinder, approved by the District as to design and manufacture.

B. Minimum Mandrel Diameter: The circular cross section of the mandrel shall have a diameter of at least 95 percent of the specified average inside pipe diameter of the pipe, as follows:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Nominal Size Inches</th>
<th>Minimum Mandrel Diameter Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC (PS 46) ASTM F679</td>
<td>24</td>
<td>22.130</td>
</tr>
</tbody>
</table>

3.04 MANHOLE TEST

A. General: Water tightness of manholes shall be tested in connection with tests gravity drain, or at the time the manhole is completed and backfilled.

B. Plugs: All manhole inlets and outlets shall be plugged with approved stoppers or plugs.

C. Fill Level: The manhole shall be filled with water to 2-inches below the bottom of the tapered cone section, with a minimum depth of 4 feet and a maximum depth of 20 feet. The water shall stand in the manhole for a minimum of one hour to allow the manhole material to reach maximum absorption. Before the test is begun, the manhole shall be refilled to the original depth as needed.
D. Test Requirements: The drop-in water surface shall be recorded after a period of from 15 minutes to one hour. The time of the test shall be determined by the District and may be varied to fit the various field conditions. The maximum allowable drop in the water surface shall be 1/2 inch for each 15-minute period of testing.

E. Visible Leaks: Even though the leakage is less than the specified amount, the contractor shall stop any leaks that may be observed, to the satisfaction of the District.

END OF SECTION 15043
SECTION 15061.1
STEEL CYLINDER WATER PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section provides specific details regarding the steel cylinder water pipe to be used at the new Treatment Facility and is to be utilized in conjunction with Specification Section 15061, Steel Cylinder Water Pipe. Data included herein, including specified materials, shall supersede data specified in Specification Section 15061.

B. A single Pipe Manufacturer shall be responsible for furnishing all the mortar-lined and polyurethane-coated steel pipe and smaller diameter appurtenant steel pipe. Manufacture of steel pipe and specials shall be under the direction and management of one steel PIPE Manufacturer only. This does not prevent a separate supplier from manufacturing specials or fittings; however, all Work shall be the responsibility of one manufacturer of the water piping. The responsibility of the Pipe Manufacturer shall include, at a minimum:

1. Certify all pipe, fittings and specials are being manufactured in full accordance with the Contract Documents.
2. Manage the design and fabrication of the pipe and specials.
3. Prepare and submit all submittal information and shop drawings.
4. Make any corrections that may be required to the submittal information and shop drawings.

C. All steel pipe shall be coated and lined as indicated below with welded joints.

1. Interior Lining:
   a. All piping above grade shall be epoxy lined as described herein.
   b. All piping below grade shall be cement mortar lined steel pipe as described in Section 15061.

2. Exterior Coating:
   a. Above ground steel water pipe shall be coated with an epoxy primer and polyurethane top coat as described herein.
   b. Buried steel water pipe shall be cement mortar coated as described in Section 15061.
1.02 RELATED SECTIONS

A. Section 15061 – Steel Cylinder Water Pipe

1.03 SUBMITTAL REQUIREMENTS

A. Shop Drawings: Catalog cuts and other information for all products proposed. Provide copy of approved coating system submittals to the coating applicator.

B. Lining and Coating Quality Control Submittals: Furnish the following:
   1. Applicator's Experience with list of references substantiating compliance.
   2. Coating manufacturer's certification stating the applicator meets or exceeds their coating application requirements and recommendations.
   3. Coating manufacturer shall provide a copy of the manufacturer's coating application quality assurance manual.
   4. If the manufacturer of field-applied coating differs from that of the shop applied primer, provide written confirmation from both manufacturers’ that the two coating materials are compatible.
   5. SUPPLIER to submit a color pallet. OWNER will specify color.

C. Provide copies of Certified Test Reports for all coating and lining tests.

1.04 QUALITY ASSURANCE

A. Coating Applicator's Experience and Certification:
   1. Coating Application Company and coating application supervisor (Certified Applicator) shall have a minimum of 5 years experience applying the specified coating system. Coating application personnel, whom have direct coating application responsibility, shall have a minimum of 2 years practical experience in application of the indicated coating system.
   2. Coating applicator shall be certified by the coating manufacturer as an approved applicator.

B. Coating and/or lining manufacturer technical representative shall be present for a minimum of three days technical assistance and instruction at the start of coating and/or lining operations within the shop. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.

C. During the site visit, the coating manufacturer’s technical representative shall present with OWNER to observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.
D. Coating and/or lining manufacturer’s technical representative shall be onsite for three working days, minimum, at the start of each construction season to inspect coating application and procedures in the field. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.

E. Coating and/or lining manufacturer shall include 8 hours per month of shop coating technical support when requested by the Engineer.

F. Technical representative shall provide a written report to the Engineer for each visit. Report shall include copies of test data collected, description of observations, and all recommended corrective actions. Report shall be submitted within 5 working days after the visit. When deemed necessary by the Engineer, work will not be permitted to proceed until the recommended corrective actions have been implemented. After all corrective recommendations have been completed; the manufacturer representative shall return and certify that the application complies with the manufacturer’s coating application recommendations.

G. Additional visits by the manufacturer’s representative shall be made at sufficient intervals during surface preparation and coating or lining as may be required for product application quality assurance, and to determine compliance with manufacturer’s instructions, and as may be necessary to resolve problems attributable to, or associated with, manufacturer’s products furnished for this project.

1.05 ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDFT</td>
<td>Minimum Dry Film Thickness</td>
</tr>
<tr>
<td>mil</td>
<td>Thousandths of an Inch</td>
</tr>
</tbody>
</table>

1.06 DEFINITIONS

A. Manufacturer’s Representative: Employee of coating manufacturer who is factory trained and knowledgeable in all technical aspects of their products and systems. Sales representatives are not acceptable as a technical representative unless written authorization from the coating manufacturer is provided which states the sales representative has full authority to act on the behalf of the coating manufacturer.

1.07 REFERENCE STANDARDS

A. AWWA C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

B. AWWA C216 Heat-shrinkable Cross-linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

C. AWWA C217 Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
D. AWWA C222 Polyurethane Coatings for Interior and Exterior of Steel Water Pipe and Fittings
E. NACE RP-0274 High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.
F. SSPC-SP-1 Solvent Cleaning Surface Preparation
G. SSPC-SP-2 Hand Tool Cleaning Surface Preparation
H. SSPC-SP-3 Power Tool Cleaning Surface Preparation
I. SSPC-SP-5 White metal Abrasive Blast Surface Preparation
J. SSPC-SP-6 Commercial Abrasive Blast Surface Preparation
K. SSPC-SP-10 Near White Metal Abrasive Blast Surface Preparation
L. SSPC-SP-11 Power Tool Cleaning to Bare Metal

1.08 SPECIAL WARRANTY REQUIREMENTS
A. The SUPPLIER and coating applicator shall warrant to the OWNER and guarantee the work under this section against defective workmanship and materials for a period of two (2) years commencing on the date of final acceptance of the work.

1.09 OBSERVATION OF WORK
A. The SUPPLIER shall give the OWNER’s Authorized Representative a minimum of 14 days advance notice of the start of any work to allow scheduling for shop observation. Provide OWNER’s Authorized Representative a minimum 3 days’ notice for actual start of surface preparation and coating application work.
B. Provisions shall be made to allow OWNER’s Authorized Representative full access to facilities and appropriate documentation regarding coating application.
C. Observation by the OWNER’s Authorized Representative or the waiver of observation of any particular portion of the work shall not be construed to relieve the SUPPLIER of his responsibility to perform the work in accordance with these Specifications.
D. Materials shall be subject to testing for conformance with these specifications as the OWNER’s Authorized Representative may determine, prior to or during incorporation into the work.

PART 2 - MATERIALS

2.01 GENERAL
A. Exterior and interior pipe and fitting surfaces shall be prepared and coated in accordance with referenced standards, written directions of the coating or lining manufacturer’s, and these specifications, whichever is more stringent.
B. Coatings and linings will be stored, handled, and applied per manufacturer’s written directions.

C. Pipeline coating or lining shall be the product of a single manufacturer. Product substitutions during the project will not be permitted.

2.02 EXTERIOR SHOP-APPLIED COATINGS – EXPOSED PIPE

A. General.

1. Steel pipe shall be coated in accordance with AWWA C222, except as modified herein.

2. Pipe that is atmospherically exposed shall be shop primed as specified herein.

3. Buried dielectrically coated pipe and fittings passing through a structure wall or floor shall be coated for a minimum of two-inches beyond the interior wall or floor surface.

B. Plural Component Polyurethane:

1. General: Plural component, polyurethane coating system (referred to as a polyurethane system) shall be applied in accordance with AWWA C222, and as modified herein. Polyurethane coating shall have a light color to reflect sunlight and reduce thermal cycling of pipe and coating.

2. Shop Surface Preparation:

   a. Steel pipe: SSPC-SP5, White Metal blast, 3.00 mil profile, minimum, or as required by the manufacturer, whichever is greater using standardized testing procedures including Press-O-Film and micrometer.

3. Shop Applied Coating Requirements:

   a. Self-priming, plural component, 100 percent solids, non-extended polyurethane, suitable for burial or immersion.

   b. One coat, 35 mils total dry film thickness, minimum, or as required to meet the holiday and coating defects limits specified this section.

   c. Shall be one of the following products, subject to review and acceptance of submitted product performance reports:

      1) Protec II, Futura Coatings, Hazelwood, Missouri

      2) Chemthane 2265, Chemline, Inc, St. Louis, Missouri

      3) Carboline, Polyclad 777, Carboline Company, St. Louis, Missouri

      4) LifeLast Durashield 210
Acceptance of submitted product is contingent upon:

1) Submission of an independent testing report conducted within three years prior to bid opening documenting conformance to the coating performance criteria specified herein.

2) Verification that no significant change in product formulation has occurred through comparison of current product Part A and B formulation with infrared spectrometry analysis of test product for the laboratory test report.

4. Laboratory Coating Testing and Report:

a. General: Coating manufacturer shall submit to the Engineer for approval, test reports indicating conformance to the specified performance criteria using prepared samples as defined using coating materials conforming to the following general requirements:

1) Polyurethane coating material tested shall have been manufactured within 30 days of test sample preparation.

2) Coating material to have a minimum of three years prior pipeline coating application history.

3) Extended polyurethane coatings will not be acceptable.

4) Submission of incomplete reports, use of test procedures or methods other than those specified, or preparation of samples with a coating material other than those listed will result in rejection of the coating.

5) Reports shall be submitted for review and approval not less than 30 days prior to coating application along with current product data sheets and MSDS sheets for parts A and B.

6) New product formula tests shall be accompanied with Part A and B wet samples for infrared spectrometry analysis. Wet samples shall be from the lot and batch tested and shall be collected and seal by the Engineer for laboratory analysis by the Engineer.

b. Test Sample Preparation:

1) Coating manufacturer to provide 10 days advanced notification of coating sample preparation for Engineer observation, unless previous test reports are used, which have been approved within three years of bid opening.

2) Failure to fully conform to the preparation requirements will result in rejection of the submitted coating material.
3) Sample preparation completed by the coating manufacturer shall be fully documented and reported to the testing agency by the manufacturer.

4) All coating test samples shall be prepared in conformance with the following general requirements.

c. Sample Surface preparation.

1) Method: Abrasive Blast, Green Diamond or Steel Grit, SSPC-SP5, White Metal

2) Profile: 3.25 mils (±0.25 mils), Angular profile, 90 Peak Count per inch minimum, measured and recorded using surface profilometer.

d. Coating Application:

1) Method: Spray film, in accordance with manufacturer’s written shop application requirements.

2) Thickness: Greater than or equal to 30 mils with no runs.

3) Cure: Air cure only, oven or other accelerated cures will not be acceptable.

4) Form: Sheet, steel panel, or steel pipe as required for test procedure.

e. Sample Quantity: Three minimum for each test performed or as required by the ASTM Test Standard, whichever is more stringent.

f. Coating Tests:

1) Testing shall be performed by a certified independent laboratory testing agency with a minimum five years experience in the performance of ASTM test procedures on coating systems.

2) All testing shall be at room temperature, unless specifically required otherwise by the ASTM test procedure.

3) Water Absorption (ASTM D570)

   a) Criteria: 2.00 percent, maximum

   b) Method: Long-term Immersion

   c) Sample: Sheet, 1 mm maximum thickness
Steel Cylinder Water Pipe
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4) Permeance (ASTM E96).
   a) Criteria: 0.20 inch-pound
   b) Method: Water Procedure BW (App. X1)
   c) Conditions: Supported in manner to provide full circulation of air around test container for duration of test procedure.

   a) Criteria: 125 inch-pounds, minimum

6) Cathodic Disbondment (ASTM G95)
   a) Criteria: 12 mm, maximum
   b) Potential: -3.00 volts
   c) Duration: 30 days
   d) Radius: Measured from original holiday radius

7) Adhesion to Steel, Dry (ASTM D4541):
   a) Criteria: 3,000 psi, minimum
   b) Equipment: Delfesko Positest
   c) Dollies: 20 mm, maximum, scored to metal substrate

8) Abrasion (ASTM D4060).
   a) Criteria: 85 mg loss, maximum
   b) Conditions: CS-17 wheel, 1,000 grams weight, 1,000 revolutions

9) Tensile Strength (ASTM D412).
   a) Criteria: 4,000 psi, minimum

    a) Criteria: 70, Shore D, minimum

11) Flexibility (ASTM D522).
    a) Criteria: Pass (no cracking)
    b) Mandrel Diameter: 3 inch, 180 degrees
g. Reporting

1) The coating applicator shall submit daily inspection reports within one week of inspection date to the OWNER and CM. As required by the ASTM test method, and the following additional information:
   a) Sample panel preparation date and identification
   b) Surface preparation method and abrasive
   c) Surface Preparation profile and peak count
   d) Coating lot and date of manufacture
   e) Application spray gun and equipment used

2) Application temperatures of coating materials and material temperature at the gun, ambient temperature, and panel surface temperature

3) Include all periodic test data and/or observations for all tested samples and show all multiple measurements in both table and graph.

4) Show all calculations as required by the ASTM test method.

5) Include digital photographic documentation of all visual assessments, test apparatus, and final panel condition using 4 mega pixels minimum resolution.

6) Submit reports in both PDF and color printed format with photographs in JEPG format on CD.

2.03 SPECIALS, FITTINGS, AND CONNECTIONS

A. Coating and lining application for special sections, connections, and fittings for steel pipe shall conform to coating system and application requirements as specified in this section.

B. Specials, fittings, and connections shall be defined as any pipe section with turnouts for blowoffs, interconnects, any valve, or other appurtenances; tees; crosses; wyes; laterals; manholes; mitered angles or elbows; and pipes which require special fabrication that prevents mechanical production application of the specified coating system from end to end of pipe joint.

C. In addition to the items listed as specials, the following items shall also be considered as specials:

1. Pipe joints with pass through holes.
Steel Cylinder Water Pipe
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D. Specials, fittings, and connections shall be externally coated with polyurethane coating system applied from end to end of pipe joint on all specials, fittings, and connections.

2.04 MATERIALS FOR REPAIR OF COATINGS AND LININGS

A. General.

1. Coating or lining repair materials shall be compatible with the shop-applied coating or lining system and shall be approved by the coating or lining manufacturer.

2. Minor coating repairs for polyurethane coated pipe shall be as specified herein.

B. Polyurethane Coating Factory Repairs.

1. Polyurethane coating system repair shall be in accordance with the coating manufacturer’s recommended procedures.

2. Coating material for minor repairs shall be single use kits or other mix ratio controlled packages of slow set polyurethane coating material similar to the existing coating.

3. Major repairs will be completed using the coating material specified for the coating or the lining. Coating shall be reapplied using plural component spray equipment by a manufacturer certified coating applicator.

2.05 MATERIALS FOR STEEL PIPE LOCATED ABOVE GRADE

A. Liquid Applied Epoxy Coating:

1. Epoxy coatings shall be NSF approved coatings suitable for potable water contact in accordance with ANSI/NSF Standards 60 and 61.

2. Provide epoxy lining in accordance with AWWA C210 (Liquid Epoxy Coating Systems of the Interior and Exterior of Steel Water Pipelines). Interior epoxy lining shall be applied and inspected prior to installation of the pipe. Epoxy lining shall be Tnemec 140 Pota Pox. Lining system shall be NSF 61 approved. Total interior lining system shall be a minimum of 14 mils DFT.

PART 3 - EXECUTION

3.01 ENVIRONMENTAL LIMITATIONS – COATINGS AND LININGS

A. General.

1. Products shall comply with federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposure.
2. Comply with applicable federal, state, and local, air pollution and environmental control regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, and coating application.

3. Do not perform abrasive blast cleaning whenever the relative humidity exceeds 85 percent, whenever surface temperature is less than 5 degrees above the dew point of the ambient air.

4. Do not apply coatings when:
   a. Surface and ambient temperatures exceeds the maximum or minimum temperatures recommended by the coating manufacturer as written in published product literature.
   b. The surface temperature exceeds 10 degrees F below the maximum temperature recommended by the coating manufacturer as written in published product literature during application and curing.
   c. In dust or smoke-laden atmosphere, blowing dust or debris, damp or humid weather, or under conditions that could cause icing on the metal surface.
   d. For epoxy coatings or linings when it expected that surface temperatures would drop below 5 degrees above dew point within 4 hours after application of coating.
   e. Whenever relative humidity exceeds 85 percent for polyurethane coating application.

5. Where weather conditions or project requirements dictate, SUPPLIER shall provide and operate heaters and/or dehumidification equipment to allow pipe surfaces to be abrasive blasted and coated as specified and in accordance with the manufacturers coating application recommendations.

6. Work activities can be restricted by the Engineer until adequate temperature and humidity controls are in place and functioning within the environmental limits specified.

7. Coating applicator shall provide a monitoring system approved by the coating manufacturer that constantly records pipe and coating conditions during coating application. Recorded monitoring parameters shall include pipe temperature, line speed, surface preparation, holiday test and other parameters applicable to the type of coating.

B. Temperature Control.

1. In cold weather or if moisture collects on the pipe, preheat pipe to a temperature between 45 and 90 degrees and 5 degrees above dew point, whichever is greater.
2. When temperatures are above or below the coating manufacturers recommended application temperatures, the SUPPLIER will provide temperature controls as necessary to permit work to precede within the manufacturer’s temperature limitations.

3. Provide tenting, insulating blankets, baffles, or bulkheads as required to zone and control heating or cooling effectiveness.

4. Heating shall be with indirect fired heaters that do not increase humidity levels within the work area. Heaters shall be sized for the area to be heated.

C. Dehumidification.

1. SUPPLIER shall provide dehumidification equipment when necessary for shop or field environmental control during surface preparation and/or coating application. Dehumidification equipment shall be properly sized to maintain dew point temperature 5 degrees or more below surface temperature of metal surfaces to be cleaned and coated.

2. Cleaned metal surfaces shall be prevented from flash rusting throughout the project duration, condensation or icing shall be prevented throughout surface preparation and coating application.

3. Equipment size and power requirements shall be designed by personnel trained in the operation and setup of dehumidification equipment based on project requirements and anticipated weather conditions.

4. Dehumidification equipment shall operate 24 hours per day and continuously throughout surface preparation and coating application.

5. SUPPLIER to provide personnel properly trained in the operation and maintenance of the dehumidification equipment or provided training by the dehumidification equipment supplier.

6. Daily maintenance requirements of the equipment shall be documented in writing and posted near the equipment for review by the Engineer.

7. Reblasting of flash rusted metal surfaces or removal of damaged coatings, because of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the SUPPLIER.

3.02 SURFACE PREPARATION – POLYURETHANE COATING AND EPOXY LINING

A. General.

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of coating manufacturer whose product is to be applied.

2. Visible oil, grease, dirt, and contamination shall be removed in accordance with SSPC-SP1, solvent cleaning.
3. Surface imperfections such as metal slivers, burrs, weld splatter, gouges, or delaminations in the metal shall be removed by filing or grinding prior to abrasive surface preparation.

4. Protect prepared pipe from humidity, moisture, and rain. All flash rust, imperfections, or contamination on cleaned pipe surface shall be removed by reblasting.

5. Priming and coating of pipe shall be completed the same day as surface preparation.

B. Weld Surface Preparation.

1. Requirements: Spray applied coating systems do not require weld grinding.

C. Steel Surface Preparation.

1. Surface preparation of steel pipe shall be in accordance with SSPC surface preparation standards utilizing the degree of cleanliness specified in Section 2.02.B.2.a.

2. Grit and/or shot abrasive mixture and gradation shall be as required to achieve the degree of cleanliness and coating adhesion specified.

3. Pipe cleaned by abrasive blasting with recyclable steel grit and/or shot or other abrasive shall be cleaned of debris and spent abrasive in an air wash separator.

4. Polyurethane coating system shall have a sharp angular surface profile of the minimum depth specified.

5. Work shall be performed in a manner that does not permit the cleaned metal surface to rust back or flash rust.

6. Rust back or flash rust shall be fully removed with the steel surface cleanliness equal to the metal surface cleanliness prior to rust back or flash rusting. Determination of the equivalent surface cleanliness shall be at the Engineer’s sole discretion.

3.03 SHOP – APPLIED COATING SYSTEMS

A. Polyurethane Coating or Lining.

1. Applicator Qualifications:

   a. Equipment will be certified by the coating manufacturer to meet the requirements for material mixing, temperature control, application rate, and ratio control for multi-part coatings.
b. Equipment not meeting the written requirements of the coating manufacturer shall be rejected for coating application until repairs or replacement of the equipment is made to the satisfaction of the Engineer.

c. Personnel responsible for the application of the coating system shall have certification of attendance at the coating manufacturer’s training class within the last three years. The certified applicator shall be present during all coating application work and shall have responsibility for controlling all aspects of the coating application.

2. Pipe surface temperature shall be within temperature and dew point recommended in manufacturer’s product literature and as specified in this Section

3. Coating application shall be performed in an environmentally controlled shop area that meets or exceeds the written environmental application requirements of the coating manufacturer. Application in outdoor conditions will not be acceptable without adequate environmental shelter, environmental controls, and/or dehumidification.

4. Coating adhesion and holidays testing shall be tested as specified in this Section.

5. Coating manufacturer shall provide to the Engineer a copy of the manufacturer’s coating application quality assurance manual prior to beginning coating application. Strict conformance to the requirements of the manual will be required. Deviation from the requirements of the manual will be grounds for the Engineer to reject the applied coating.

6. Unacceptable Coating Application:

   a. Coating applied under improper environmental conditions will be rejected.

   b. Pipes that exceed the allowable quantity of coating defects, regardless of size or cause, shall be rejected.

   c. Coating which fails the adhesion or holiday testing as specified this section shall be rejected.

   d. Pipe coating that is subject to off ratio application, blistering, or is not applied in conformance with the coating manufacturer’s written instructions or recommendations shall be rejected.

7. Rejected coating shall be removed from the full length of the pipe to bare metal and reapplied using proper application methods in accordance with the quality assurance manual and the requirements of these specifications.

8. Perform coating and lining repairs as specified in this section.

3.04 EXTERIOR COATING HOLDBACK

   A. Coating holdbacks shall be straight and cut through the full thickness of the coating.
B. Cutbacks shall be completed in a manner that permits field coating of joints in accordance with the manufacturer’s recommendations and as specified herein.

C. Holdbacks shall be as required for proper jointing of pipe, considering joint welding requirements, and be as follows:

<table>
<thead>
<tr>
<th>Polyurethane coating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-on joint, spigot</td>
<td>1 inch before centerline gasket</td>
</tr>
<tr>
<td>Push-on, bell</td>
<td>Flush with bell end</td>
</tr>
<tr>
<td>Welded, spigot</td>
<td>3 inches, minimum</td>
</tr>
<tr>
<td>Welded, Bell</td>
<td>4-inches, minimum</td>
</tr>
</tbody>
</table>

D. Holdback Corrosion Protection:

1. Holding primer for corrosion protection of cutbacks or holdbacks shall be compatible with the specified joint coating system and weld after backfill requirements, when applicable.

2. Approved holdback primers are:
   a. Tnemec Omnithane – Suitable for all joints, except joints subject to weld after backfill
   b. Tnemec 90E-92 Ethyl Silicate Inorganic Zinc Primer – suitable for all joints, including weld after backfill joints.
   c. ICI Devoe Cathacoat 304V Ethyl Silicate Inorganic Zinc Primer – suitable for all joints including weld after backfill joints.
   d. Polyken or other tape primers are not allowed

3. Primer shall not result in running or melting of the coating or cause toxic fumes when heated during weld after backfill operations.

4. Application and thickness of holding primer shall be in accordance with the coating manufacturer’s recommendations, but shall not impair the clearances required for proper joint installation.

5. Primer application on spigot end of field welded pipe shall be held back 1 to 2 inches from the end of the spigot or as necessary to prevent toxic fumes during field welding.

6. Any corrosion within the holdback areas shall be abrasively blasted to near white metal in accordance with SP10 or power tool cleaned to bare metal in accordance with SP11 prior to applying joint coating.
3.05 REPAIR OF COATINGS AND LININGS – POLYURETHANE COATING AND EPOXY LINING

A. General:

1. All areas where holidays are detected or coating is visually damaged, such as blisters, tears, rips, bubbles, wrinkles, cuts, or other defects shall be repaired. Areas where no holidays are detected, but are visually damaged shall also be repaired.

2. Maximum defects allowable shall be as specified herein for the coating system.

B. Polyurethane Coating or Lining Repairs.

1. General.

a. Complete coating or lining repairs on any piece of pipe length shall be in accordance with the coating manufacturers written instructions and these specifications, whichever is stricter.

b. Defect Size:

1) Minor repairs - repairs that are less than 6-inches in the greatest dimension.

2) Major repairs - repairs that exceed 6-inches in the greatest dimension.

c. Pipes exceeding the maximum number or size of coating defects shall be stripped of coating, reblasted, and recoated.

d. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the SUPPLIER’s expense.

2. Minor Repairs:

a. Coating or lining repairs on any joint of pipe shall not exceed 1.5 per 100 square feet of surface area.

b. Two or more minor repairs within 6-inches diameter circle will be considered a single repair.

c. Repairs for adhesion testing will not be included in the total number of repairs.

d. Minor repairs:

1) Surface Preparation: Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coat and feather the edges of the defect for a minimum of 2 inches around the defect.
2) Shop repair Materials:
   a) Slow setting parent material polyurethane coating material in syringes or other single use packaging that controls mix ratio.
   b) Coating Manufacturer’s polyurethane coating repair products subject to Engineer approval.

3) Apply a single coat of the specified patch coating material at the specified coating thickness.

4) Repairs adhesion shall be 50 percent of the specified coating adhesion.

3. Major Repairs:
   a. Major repairs shall not exceed two per pipe joint and the combined area shall not be greater than 50 percent of the pipe.
   b. Major repairs:
      1) Surface Preparation:
         a) The metal surface and surrounding coating shall be abrasively blasted in accordance with SSPC-SP5, White Metal Blast, or to equal in cleanliness and profile as the original surface preparation.
         b) Existing coating shall be feathered and roughened to the equivalent of 40 grit sandpaper.
      2) Shop Repair Materials:
         a) Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.
         c. One coat of the specified original coating material shall be applied over the repaired surface at the specified thickness.
         d. Repair adhesion shall be equal to the specified coating adhesion.

3.06 INSPECTION AND TESTING – POLYURETHANE COATING AND EPOXY LINING

A. General.
   1. Applicator shall inspect and test the coating system in accordance with referenced standards and these specifications, whichever is more stringent as determined by the ENGINEER and OWNER.
The frequency of the testing shall be determined by the applicator, but shall not be less than the requirements of this specification.

2. OWNER or OWNER’s Authorized Representative will conduct random independent inspections and tests for the final acceptance or rejection of pipe coating or lining at any time.

B. Adhesion Testing.

1. General.

a. Adhesion testing shall be conducted at the shop prior to shipment. Pipe shipped without adhesion testing will be field-tested. Pipe rejected in the field will be returned to the shop for repair at the sole expense of the SUPPLIER.

b. A minimum of two pipes will be tested for adhesion from each lot of pipe coated up to 3,000 square feet of pipe. An additional adhesion test will be conducted on every increment up to 2,000 square feet of pipe coated in excess of the first 3,000 square feet of pipe. (i.e. if one workday of production is 6,000 square feet of pipe, four adhesion tests will be conducted on the pipe lot.)

c. A pipe lot is defined as the quantity of pipe that is coated by a single crew within a work shift, but not to exceed 12-hours.

d. The pipe coating applicator shall repair all coating damage from shop adhesion testing. SUPPLIER shall be responsible for coating repairs for all field adhesion testing.

e. Adhesion tests will be performed not less than 24 hours after coating application. Tests conducted prior to 24-hours will be acceptable only if the test meets or exceeds the adhesion criteria specified and the test was requested by the pipe fabricator.

f. Pipe will be randomly selected for adhesion testing.

g. OWNER or the OWNER’s Authorized Representative has the right to conduct additional adhesion testing as deemed necessary to assure the pipe meets or exceeds the requirements of this specification at any time and location prior to pipe installation.

2. Rejection of Coating.

a. If any pipe within a lot fails to meet the test criteria specified for the coating type, that pipe shall be rejected along with all other pes within the lot. Each pipe within the rejected pipe lot will then be individually tested and rejected on a pipe-by-pipe basis in conformance with the test procedures and criteria specific for the coating type.
b. All rejected pipe shall have all coating removed from the full length pipe and the pipe abrasive blasted and recoated.

   a. Acceptance Criteria.
      1) Acceptance will be based on one pull minimum, with no pulls less than the minimum 1,750 pound criteria where multiple accepted pulls are conducted on the same joint of pipe.
      2) The average value for all coating or lining adhesion pulls performed within a lot of pipe shall not be less than 2,000 psi.
      3) Adhesion testing shall be conducted on two sufficiently cured, coated sections of pipe from each shift selected at random with one from the beginning shift and one from halfway through the shift. Adhesion testing shall be conducted in accordance with ASTM D4541. The coating around the dolly shall be scored completely through to the steel substrate. If the adhesion is not satisfactory, two additional tests shall be made at two different locations on the same pipe. If either additional test fails, the pipe shall be rejected. If the pipe is rejected, a systematic inspection of all pipe coated on that shift shall be made, and all pipe not meeting this adhesion requirement shall be rejected. Damaged test areas of accepted pipe and areas determined to have unsatisfactory adhesion shall be repaired as outlined in this specification.
      4) Each pipe in a lot shall be tested if the initial average value for the first two pipe spools is below the minimum requirement. Pipe lots that do not meet the average value for all adhesion pulls shall be rejected. Each pipe that fails the minimum adhesion criteria shall be rejected as determined above.
      5) Failure shall be by adhesive and cohesive failure only. Adhesive failure is defined as separation of the coating from the steel substrate. Cohesive failure is defined as failure within the coating, resulting in coating remaining both on the steel substrate and dolly.
   b. Test Procedures.
      1) Polyurethane coating adhesion to steel substrates shall be tested using self-aligning pneumatic pull off equipment, such as the Delfesko Positester, and test procedures in accordance with ASTM D4541 and AWWA C222, except as modified in this section.
2) All adhesion test pull records shall be maintained in an electronic spreadsheet that includes pipe identification, pipe coating date, adhesion test date, surface tested (interior or exterior), surface temperature, coating thickness, tensile force applied, rate of pressure change per second, mode of failure, and percentage of substrate failure relative of dolly surface.

3) Dollies for adhesion testing shall be 20 millimeters in diameter, and glued to the coating surface and allowed to cure for a minimum of 12 hours before testing.

4) Polyurethane coatings shall be scored around the dolly prior to conducting the adhesion test. Scoring shall be completed manually, normal to the pipe surface, or in a manner that does not stress or over heat the coating.

5) Adhesion testing shall be performed at temperatures between 55 and 100 degrees F. Tests may be performed at temperatures up to 115 degrees F if no significant affect in the test results are statistically detectable.

6) Partial substrate and glue failures will be retested if the substrate failure is less than 50 percent relative of the dolly surface area and the applied tension was less than the specified adhesion. Pipes that have partial substrate failures greater than 50 percent and less than the specified adhesion will be rejected as a substrate adhesion failure.

7) Glue failures in excess of the minimum required tensile adhesion would be accepted as meeting the specified adhesion requirements.

8) Adhesion tests will be conducted on polyurethane pipe coating and lining independently and will be accepted or rejected independently of the other.

C. Holiday Testing.

1. Holiday tests on polyurethane coatings linings will be conducted on the completed coating after cure or 24-hours, whichever is less, using a high voltage spark test in accordance with NACE Standard RP-0274 and these specifications. In addition, the pipe shall be holiday tested by the SUPPLIER just before the pipe is laid in the trench.

2. Coating thickness used for holiday testing shall be the minimum specified coating thickness.
D. Dry Film Thickness Testing.

1. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off or eddy current equipment.

2. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this specification.
SECTION 15100
CHEMICAL PROCESS VALVES

PART 1 - GENERAL

1.01 DESCRIPTION
A. This section provides specific details regarding the chemical ball and plug valves to be used at the new Treatment Facility.

1.02 RELATED SECTIONS
A. Section 15104 – Ball Valves

1.03 SUBMITTAL REQUIREMENT
A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval. In addition, valve manufacturer shall certify in writing that valve design and materials of construction are suitable for the intended service.

PART 2 - PRODUCTS

2.01 GENERAL
A. Valves shall include operator, actuator, and accessories as required for a complete and operable installation.
B. All valves and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.
C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
D. Unless specified otherwise, all hardware on the valve and actuator including bolts, washers, and nuts shall be Hastelloy C-276 hardware.

2.02 MATERIALS AND EQUIPMENT
A. BV1:
   1. Valve: Ball valves shall be manufactured of Grade I, Type I, PVC with Teflon seats. Seals shall be EPDM. Valve shall be provided with double unions and ball blocking feature. Valves will be factory equipped with 1/8-inch vent hole specifically for sodium hypochlorite applications.
   2. Operator: Handle.
Chemical Process Valves
Section 15100 - 2

3. Pressure: 150 psi @ 73°F.


5. Asahi/America Type 21 Ball Valve, Chemtrol Division, NIBCO Inc.

B. DV1:

1. Valve: Suitable for use with sodium hypochlorite up to 15% concentration shall be of solid thermoplastic construction (PVC or CPVC) for body and bonnet with molded flanged ends. The valves shall come standard with a position indicator, travel stop (to prevent overtightening) and bonnet O-ring sealing arrangement. The valve shall be weir type with a square bonnet body sealing design and bayonet connection diaphragm (1/2” - 2”) or round bonnet body sealing design and threaded stud diaphragm connection (2-1/2” - 6”). All PTFE diaphragms shall be supplied with a PVDF gas barrier between the layers of EPDM and PTFE. The PVDF gas barrier prevents against the migration of gas through the PTFE membrane and attacking the EPDM backing cushion. The face-to-face dimensions shall conform to Type G. PVC conforming to ASTM D1784 Cell Classification 12454A, CPVC conforming to ASTM D1784 Cell Classification 23567A and PVDF conforming to ASTM D3222 Cell Classification Type II. Valves shall be rated to 150psi for PTFE diaphragms at 70º F.

2. Operator: Motorized

3. Pressure: 100 psi @ 73° F.


5. Asahi/America Type 14 or approved equal

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the City before they are installed.

B. After installation, all valves and appurtenances shall be tested at least 2 hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the District.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the
proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.

E. All exposed bolts shall be painted the same color as the pipe.

F. Valve Orientation:

1. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet inches or less above finished floor, unless otherwise shown.

2. Install operating stem horizontal in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above finish floor, unless otherwise shown.

3. If no plug valve seat position is shown, locate as follows:
   a. Horizontal Flow: The flow shall produce an "unseating" pressure, and the plug shall open into the top half of valve.
   b. Vertical Flow: Install seat in the highest portion of the valve.

G. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

3.02 INSPECTION AND TESTING

A. Completed pipe shall be subjected to hydrostatic pressure test for 4 hours at full working pressure. All leaks shall be repaired and lines retested as approved by the District. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. This section provides specific details regarding the butterfly valves to be used at the new Treatment Facility and is to be utilized in conjunction with Specification Section 15103, Butterfly Valves. Data included herein, including specified materials, shall supersede data specified in Specification Section 15103.

1.02 RELATED SECTIONS

A. Section 15103 – Check Valves

1.03 SUBMITTAL REQUIREMENTS

A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval. In addition, valve manufacturer shall certify in writing that valve design and materials of construction are suitable for the intended service.

B. Quality Control Submittals:

1. Certificate of Compliance for:
   a. AWWA service butterfly valves; full compliance with AWWA C504.
2. Tests and inspection data.
3. Manufacturer's Certificate of Proper Installation.

PART 2 - MATERIALS

2.01 GENERAL

A. Valves shall include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories as required for a complete and operable installation.

B. All valves and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
D. Unless specified otherwise, all hardware on the valve and actuator including bolts, washers, and nuts shall be at a minimum Type 304 stainless steel for valves with ferrous body materials and Type 316 stainless steel for valves with stainless steel or thermoplastic body materials, except for acid service valves which shall be provided with Hastelloy C-276 hardware.

E. Factory Finishing:

1. Epoxy Lining and Coating:
   a. NSF approved and in accordance with AWWA C550 unless otherwise specified.
   b. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
   c. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2. Exposed Valves:
   a. Safety isolation valves and lockout valves with handles, handwheels, or chain wheels "safety yellow."

3. Stainless Steel Valves: Pickling & Passivation shall be provided for all stainless steel valves to provide a bright, uniform finish of the valve body interior and exterior surfaces, including the valve trim, and hardware.

2.02 MATERIALS AND EQUIPMENT

A. General:

1. Butterfly valves shall meet or exceed the design standards of AWWA C504-150B, unless otherwise noted.

2. Valves shall be bubble tight in either direction at the rated pressure and shall be suitable for throttling and/or operation after long periods of inactivity.

B. BFV1:

1. Valve: Butterfly valve shall be lugged style, ductile iron body with a solid 316 stainless steel shaft. Disc shall be 316 stainless steel with an EPDM resilient seat. Seals shall be EPDM or PTFE.

2. Operator: Per Valve Schedule.


5. Bray Controls Series 31, Pentair Series GR or approved equal.
C. BFV2:

1. Valve: Butterfly valve shall be flanged style, cast or ductile iron fully rubber lined body ASTM A126. Disc shall be ductile iron ASTM A536 Grade 65-42-132 with 316 stainless steel disc edge, and EPDM seat. Seals shall be EPDM or PTFE.

2. Operator: Per Valve Schedule.

3. Pressure: 150 psi

4. Service: Blending Station, Tank-5000 (Above Ground)

5. DeZurik AWWA or Pratt TRITON XR-70.

D. BFV3:

1. Valve: High Performance Butterfly valve shall be lugged style, capable of bi-directional, drop tight service to rated pressure, conforming to the design standards of ANSI B16.5 flange mating. The valve body shall be constructed of 316 Stainless Steel, ASTM A351, Grade CF8M. Resilient seat shall be PTFE, retained in the body and be replaceable without removing the disc or stem. The disc shall be constructed of 316 Stainless Steel, ASTM A351, Grade CF8M and shall be offset to provide uninterrupted 360° seating. Valve shafts shall be 17-4 stainless steel. At the operator end of the valve shaft, a packing gland utilizing “V” type chevron packing shall be utilized.

2. The valve shall be controlled electrically. Actuation shall be according to Specification 15121. Manual overrides shall be provided through the use of a handwheel operator.

3. Control valves shall be capable of controlling the flow at the specified minimum and maximum flow conditions and within the acceptable operating range as indicated in the Drawings.

4. Testing: Valves shall be tested in accordance with ANSI B16.104 Class V.

5. Service: Modulating Flow Control Valves.

6. All HP BFV valves shall be as manufactured by DeZURIK, Pratt, or an approved equal.
SECTION 15105
V-PORT BALL VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work: Furnish and install process control valves of the type(s) and size(s) and in the location(s) as shown on the Drawings and/or specified herein.

B. Related Sections:
   1. Division 15: Mechanical.
   2. Refer to Divisions 16 and 17 of the specifications for additional requirements.

1.02 QUALITY ASSURANCE

A. Scope: The blending station includes a v-port ball valve with motor operator for flow control of bypass and blending.

1.03 SUBMITTALS

A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval. In addition, valve manufacturer shall certify in writing that valve design and materials of construction are suitable for the intended service.

B. Quality Control Submittals:
   1. Certificate of Compliance for:
      a. Electric operators; full compliance with AWWA C540.
      b. All wetted components; full compliance with NSF 61.
   2. Tests and inspection data.
   3. Manufacturer's Certificate of Proper Installation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site as specified in the Specific provisions.
C. Finished surfaces of all exposed valve openings shall be protected.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

**1.05 MAINTENANCE**

A. Special Tools: Deliver 1 set of any special tools needed to assemble and disassemble the metering pump.

B. Extra Materials: Spare parts shall include a complete set of ball check valves (balls, seats and gaskets), peristaltic hoses, and a diaphragm for each pump.

**1.06 SPARE PARTS**

A. Provide one (1) set of valve packing for every five valves supplied. No less than one (1) set of packing shall be provided for each type and model of valve supplied.

B. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

A. Valve to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories for a complete operation.

B. All valves and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. All bolts, washers and nuts shall be Type 316 stainless steel, unless specified otherwise.

E. Factory Finishing:

   1. Epoxy Lining and Coating:
      
      a. In accordance with AWWA C550 unless otherwise specified.

      b. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.

      c. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

   F. Exposed Valves:

      1. In accordance with Section 09900: Painting.
2. Safety isolation valves and lockout valves with handles, handwheels, or chain wheels "safety yellow."

2.02 MATERIAL AND EQUIPMENT

A. Approved Materials

1. All materials that come into contact with the water being treated or the finished water shall be NSF 61 certified for the materials used in products that come into contact with the water, in accordance with Title 22, Section 64591 of the California Code of Regulations.

2. Brass and bronze valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

3. Approved alloys are of the following ASTM designations:

   a. B61, B62, B98 (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.

   b. Stainless steel Alloy 18-8 may be substituted for bronze.

B. V-Port Ball Valves

1. Valve: Accuracy for valve, actuator and positioner assembly shall be 0.5% or better with a resolution of 200 or more discrete positions over 90° range of operation.

2. Each valve, actuator and positioner shall be assembled, adjusted, and tested as a unit by the valve manufacturer. Shafts shall be blowout proof and constructed of 2205 duplex stainless steel (ASTM A276).

3. Shaft to Ball connection shall be splined and have a torque screw to eliminate backlash (deadband).

4. V-Port ball design shall be optimized to meet or exceed 200:1 rangability.

5. Back of ball must be streamlined to transition flow and minimize erosion. Hollow ball designs shall not be allowed. Seat to ball interface shall be self-aligning and controlled without the use of shims or threaded components.

6. Valve Seats shall be interchangeable in the same body. Flexible Metal seat used for fibrous media provides shut-off to ANSI/FCI 70-2 Class IV.

7. Bearings shall be 317 stainless steel wire mesh reinforced PTFE or solid metal with optional seal.

8. Packing shall be multiple v-ring PTFE or braided carbon graphite including anti-extrusion ring, shall permit inspection, adjustment or complete replacement of packing without disturbing any part of the valve or actuator assembly except the packing follower.
9. Bodies shall be constructed of 317 stainless steel (ASTM A351). The valve body shall be flanged class 150, ANSI/ISA-75.08.02.

10. The valve shall be controlled electrically. Actuation shall be according to Specification 15121. Manual overrides shall be provided through the use of a handwheel operator.

11. Control valves shall be capable of controlling the flow at the specified minimum and maximum flow conditions and within the acceptable operating range as indicated in Table 15105-A herein.

12. Acceptable Manufacturer:
   a. DeZURIK VPB
   b. Flow-Tek Advanced V-Control Ball Valve,
   c. or an approved equal.

13. Testing: All valves shall be hydrostatic and leak tested in accordance with AWWA C-504.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Install in accordance with manufacturer's recommendations.

3.02 START-UP AND INSTRUCTION
   A. Manufacturer's Representative: Present at site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:

   1. One (1) person-day per completion phase for installation assistance and inspection. No less than a total of three (3) person-days of installation assistance.

   2. One (1) person-day per completion phase for functional and performance testing and completion of Manufacturer's Certificate or Proper Installation and pre-startup classroom or site training. No less than a total of three (3) person-days of functional and performance testing.
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<thead>
<tr>
<th>Item/Design Conditions</th>
<th>RO Concentrate Control</th>
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<tbody>
<tr>
<td>Valve Type:</td>
<td>V-Port</td>
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<tr>
<td>Valve Size:</td>
<td>16 inch</td>
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<tr>
<td>Design Pressure Drop:</td>
<td>8 - 20 psi</td>
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<tr>
<td>End Connections:</td>
<td>150# FLG</td>
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<tr>
<td>Water Rate of Flow, Min/Max:</td>
<td>1,400 - 7,900 gpm</td>
</tr>
<tr>
<td>Maximum Allowable Noise Level:</td>
<td>90 dBa</td>
</tr>
<tr>
<td>Acceptable Control Range, % Open, Min/Max:</td>
<td>20%/80%</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 15111.1
CHECK VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section provides specific details regarding the check valves to be used at the new Treatment Facility and is to be utilized in conjunction with Specification Section 15111, Check Valves. Data included herein, including specified materials, shall supersede data specified in Specification Section 15111.

1.02 RELATED SECTIONS

A. Section 15111 – Check Valves

1.03 SUBMITTAL REQUIREMENTS

A. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval. In addition, valve manufacturer shall certify in writing that valve design and materials of construction are suitable for the intended service.

PART 2 - MATERIALS

2.01 GENERAL

A. Valves shall include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories as required for a complete and operable installation.

B. All valves and appurtenances shall be of the size shown on the Drawings and all equipment of the same type shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. Unless specified otherwise, all hardware on the valve and actuator including bolts, washers, and nuts shall be at a minimum Type 304 stainless steel for valves with ferrous body materials and Type 316 stainless steel for valves with stainless steel or thermoplastic body materials, except for acid service valves which shall be provided with Hastelloy C-276 hardware.

E. Factory Finishing:

1. Epoxy Lining and Coating:
Check Valves  
Section 15111.1 - 2

a. NSF approved and in accordance with AWWA C550 unless otherwise specified.

b. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as "fusion" or "fusion bonded" epoxy.

c. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2. Exposed Valves:
   a. Safety isolation valves and lockout valves with handles, handwheels, or chain wheels "safety yellow."

3. Stainless Steel Valves: Pickling & Passivation shall be provided for all stainless steel valves to provide a bright, uniform finish of the valve body interior and exterior surfaces, including the valve trim, and hardware.

2.02 MATERIALS AND EQUIPMENT

A. CV1:
   1. Swing Check Valve as defined in Section 15111.

B. CV2:
   1. Valve: Check valves shall be the globe style silent check valve equipped with 125# ANSI Flat Face Flanges. Silent check valves shall be equipped with a spring mechanism to provide for non-slam closure of the valve without backflow, in any position, and shall not be dependent on gravity or backflow for closure.

   2. Materials of Construction shall be as follows.

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>Ductile Iron</td>
<td>ASTM A536, Grade 65-45-12</td>
</tr>
<tr>
<td>Disc</td>
<td>Aluminum bronze</td>
<td>ASTM B148</td>
</tr>
<tr>
<td>Spring, Pin, Stops</td>
<td>Stainless Steel</td>
<td>ANSI Type 316</td>
</tr>
<tr>
<td>Seat</td>
<td>EPDM Rubber</td>
<td>ASTM D412</td>
</tr>
</tbody>
</table>


   5. APCO Series CSC-600, Pratt Series 821G, or Titan CV 50-DI-B.

C. CV3:
   1. Valve: Diaphragm check valve shall be manufactured of Type I, Grade 1 PVC with a Viton diaphragm. The check valve shall utilize a normally closed design which is
entirely automatic in action. The check valve must operate effectively in any position it is installed in.

2. Pressure: 150 psi @ 73°F.


4. Plast-O-Matic Series CKM or approved equal.

D. CV4:

1. Valve: Ball check valve shall be manufactured of Type I, Grade 1 PVC with EPDM seals, and designed for horizontal or vertical installation with equal effectiveness. Valves shall be provided with double true unions.

2. Pressure: 150 psi @ 73°F.

3. Service: Fume Scrubber anti-siphon

4. Asahi/America, Hayward True Check.

END OF SECTION
SECTION 15121
ELECTRIC MOTOR ACTUATORS

PART 1 -GENERAL

1.01 DESCRIPTION

This section includes materials and installation of electric motor actuators.

1.02 RELATED WORK SPECIFIED ELSEWHERE AND REFERENCE CODES AND STANDARDS

Section 09900 Painting and Coating

1.03 SUBMITTALS

A. Submit manufacturer's catalog data showing motor actuator parts and materials of construction, referenced by AISI, ASTM, SAE, or EMWD specification and grade. Show motor actuator dimensions and weights. Show coatings.

B. Show the maximum torque required to open and close each motor operated valve. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque, and hydrostatic torque. Assume that the differential pressure across the valve is equal to the pressure or head rating of the valve.

C. Submit curves for actuator output torque versus motor current and motor speed. Indicate rated torque output of the actuator.

D. Submit motor data including nameplate data, insulation type, duty rating, and torque output at duty rating.

E. Submit electrical schematic drawings and physical wiring diagrams showing all components.

PART 2 -MATERIALS

2.01 MANUFACTURES

Electric motor actuators shall be Aumua or equal.

2.02 ACTUATOR IDENTIFICATION

Motor actuators shall have the name of the manufacturer cast or molded onto the actuator body or shown on a permanently attached plate in raised letter.
2.03 MOTORS FOR ELECTRIC ACTUATORS

Motors shall be totally enclosed, nonventilated, 120 volts, 1 phase. Motors shall be specifically designed and rated for 15-minute duty operation and frequent jogging and reversing service. Output capacity shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Motors shall be NEMA Design C or D and have Class F insulated with B temperature rising a times rating of 15 minutes at 40ºC at an average load of at least 33% if maximum valve torque. Temperature shall be limited by thermostats embedded in the motor end windings and integrated into its control insulation system. Provide motor with torque output (at duty rating) that exceeds the requirements of paragraph D below including safety factor. The motor shall be furnished with space heater suitable for operation on 120-volt single phase.

2.04 ACTUATOR TORQUE REQUIREMENTS

The rated output torque of the motor actuator shall be at least 1.5 times the maximum torque required to open and close the valve at any position including seating and unseating conditions. Each motor actuator shall have ample power capacity for accurately seating, unseating, and positioning the valve when subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly. Coordinate with the valve manufacturer to assure that the motor actuator torque output does not exceed the torque limits of the valves operating stem or shaft. Measurement of torque shall be from direct measurement of force at the out of the actuator. Actuator ratings for butterfly valves shall be determined in accordance with AWWA C504.

2.05 DESIGN OF ELECTRIC MOTOR ACTUATORS

A. Desired design of the actuators is to move valves from fully closed to fully open in 120 seconds and to be adjustable.

B. Each electric actuator shall contain a reversing magnetic starter, three overloads (one in each ungrounded leg), 480/120-volt control power transformer, local/remote selector switch, stop-open-close pushbuttons, and open and closed indicator lights. The control housing shall be NEMA 4 construction with threaded hubs for conduit entry. All external fasteners shall be zinc plated stainless steel.

C. Actuator housings, supports, and connections to the valve shall be designed with a minimum safety factor of five based on the ultimate strength or three based on the yield strength of the material used.

D. Gear actuators shall be totally enclosed, and factory-grease packed or oil lubricated. The power gearing shall consist of helical gears of heat-treated steel. Worm gears shall be alloy bronze accurately cut with a hobbing machine. Worm
shall be hardened steel alloy. Design and construct gear reducers in accordance with AGMA 440.04. Design gears for 24-hour continuous service with an AGMA rating of 1.50.

E. Provide following protection for each motor actuators:

- Jammed valve
- High Motor temperature
- Hight Torque
- Single Phasing protection
- Space heater

F. The actuators shall have a manually operated handwheel which shall not rotate during electrical operation. In the event electrical power is interrupted, handwheel operation shall be activated by a hand lever attached to the mechanism. While the valve is being operated manually, the motor shall not rotate. Upon restoration of electrical power, the handwheel shall automatically disengage. Design the handwheel diameter such that hand operation will not damage the valve.

G. Provide a hammer-blow device in each actuator to permit the motor to reach full speed before the load is applied. Provide hammer-blow action for manual operation also.

H. Valve actuator Control Interface:

Provide a non-intrusive, non-contacting interface for configuring all input and output settings, control values, ranges, torque switch settings, valve positions switch settings, and options.

The actuator shall include a dedicated numeric symbol digital position indicator displaying valve position from fully open to fully closed in 1% increment.

Three different indicating lights corresponding opened, closed and intermediate valve positions shall be included on the actuator display when power is switched on.

The digital display shall be capable of indicating real time torque and valve position simultaneously, both being displayed in 1% increments of valve position and actuator rated torque. In addition, torque shall also be displayed in horizontal bar graph form.

I. Control Input

The actuator shall be capable of using 24VDC inputs. It shall control the valve when LOCAL-STOP-REMOTE is in REMOTE.
OPEN and CLOSE inputs configurable between maintained (actuator runs until end of travel, high torque, or a STOP input) and momentary (actuator stops when command is removed).

J. Status Output

Monitor relay output: Dry contact, normally closed, opens when actuator is not in REMOTE or in the event of any internal fault or alarm condition.

Dry contact outputs configured for the functions indicated on the Contract Documents. Provide the following outputs for all actuators.

- Fully closed
- Fully closed
- LOCAL-STOP-REMOTE in REMOTE position

The valve actuator shall be capable of being configured for the following additional functions:

- High motor temperature
- Valve Opening or Closing
- Motor Tripped on Torque in Mid-Travel
- Motor Tripped on Torque Going Open
- Motor Tripped on Torque Going Closed
- Pre-Set Torque Exceeded
- Motor Stalled
- Actuator Being Operated by Hand wheel
- Valve Jammed
- Control Supply Lost
- Battery Low
- Internal Failure Detected

K. Additional Requirements for Actuators

Prove an internal backup power source to maintain settings and track valve position when main power is off.

Position sensing shall be electronic and adjustable using solid-state encoder wheel. Mechanical limit switches and potentiometers are not acceptable.

Torque shut down setting shall be adjustable in 1 percent increment between 40 to 100 percent of rated torques.

Where noted or shown, valves shall be furnished with fail-safe (OPEN) electric motor actuators.

Actuators shall be rated for minimum 60 starts per hour for direct mounting on a quarter turn valve.
Actuator shall be designed to drive the valve full open on loss of power or control signal. With power on, the valve motor shall be used to open and close the valve on local or remote-control signal. Operating power shall be used to wind a mechanical spring assembly and apply a brake. On power or signal loss, the brake shall be released, and the mechanical spring shall drive the valve open. The actuator shall be capable of operating the valve to full open in 15 seconds or less.

PART 3 - EXECUTION

3.01 ATTACHING ELECTRIC ACTUATORS

The valve manufacturer shall mount the electric motor actuator and accessories on each valve and stroke the valve prior to shipment. Adjust limit switch positions and torque switches.

3.02 PAINTING AND COATING

Coat electric motor actuator the same as the valve to which it is attached. Apply prime coat at factory. Finish coat shall be applied in the field and shall match the color of the valve to which the actuator is attached.

3.03 FIELD TESTING OF MOTOR ACTUATORS

A. Test motor actuators as installed by measuring the current drawn in amperes by each motor for unseating, seating, and running conditions. The measured current shall not exceed the value on the current/torque curve corresponding to two-thirds the output torque capacity (at specified duty rating).

B. If the measured current drawn exceeds the above value, provide a larger motor or gear drive or adjust the actuator so that the measured amperage does not exceed the value.

C. Assure that limit switches are placed at their correct settings. Open and close valves twice and assure that limit switches function.

END OF SECTION 15121
SECTION 15122
MISCELLANEOUS PIPE APPURTE NANCES

PART 1 -GENERAL

1.01 DESCRIPTION

This section includes flexible gasketed sleeve-type compression pipe couplings, expansion joints, adaptors, and transition couplings for steel, ductile-iron, and PVC pipes. Not all couplings identified in this section are necessarily required.

1.02 REFERENCES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI B16.5</td>
<td>Pipe Flanges and Flanged Fittings</td>
</tr>
<tr>
<td>ASTM A36</td>
<td>Standard Specification for Carbon Structural Steel</td>
</tr>
<tr>
<td>ASTM A47</td>
<td>Standard Specification for Ferritic Malleable Iron Castings</td>
</tr>
<tr>
<td>ASTM A53</td>
<td>Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless</td>
</tr>
<tr>
<td>ASTM A108</td>
<td>Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished</td>
</tr>
<tr>
<td>ASTM A193</td>
<td>Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature Service</td>
</tr>
<tr>
<td>ASTM A194</td>
<td>Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both</td>
</tr>
<tr>
<td>ASTM A283</td>
<td>Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates</td>
</tr>
<tr>
<td>ASTM A510</td>
<td>Standard Specification for General Requirements for Wire Rods and Course Round Wire, Carbon Steel</td>
</tr>
<tr>
<td>ASTM A512</td>
<td>Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing</td>
</tr>
<tr>
<td>ASTM A536</td>
<td>Standard Specification for Ductile Iron Castings</td>
</tr>
<tr>
<td>AWWA C105</td>
<td>American National Standard for Polyethylene encasement for Ductile-Iron Pipe Systems</td>
</tr>
<tr>
<td>AWWA C110</td>
<td>American National Standard for Ductile-Iron and Gray-Iron Fittings for Water</td>
</tr>
<tr>
<td>AWWA C153</td>
<td>Ductile-Iron Pipe and Fittings</td>
</tr>
<tr>
<td>AWWA C210</td>
<td>Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines</td>
</tr>
<tr>
<td>AWWA C213</td>
<td>Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines</td>
</tr>
<tr>
<td>AWWA C606</td>
<td>Grooved and Shouldered Joints</td>
</tr>
</tbody>
</table>
1.03 SUBMITTALS

A. Submit manufacturer's catalog data for each coupling, adaptor, or other appurtenance. Include manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used.

B. Show materials of construction by ASTM reference and grade. Show coatings and provide dimensions. For thrust harness, include number, size, and material of tie rods and lugs.

C. Submit installation instructions including manufacturer's recommended torques to which the coupling bolts shall be tightened.

D. Operations & Maintenance information in accordance with Section 01730 “Operating and Maintenance Manual”.

E. Submit in accordance with Section 01300 “Submittals”.

1.04 MEASUREMENT AND PAYMENT

Full compensation for Miscellaneous Pipe Appurtenances including furnishing all materials, labor, tools, equipment, and incidentals and performing all work described in this Section and as indicated on the Plans shall be included in the Contract price paid for related piping work and no additional compensation shall be allowed therefor.

PART 2 - MATERIALS

2.01 STEEL FLEXIBLE PIPE COUPLINGS

A. Steel couplings shall have middle rings made of steel conforming to ASTM A36, A53 (Type E or S), or A512 having a minimum yield strength of 30,000 psi. Follower rings shall be malleable iron (ASTM A47, Grade 32510), ductile iron (ASTM A536), or steel (ASTM A108, Grade 1018, or ASTM A510, Grades 1018 or 1021). Minimum middle ring length shall be 5 inches for pipe sizes 3/4 inch through 4-1/2 inches; 7 inches for pipe sizes 5 inches through 24 inches; and 10 inches for pipe sizes larger than 24 inches.

A. Sleeve bolts shall have a minimum yield strength of 40,000 psi and an ultimate strength of 60,000 psi. Nuts and bolts shall be 316 Series stainless steel, regardless of location.
B. Steel follower rings shall be cast, forged, or hot rolled in one piece. Do not use rings fabricated from two or more shapes.

C. Wall thickness of sleeve shall be at least that specified for the size of pipe in which the coupling is to be used.

### 2.02 JOINT HARNESSSES

A. Bolt or stud material shall conform to ASTM A193, Grade B7. Nuts shall conform to ASTM A194, Grade 2H. Lug material shall conform to ASTM A36, ASTM A283, Grade B, C, or D, or ASTM A285, Grade C. Lug dimensions for steel pipe shall be as shown in AWWA Manual M11. Lugs shall be Type P for pipes 6 through 10 inches and Type RR for pipes 12 inches and larger.

B. Select number and size of bolts based on the test pressure shown in the drawings. For test pressures less than or equal to 150 psi, use the 150-psi design in the table.

C. Provide washer for each nut where harness is shown to be electrically insulated. Washer material shall be the same as the nuts. Minimum washer thickness shall be 1/8 inch.

### 2.03 FLEXIBLE PIPE COUPLINGS FOR PLAIN END STEEL PIPE

A. Flexible pipe couplings for steel pipe shall be steel, Dresser Style 38, Smith-Blair Type 411, Romac Style 400, Baker Series 200, or approved equivalent.

### 2.04 FLEXIBLE PIPE COUPLINGS FOR PLAIN END DUCTILE-IRON PIPE AND PVC PIPE

A. Flexible pipe couplings for pipe 12 inches and smaller shall be cast iron, Dresser Style 153, Smith-Blair Type 441, Romac Style 501, Baker Series 228, or approved equivalent.

B. Flexible pipe couplings for pipe larger than 12 inches shall be cast iron or steel, Dresser Style 38 or 153, Smith-Blair Style 411, Romac Style 400 or 501 Baker Series 228, or approved equivalent.

### 2.05 TRANSITION COUPLINGS

Transition couplings for connecting different pipes having different outside diameters shall be steel: Dresser Style 62 or 162, Smith-Blair Series 413, Romac TC400, Baker Series 212 or 240, or approved equivalent.
2.06 INSULATING FLEXIBLE COUPLINGS

A. Insulating flexible straight couplings for connecting different pipes having similar materials and diameters shall be steel: Dresser Style 39, Smith-Blair Style 416, or approved equivalent.

B. Insulating flexible transition couplings for connecting different pipes having dissimilar materials and outside diameters shall be steel: Dresser Style 39-62, Smith-Blair Type 417, or approved equivalent.

C. Couplings shall include insulator to ensure electrical isolation.

D. Couplings shall include joint restraint.

2.07 FLANGED COUPLING-ADAPTERS FOR STEEL PIPE

Flanged coupling adapters for steel pipe shall be steel: Dresser Style 128, Smith-Blair Type 913, Romac FC400, Baker 602, or approved equivalent. Flange ends shall match the flange of the connecting pipe.

2.08 FLANGED COUPLING ADAPTERS FOR CAST - AND DUCTILE-IRON PIPE AND PVC PIPE

A. Flanged coupling adapters for pipe 12 inches and smaller shall be cast iron: Dresser Style 127, Smith-Blair Series 912, Romac FCA501, or approved equivalent.

B. Flanged coupling adapters for pipe larger than 12 inches shall be steel; Dresser Style 128, Smith-Blair Type 913, Romac FC400, or approved equivalent.

C. Flange ends shall match the flange of the connecting pipe.

2.09 BALL STYLE FLEXIBLE EXPANSION JOINTS

A. Flexible expansion joints shall be installed in the locations indicated on the construction plans and shall be manufactured of ductile iron conforming to the material properties of ANSI/AWWA C153/A21.53.

B. Each flexible expansion joint shall be pressure tested against its own restraint to a minimum of 250 psi.

C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum of 15 degrees deflection per ball and 4-inches minimum expansion.
D. Each flexible expansion joint shall be single or double ball (configuration as noted on the plans) and shall have flanged outlets dimensioned according to ANSI/AWWA C110/A21.10 with an O-ring groove for a watertight seal.

E. All internal surfaces and seal contact surface parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be holiday tested with a spark test.

F. All flexible expansion joints shall be FLEX-TEND double ball or single ball flexible expansion joint (4-inch expansion) as manufactured by EBAA Iron Incorporated, Romac Flexijoint, or approved equal.

2.10 BOLTS, NUTS AND WASHERS

Unless otherwise noted, bolts, nuts and washers for submerged applications, buried applications and applications in vaults shall be Type 316 stainless steel conforming to ASTM A193, grade B8 for bolts, and ASTM A194, grade 8 for nuts. Bolts and nuts for above ground applications shall be Type 316 stainless steel or cadmium plated. Fit shall be classes 2A and 2B per ANSI B1.1 when connecting to valves with body bolt holes.

PART 3 -EXECUTION

3.01 INSTALLATION OF FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

A. Provide temporary restraint for pressure test.

B. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installing.

C. For buried applications, install in polyethylene sleeves conforming to AWWA C105. All backfill within 12-inches of joint shall be imported sand with a sand equivalent of at least 30.

D. Lubricate bolt threads with graphite and oil prior to installation.

E. Remove temporary tie restraining rods after pressure test has been accepted, but prior to covering with polyethylene sleeve and backfilling for buried applications.

3.02 PAINTING AND COATING

A. Line and coat buried flexible pipe couplings (including joint harness assemblies), transition couplings, and flanged coupling adapters with 12-mils of fusion bonded epoxy.
B. Coat flexible pipe couplings (including joint harness assemblies), transition couplings, and flanged coupling adapters located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. Prime coat shall be applied at the factory. Color shall match the color of the connecting pipe.

C. Line flexible pipe couplings with 12-mils fusion bonded epoxy.

3.03 TESTING

A. Protect any appurtenance with a pressure rating less than the test pressure.

END OF SECTION 15122
SECTION 15126
PIPE HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:
   1. Furnish all labor, materials, equipment and incidentals and install pipe hangers, supports, concrete inserts, and anchor bolts including all metallic hanging and supporting devices for supporting exposed piping.

B. Related Work Described Elsewhere:
   1. Concrete is included in Division 3.
   2. Metal fabrications are included in Division 5.
   3. Painting is included in Section 09900.
   4. Pipe and fittings are included in respective sections of Division 15.
   5. Mechanical - General Requirements: Section 15000.

C. General Design (Not Applicable)

1.02 SUBMITTALS

A. Materials and Shop Drawings:
   1. Submit to the Engineer for approval, as provided in the General Requirements shop drawings of all items to be furnished under this Section.
   2. Submit to the Engineer, for approval, samples of all materials specified herein.

1.03 QUALITY ASSURANCE

A. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five (5) times the ultimate tensile strength of the material, assuming 10 feet of water filled pipe being supported.

B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating that such requirements have been complied with.
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1.04 DELIVERY STORAGE AND HANDLING

A. The equipment provided under this section shall be shipped, handled and stored in accordance with the Manufacturer’s written instructions.

PART 2 - PRODUCTS

2.01 GENERAL

A. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and cure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. All pipe supports shall be approved prior to installation.

B. The Contractor shall select and design all piping support systems within the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of 5.

C. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing them throughout the plant.

D. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

E. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.

F. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified herein.

G. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by ITT Grinnel Co., Inc., Carpenter and Patterson, Inc., or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product, and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance will be considered for approval.
2.02 MATERIALS AND EQUIPMENT

A. Pipe Hangers and Supports for Metal Pipe:

1. Suspended single pipes shall be supported by hangers suspended by steel rods from galvanized concrete inserts, beam clamps, or ceiling mounting bolts as follows:

   a. Hangers

<table>
<thead>
<tr>
<th>Pipe Size, Inches</th>
<th>Grinnel Fig. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1/2</td>
<td>138R</td>
</tr>
<tr>
<td>1/2 through 1</td>
<td>97C</td>
</tr>
<tr>
<td>1-1/4 through 4</td>
<td>104</td>
</tr>
<tr>
<td>6 through 12</td>
<td>590</td>
</tr>
<tr>
<td>14 through 30</td>
<td>171</td>
</tr>
</tbody>
</table>

   b. Hanger rods shall be rolled steel machine threaded with load ratings conforming to ASTM Specifications and the strength of the rod shall be based on root diameter. Hanger rods shall have the following minimum diameters:

<table>
<thead>
<tr>
<th>Pipe Size, Inches</th>
<th>Min. Rod Diameter, In.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2-1/2</td>
<td>3/8</td>
</tr>
<tr>
<td>2-1/2 to 3</td>
<td>1/2</td>
</tr>
<tr>
<td>4</td>
<td>5/8</td>
</tr>
<tr>
<td>6</td>
<td>3/4</td>
</tr>
<tr>
<td>8 to 12</td>
<td>7/8</td>
</tr>
<tr>
<td>14 to 18</td>
<td>1</td>
</tr>
</tbody>
</table>

   c. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnel Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnel Fig. No. 228, or equal.

   d. Concrete inserts for pipe hangers shall be; continuous metal inserts designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers, or ceiling mounting bolts for individual pipe hangers and shall be as manufactured by Unistrut Corp., Wayne, Michigan; Carpenter
and Patterson, Inc., Laconia, New Hampshire; Richmond or equal and shall be as follows:

1) Continuous concrete inserts shall be used where applicable and/or as shown on the Drawings and shall be used for hanger rod sizes up to and including 3/4-inch diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be Series P3200 by Unistrut Corp., Fig. 1480 Type 2 by Carpenter and Patterson, Inc., or equal. Inserts to be used where supports are perpendicular to the main slab reinforcement shall be Series P3300 by Unistrut Corp., Fig. 1480 Type I by Carpenter and Patterson, Inc. or equal.

2) Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8-inch diameter. Inserts shall be Fig. 650 by Carpenter and Patterson, Inc. for hanger rod sizes 1/2-inch through and including 3/4-inch, and Fig. 266 by Carpenter and Patterson Inc., for 7/8-inch hanger rods.

3) Ceiling mounting bolts shall be used where applicable and be for hanger rod sizes 1-inch through and including 1-1/4 inches and shall be Fig. 104M as manufactured by Carpenter and Patterson, Inc., or equal.

e. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall be equal to Grinnel Fig. No. 230.

2. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnel Fig. 194, 195 and 199 as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.

a. Where the pipe is located above the bracket, the pipe shall be supported by an anchor chair and U-bolt assembly supported by the bracket for pipes 4 inches and larger and by a U-bolt for pipes smaller than 4 inches. Anchor chairs shall be equal to Carpenter Patterson Fig. No. 127. U-bolts shall be equal to Grinnel Fig. No. 120 and 137.

b. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.

3. Floor supported pipes 3-inches and larger in diameter shall be supported by either cast-in-place concrete supports or adjustable pipe saddle supports as directed by the Engineer. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and adjustable pipe saddle type supports shall be used where lateral displacement of pipes is not probable.
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a. Each concrete support shall conform to the details shown on the Drawings. Concrete shall be poured after the pipe is in place with temporary supports. Concrete piers shall conform accurately to the bottom 1/3 to 1/2 of the pipe. Top edges and vertical corners of each concrete support shall have 1-inch bevels. Each pipe shall be secured on each concrete support by a wrought iron or steel anchor strap anchored to the concrete with cast-in-place bolts or with expansion bolts. Where directed by the Engineer, vertical reinforcement bars shall be grouted into drilled holes in the concrete floor to prevent overturning or lateral displacement of the concrete support. Unless otherwise approved by the Engineer, maximum support height shall be five (5) feet.

b. Concrete piers used to support base elbows and tees shall be similar to that specified above. Piers may be square or rectangular.

c. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 pound companion flanges or slip-on welding flanges respectively. Supporting pipe shall be of Schedule 40 steel pipe construction. Each flange shall be secured to the concrete floor by a minimum of two (2) expansion bolts per flange. Adjustable saddle supports shall be equal to Grinnel Fig. No. 264. Where used under base fittings, a suitable flange shall be substituted for the saddle.

4. Vertical piping shall be supported as follows:

a. Where pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within 2 feet of the change in direction by pipe supports as previously specified herein.

b. For vertical runs exceeding 15 feet, pipes shall be supported by approved pipe collars, clamps, brackets, or wall rests at all points required to insure a rigid installation.

c. Where vertical piping passes through a steel floor sleeve, the pipe shall be supported by a friction type pipe clamp which is supported by the pipe sleeve. Pipe clamps shall be equal to Grinnel Fig. 262.

5. Anchor bolts shall be equal to Kwik-Bolt as manufactured by the McCulloch Industries, Minneapolis, Minnesota, or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Colorado.

6. All rods, hangers, inserts, brackets, and components shall be furnished with galvanized finish.

B. Pipe Hangers and Supports for Plastic Pipe:

1. Single plastic pipes shall be supported by pipe supports as previously specified herein.

2. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber hose shall be supported by ladder type cable trays such as the Electray Ladder by Husky-
Disinfection of Piping and Appurtenances

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Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of mild steel construction. Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches for rubber hose. Tray width shall be approximately 6-inch for single runs of rubber hose and 12 inches for double runs of rubber hose. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc. required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC, Husky-Burndy Model SCR or approved equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe.

3. Individual clamps, hangers, and supports in contact with plastic pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

C. Pipe Supports for Small Diameter PVC and Steel Pipe:

1. Small diameter Schedule 80 PVC piping 3-inches in diameter and smaller, and steel piping 2-inches in diameter and smaller shall be supported with "SUSPORT" system arrangements as manufactured by Universal Suspension Systems Inc. of Gillette, New Jersey or an equal approved by the Engineer. Clamping halves for the pipe support shall be manufactured of molded polypropylene and shall support and fit closely for 360° around the pipe. To support piping carrying non-corrosive fluids or gases and located in noncorrosive, indoor environments, all hardware for the "SUSPORT" system shall be nickel chrome plated carbon steel. To support piping carrying corrosive fluids or gases, piping located in corrosive environments or piping located outdoors, all hardware for the system shall be manufactured of Type 304 stainless steel.

2. In some cases, to adequately support small diameter PVC or steel piping, a metal frame support structure may be required for support of the "SUSPORT" system specified above. Where required, metal frame support structures shall be constructed using channels, fittings, brackets, hardware and other accessories as manufactured by B-Line Systems, Inc. of Highland, Illinois, or an equal approved by the Engineer. If located in indoor, non-corrosive environments, the materials for the frame structure shall be carbon steel with an epoxy coating applied by a cathodic, electro-deposition process which is equal to "Dura-a-Green" by B-Line Systems, Inc. For corrosive or outdoor environments, the materials for the frame structure be Type 316 stainless steel unless otherwise noted on the Drawings. Hardware used to construct the frame support structure shall be cadmium plated for carbon steel supports or Type 316 stainless steel for stainless steel supports.
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3. Pipe supports for small diameter PVC and steel piling shall be located wherever necessary in the opinion of the Engineer to adequately support the pipe, however, they shall have a maximum spacing as specified below for straight pipe runs. Adequate supports shall especially be used adjacent to valves and fittings in pipelines. The following table is based on spacing requirements for Schedule 80 PVC or Standard Weight (Schedule 40) steel pipe carrying a fluid with a Specific Gravity of 1.0 at a temperature not exceeding 120°F. Support spacing for PVC or steel piping carrying fluids with Specific Gravities or temperatures exceeding those stated above shall be approved by the Engineer.

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter, Inches</th>
<th>Support Spacing, Feet PVC Pipe</th>
<th>Support Spacing, Feet Steel Pipe</th>
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<tr>
<td>1/2&quot;</td>
<td>3.5</td>
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<td>3/4&quot;</td>
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<tr>
<td>3&quot;</td>
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</table>

2.03 ACCESSORIES (NOT USED)

2.04 SPARE PARTS (NOT USED)

2.05 QUALITY CONTROL

A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for this project.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.

B. All submerged pipe supports shall be prime coated with Koppers 654 Epoxy Primer or approved equal. All other pipe supports shall be prime coated with Rustinhibitive Primer No. 621 as manufactured by Koppers Company, Inc., Pittsburgh, Pa., or equal.

C. Finish coating shall be compatible with the prime coating used and shall be applied as specified in Section 09900: Painting.
3.02 INSTALLATION

A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the Engineer.

B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

D. Pipe supports shall be provided as follows:
   1. Cast iron and ductile iron shall be supported at a maximum support spacing of 10 feet, 0-inches with minimum of one support per pipe section at the joints.
   2. All vertical pipes shall be supported at each floor or at intervals of at least 15 feet by approved pipe collars, clamps brackets or wall rests, and at all points necessary to insure rigid construction.

E. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.

F. Inserts for pipe hangers and supports shall be installed on forms before concrete is poured. Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

G. Continuous metal inserts shall be embedded flush with the concrete surface.

H. Standard Pipe Supports:
   1. Horizontal Suspended Piping:
      b. Grouped Pipes: Trapeze hanger systems.
      c. Furnish galvanized steel protection shield and oversized hangers for all insulated pipe.
      d. Furnish precut sections of rigid insulation with vapor barrier at hangers for all insulated pipe.
2. Horizontal Piping Supported From Walls:
   a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall mounted framing also acceptable.
   b. Stacked Piping:
      1) Wall mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
      2) Piping clamps which resist axial movement of pipe through support not acceptable.
   c. Wall mounted piping clips not acceptable for insulated piping.

3. Horizontal Piping Supported From Floors:
   a. Stanchion Type:
      1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
      2) Use yoke saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
      3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
   b. Floor Mounted Channel Supports:
      1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
      2) Attach channel framing to floors with anchor bolts.
      3) Attach pipe to channel with clips or pipe clamps.
   c. Concrete Cradles: Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.

4. Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.

5. Standard Attachments:
   a. To Concrete Ceilings: Concrete inserts.
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b. To Steel Beams: I-beam clamp or welded attachments.

c. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.

d. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.

6. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.

3.03 INSPECTION AND TESTING (NOT USED)

3.04 START-UP AND INSTRUCTION (NOT USED)

END OF SECTION
SECTION 15260
DOUBLE WALL CONTAINMENT PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required, and install and test the double wall containment piping, fittings and appurtenances specified herein.

2. Double wall containment piping shall be used for all chemical feed piping outside of the chemical containment area. The double wall containment piping shall be used when the piping is in contact with the ground, located in the trenches or overhead, or any other location indicated on the drawings.

3. Double wall containment piping systems are required for all chemical feed systems, including the sodium hypochlorite feed piping.

B. Related Work Described Elsewhere:

1. 02718 – Installation of Water Pipeline
2. 11246 – Chemical Metering Pumps
3. 15100 – Chemical Process Valves
4. Division 15 - Mechanical.

C. General Design:

1. Double wall containment piping shall be installed in the locations as shown on the Drawings. All plastic pipe and fittings shall conform to this specification section whether provided as a part of an equipment "package" or purchased separately by the Contractor.

2. All double wall containment pipe shall be made of Schedule 80 polyvinyl chloride (PVC) with fluorinated ethylene propylene (FEP) tubing unless specifically noted otherwise on the Drawings or in other sections of the specifications.

3. Double wall chemical containment floor drains and drain piping shall be installed from the sodium hypochlorite chemical feed locations to their respective bulk storage containment areas as shown in the Drawings. Double containment drain piping shall conform to this specification.
1.02 SUBMITTALS

A. Materials and Shop Drawings:
   1. Shop drawings shall be submitted to the Engineer for approval in accordance with the General Requirements. All products within this specification shall be combined into a single submittal which shall include at least the following:
      a. Dimensioning and the technical specification for all piping, fittings, and appurtenances to be furnished.
      b. Letter of Certification from the National Sanitation Foundation International (NSF) stating compliance with Standard 14 and Standard 61.
      c. Letter from the Manufacturer verifying chemical compatibility of all products to be used in chemical feed systems.

B. Additional Information: Submit to the Engineer, for approval, samples of all materials specified herein, along with the manufacturer's descriptive literature, illustrations, specifications, installation instructions and related information.

1.03 QUALITY ASSURANCE

A. All Schedule 80 PVC and FEP tubing double containment piping including fittings and appurtenances shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

B. Solvent welder shall be qualified in accordance with Chapter VII of the ASME B31.3-93 Code, Part 9, Paragraph A328.

C. Piping shall be marked with nominal size, type, class, schedule or pressure rating, manufacturer and all markings required by applicable ASTM and AWWA standards.

D. PVC Schedule Type Piping shall be Schedule 80 unless otherwise indicated on the Drawings. Pipe and fittings shall be extruded from Type I, Grade I, Class 12454-B material in accordance with ASTM D 1784.

1.04 DELIVERY, STORAGE AND HANDLING

A. PVC containment pipe and FEP carrier tubing shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a fork lift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.
B. When it is necessary to store PVC containment pipe and FEP tubing for more than 30 days, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. Double wall containment pipe shall not be stored close to heat sources or hot objects such as heaters, fires, boilers or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. The interior and all sealing surfaces of pipe, fittings and other appurtenances shall be kept clean and free of dirt and foreign matter.

C. Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged or defective pipe and fittings, or any length of pipe having a gouge, scratch or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the work and replaced with new acceptable pipe at no additional cost to the District.

PART 2 - PRODUCTS

2.01 GENERAL

All double wall containment piping system components shall be fabricated, tested, and assembled as shown on the drawings.

2.02 MATERIALS AND EQUIPMENT

A. FEP Tubing and Fittings:

1. Materials:
   
   Small Bore FEP Tubing: Carrier pipe shall be of flexible virgin FEP tubing, suitable for flaring and available in continuous lengths of 25, 50, 100, 250, and 1,000 feet.

2. FEP tubing wall thickness shall be as follows:

   For NS 1/4-inch, 0.047-inches.
   For NS 3/8-inch, 0.062-inches.
   For NS 1/2-inch, 0.062-inches.
   For NS 3/4-inch, 0.062-inches.
   For NS 1-inch, 0.062-inches.

3. Pressure ratings for FEP tubing shall be as follows:

   For 1/2-inch, no less than 230 psi.
   For 3/4-inch, no less than 140 psi.
   For 1-inch, no less than 100 psi.
4. Fittings: FEP tubing fittings shall be flare-type.

5. Manufacturers: Tubing shall be manufactured by Chemline Plastics Unlimited or Engineer approved equal. Fittings shall be manufactured by FlareLINK by Fit-LINE, Inc., or Engineer approved equal.

B. Schedule 80 PVC Containment Piping:

1. Materials:
   Pipe shall be made of polyvinyl chloride, Schedule 80, conforming to ASTM D1784-92.

2. Fittings:
   Fittings for Schedule 80 pipe shall be socket type, solvent welded in conformance with ASTM D2467. Solvent welded joints shall be watertight.

3. Solvent Cement:
   PVC solvent cement shall be in compliance with ASTM.

C. Accessories:

1. Leak Detection System
   Install in strict accordance with the system manufacturer’s instructions and recommendations. Leak detection shall be installed with a sensor located at the lowest point in the piping, with all pipe sloping to the location of the leak detection sensor. The leak detection system shall sound an alarm when a leak event occurs.

   Signal wires from the low point sensor shall be connected to the local output panel. Contact with any aqueous chemical shall result in an audible alarm and a LED signal. The local output panel shall be housed in a NEMA 4X enclosure. The leak detection output panel shall be located directly outside the chemical feed pumping facility where the pipe first penetrates the ground surface. For any miscellaneous control component data see Division 17 Specifications. The output relays shall be capable of interfacing with the SCADA for the proposed plant expansion.

   The leak detection system shall be a product of the containment piping manufacturer.

2.03 SPARE PARTS

All special tools, solvents, lubricants, and cements required for normal installation shall be furnished with the pipe.

2.04 QUALITY CONTROL

Contractor shall follow Manufacturer’s and Supplier’s recommended product quality control specifics as required for project.
PART 3 - EXECUTION

3.01 GENERAL

A. Install double wall containment pipe where shown on the Drawings and in strict accordance with the manufacturer's technical data and printed instructions.

B. All piping shall have sufficient number of unions to allow convenient removal and shall be as approved by the Engineer.

C. All valves and equipment shall be supported independently from the pipe. Anchor valves such that the turning moment resulting from their operation will not be transmitted to the pipe.

3.02 INSTALLATION OF PVC PIPING, SCHEDULE TYPE

A. Joints for double wall containment pipe and fittings shall be solvent welded or threaded. All joints shall be made watertight. All pipe cutting, threading and jointing procedures for solvent welded pipe joints shall be in strict accordance with the pipe and fittings manufacturer's printed installation instructions. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary and apply solvent cement of proper grade.

B. Installation of valves and fittings shall be strictly in accordance with the manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections at sleeves. In making solvent weld connections the solvent shall not be spilled on valves or allowed to run from joints.

C. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout Drawings and the structural Drawings.

D. Below ground double wall chemical containment piping shall be backfilled with a 1 to 2 sack cement slurry.

3.03 INSTALLATION OF FLEXIBLE NON-METALLIC TUBING AND FITTINGS

A. Install small bore flexible tubing in accordance with manufacturer’s printed instructions, in neat straight lines, supported at close enough intervals to avoid sagging, and in continuous runs wherever possible.

B. Bundle tubing in groups of parallel tubes within protective sheath.

C. Tubes within protective sheath may be color coded, but protect tubing other than black outside the sheath by wrapping with black plastic electrician’s tape.

D. For buried tubing in chemical service, tubing shall be installed in Schedule 80 PVC carrier pipe to serve as double containment. Requirements are as follows:

1. Carrier pipe shall utilize long radius elbows to facilitate pulling of tubing.
2. Carrier pipe shall have a wye installed in the riser as shown on the drawings for each chemical to allow for leak detection sensor installation. Leak detection sensor shall be Flowline Switch-Tek Optic Leak detection switch, Model L010-230, or equal. Sensor shall be installed in the downward facing vertical branch.

3.04 INSPECTION AND TESTING

A. All PVC piping and FEP tubing shall be hydrostatically pressure tested and flushed in accordance with the requirements in Section 02718: Installation of Water Pipeline.

B. Following installation and testing:

1. Flush clean the carrier and containment piping system.

2. Purge the annular space of moisture with clean, dry air.

3. Purge carrier tubing for sulfuric acid with compressed nitrogen.

END OF SECTION
SECTION 15710
HEATING, VENTILATION, AND AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

The Contractor shall furnish, install, and test the heating, ventilation, and air conditioning (HVAC) equipment including ancillary equipment and components, as specified herein and shown on the Drawings.

1.02 SPECIFIC PROJECT VENTILATION AND AIR CONDITIONING REQUIREMENTS

A. Air Conditioner System

Contractor shall furnish, install, place into operation, and test one (1) complete split-ductless air conditioning system with one (1) outdoor unit and one (1) indoor unit, as shown on the Drawings and as specified herein. All components of the system shall be the products of the same manufacturer. Manufacturer's supply shall include all components required for a complete and operable HVAC system, including, but not limited to, the following:

1. Outdoor Unit

Outdoor unit shall be ground-mounted, two-pipe type modular heat pump unit furnished without heating capacity (cooling only). Outdoor unit shall have a two (2) ton (24,000 Btu/hr) nominal cooling capacity, be capable of supporting one (1) indoor unit, and shall be equipped with an invertor-driven compressor. Outdoor unit shall be a P-Series, ModelPUZ-A24NHA7, as manufactured by Mitsubishi Electric, or equal.

2. Indoor Units

Indoor units shall be ceiling-suspended type compact units with 24,000 Btu/hr cooling capacity and variable 635 to 775 cfm air flow rate. Indoor units shall be capable of varying fan speed to four (4) selectable manual settings or automatically to optimize cooling. Sound pressure level at low air flow shall be 45 dBA or less. Indoor units shall be provided with a drain piping connection, painted steel cover, polypropylene honeycomb filter, and mounting hardware. Indoor units shall be P-Series Ceiling-Suspended type, Model PKA-A24KA7, as manufactured by Mitsubishi Electric, or
equal.

3. Remote Controller

Each indoor unit shall be provided with a wall-mounted controller (thermostat). Wall-mounted controller shall allow operator to set temperature, fan mode, fan speed (in manual), and turn unit on and off. Controller shall be capable of sensing room temperature or receiving temperature from the sensor in the indoor unit. Control wiring shall be via a two-conductor shielded cable. Controller shall be a Simple MA Remote Controller, Model TAR-40MAAU, as manufactured by Mitsubishi Electric, or equal.

C. Contractor shall provide two (2) wall-mounted exhaust fans, one in the generator room, and another in the chemical storage room. The exhaust fans shall be complete with fabricated wall support brackets, gravity backdraft damper, companion flange, and flexible duct, as shown on the Drawings. The generator room wall-mounted fan shall be Greenheck AER-E24C,3725 CFM unit or equal complete with backdraft dampener. Fan to be controlled via T-stat in the space. Fan is commanded on after generator shuts off. Fan commanded off when temperature in the room is equal to ambient temp. The chemical room wall-mounted fan shall be Greenheck AER-E24C-314-A 4700 CFM unit or equal complete with backdraft dampener. Fan to be controlled via time schedule.

D. Contractor shall provide two (2) inline exhaust fans, one to serve the restroom, and another to serve the future ammonia storage room. The exhaust fans shall be complete with gravity backdraft damper, companion flange, and flexible duct as shown on the Drawings. The restroom exhaust fan shall be Greenheck SQ-70-VG 75 CFM unit or equal complete with backdraft dampener. Restroom exhaust fan to be controlled via schedule based on occupancy. The future ammonia storage room exhaust fan shall be Greenheck SQ-100-VG 1110 CFM unit or equal complete with backdraft dampener. Future ammonia storage exhaust fan to be controlled via schedule based on occupancy.

E. The Contractor shall provide the following louvers

Generator Room: one (1) 6” deep 10'x10' H wall louver suitable for mounting in an 8" CMU wall, and as specified herein. One (1) 12'x12' H acoustical intake louver for mounting in an 8" CMU wall. Both louvers shall be complete with motorized dampers. One (1) 6” deep 3’x3’ exhaust louver serving exhaust fan EF-
2. Louver shall be complete with backdraft damper.

Restroom: Provide one (1) 6” deep 12”x12” H wall louver serving EF-1 suitable for mounting in an 8” CMW wall, and as specified herein. Provide one (1) 6” deep 12”x12”H wall intake louver to serve restroom as specified herein.

Chemical Storage Room: Provide one (1) 6” deep 3.5’x3’H exhaust louver serving EF-4 suitable for mounting in an 8” CMU wall, and as specified herein. Louver shall be complete with backdraft damper. One (1) 8” deep 72”x30”H intake louver suitable for mounting in an 8” CMU wall, and as specified herein. Louver complete with backdraft damper.

Future Ammonia Storage Room: Provide one (1) 6” deep 22”x22” H wall louver serving EF-3 suitable for mounting in an 8” CMW wall, and as specified herein. Provide one (1) 6” deep 26”x22”H wall intake louver to serve Future Ammonia Storage Room as specified herein.

1.03 GENERAL REQUIREMENTS

A. Ambient Conditions and Elevations

Equipment shall be designed to operate at the elevation and ambient conditions shown on the Drawings and specified in the Special Conditions.

B. Dimensional Restrictions

Equipment and layout dimensions will vary between manufacturers. The equipment sizes and layout areas indicated on the Drawings is based on typical equipment. Contractor shall review the Contract Drawings, the manufacturer's drawings (dimensional and layout) and installation requirements, and shall make any modifications required for proper installation subject to acceptance by the District.

C. Coordination

Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, and recommendations of the equipment manufacturer. Contractor shall verify that each component of the system is compatible with all other parts of the system; that all piping, ductwork, materials, equipment, and motor sizes are appropriate; and that all devices
necessary for a properly functioning system have been provided.

D. Manufacturers and Local Service

Where two or more units of the same class of equipment are required, they shall be the product of a single manufacturer. However, all the component parts of the system need not be the products of one manufacturer.

Each equipment manufacturer shall have a local service center and shall be able to provide service within 24 hours. The service center shall be equipped and staffed to service the system and shall maintain a local parts supply. Information on equipment manufacturers' representatives shall be included with the submittals.

E. The materials being called out are typical at each well site.

1.04 SUBMITTALS

A. Shop Drawings

In accordance with the General Conditions, Section F - Labor and Construction, Contractor shall submit complete information, drawings, and technical data for all equipment and components, including, but not limited to, the following:

1. Complete specifications, dimensioned drawings of each equipment unit and support curb (if applicable), catalog cuts, data sheets, bill or materials, and descriptive literature which shall include make, model, dimensions, weight of equipment, and electrical schematic wiring diagrams (if applicable).

2. Details of unit support and anchorage requirements.

3. Complete performance data, performance curves, and ratings that will indicate full compliance with the specifications.

4. Control components, including description of control component operations. Equipment wiring diagrams and interconnection diagrams.

5. Detailed information on structural, mechanical, electrical, or other changes or modifications necessary to adapt equipment and materials to be supplied to the arrangement or details shown on the Drawings.
6. Shipping, unloading, storage, and installation instructions, lifting points, and any special precautions to be observed during unit storage and installation.

B. Operation and Maintenance Manuals

Contractor shall prepare and submit a complete and organized operation and maintenance manual for all equipment and components. The manual shall be submitted in accordance with the General Conditions, Section F – Labor and Construction and Specification Section 01430, and shall include, but not be limited to, the following:

1. Equipment System Performance Data and Drawings
   a. Detailed Bill of Materials for all system equipment, materials, and components, listing: quantity, description, and catalog/part number.
   b. Performance capabilities and operating requirements for each piece of equipment.
   c. As-built shop drawings for all equipment and components, including fabrication and assembly drawings, wiring diagrams, and schematics.

2. Equipment System Installation Requirements
   a. Complete, detailed installation instructions for each piece of equipment.

3. Equipment System Operation Data
   a. Complete, detailed operating instructions for each piece of equipment, including system startup and normal operating procedures and sequence.
   b. Safety precautions, including explanations for all safety considerations relating to each system operating condition.
c. Recommended spare parts list.

4. Equipment Service and Maintenance Data
   a. Maintenance data shall include all information and instructions required by District's personnel to keep equipment properly cleaned, lubricated and adjusted so that it functions economically throughout its full design life.
   b. Unloading, handling, and long-term storage requirements.
   c. Explanation with illustrations as necessary for each maintenance task.
   d. Recommended schedule of maintenance tasks.
   e. Lubrication charts and tables of alternate lubricants.
   f. Troubleshooting instructions.
   g. List of maintenance tools and equipment.
   h. Name, address, and phone number of manufacturer and manufacturer's local service representative.

5. System Warranty

PART 2 - PRODUCTS

2.01 GENERAL

A. Equipment Manufacture and Fabrication

   Manufacture and fabrication of equipment shall comply with the requirements of Technical Specification Section 11005, General Mechanical and Equipment Specifications, including drive units and safety guards.

B. Shop Testing

   The equipment furnished under this section shall be tested at the factory according to the standard practice of the manufacturer. Ratings shall be based
on tests made in accordance with applicable AMCA, ASHRAE, ARI, NBS, NFPA, and UL Standards.

C. Balance

All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient course for rejection of the equipment. The mass of the unit and its distribution shall be such that the resonance at normal operating speeds is avoided. In any case, the maximum measured root-mean-square (rms) value as measured at any point on the equipment shall not exceed those listed in the latest ASHRAE Applications Handbook.

At any operating speed, the ratio of rotative speed to the critical speed of a unit or components thereof shall be less than 0.8 or more than 1.3.

2.02 SPLIT-DUCTLESS AIR CONDITIONING SYSTEM

A. A split-ductless air conditioning system shall be provided for room cooling as shown on the Drawings. Air conditioning system components shall be factory assembled, piped, internally wired, and fully charged. The air conditioning system shall be Intertek ETL listed. The air conditioning system shall be factory run tested to check cooling operation, operation of internal components, and control sequence.

B. The air conditioning system shall be rated for a minimum total cooling capacity as specified in Part 1.02, herein. The air conditioning system shall be provided with a single indoor unit or multiple indoor units as specified in Part 1.02, herein, or as shown on the Drawings. When specified herein or shown on the Drawings, the air conditioning system shall be provided with a heat pump system (each indoor unit) rated for a minimum total heating capacity as specified in Part 1.02 herein.

C. The air conditioning system shall have a minimum Energy Efficiency Ratio (EER) of 12.2.

D. The air conditioning system shall be equipped with the following components: floor mounted outdoor unit, wall mounted or ceiling suspended indoor unit(s), refrigerant piping between the indoor and outdoor unit(s), control wiring between the indoor and outdoor unit(s), condensate drain piping for indoor unit(s) to outside of building, and wired wall mounted controller(s).
E. Outdoor Unit

1. The outdoor unit at Treatment Plant shall be a 1-phase, 208 volt, 60 Hz unit and shall include a direct drive propeller fan(s), fan motor (one (1) motor per fan), factory pressure tested heat exchanger (condenser) coil, compressor, refrigerant accumulator on the suction side of the compressor, control circuit board, wiring, and piping. Air shall discharge horizontally from the outdoor unit.

2. The coil shall be constructed with lanced or corrugated aluminum plate fins attached to copper tubing.

3. The fan shall be provided with permanently lubricated shaft bearings.

4. Refrigerant flow from the outdoor unit to the indoor units shall be regulated by an electronically controlled inverter-driven compressor.

5. The compressor shall be hermetically sealed, inverter driven, variable speed, and dual rotary type. The compressor shall be provided with internal thermal overload protection and mounted on vibration isolation pads.

6. The outdoor unit shall be capable of monitoring ambient temperature, condenser coil temperature, and refrigerant discharge temperature.

7. The outdoor unit enclosure shall be a weather-resistant bonderized galvanized steel cabinet with an electrostatically applied, thermally fused polyester coating. All assembly hardware shall be weather-resistant and enclosure shall be provided with integral mounting feet.

F. Indoor Unit(s)

1. Each indoor unit shall include a line-flow or double inlet forward curve radial fan(s) direct driven by a single fan motor, factory pressure tested heat exchanger (evaporator) coil, easily removable return air filter, corrosion resistant condensate drain pan, control circuit board, wiring, and piping housed in a high strength molded plastic or corrosion resistant coated metallic enclosure. Air shall discharge horizontally from the indoor unit(s).

2. The coil shall be constructed with smooth aluminum plate fins attached to copper tubing.
3. The fan(s) shall be statically and dynamically balanced and provided with a permanently lubricated shaft bearing. The fan(s) shall be capable of operating at a minimum of three (3) selectable fixed speeds or operating in automatic (automatically vary speed).

4. Each indoor unit shall include multi-position horizontal louvers to adjust air flow up and down and adjustable vertical vanes to adjust air flow left and right. If specified in Part 1.02 herein, horizontal and/or vertical louvers shall be motorized.

5. Each indoor unit shall have a self-diagnostic function, time delay start function, and auto restart function after power interruption. Each indoor unit shall be capable of monitoring indoor room temperature and evaporator coil temperature.

6. Each indoor unit shall be purged with dry air in the factory prior to shipment.

7. Each indoor unit shall be 1-phase, 208 volt, and powered directly from the lighting panel.

8. Each indoor unit shall be provided with a fresh air intake with appropriate duct and damper.

9. Provide seismically rated minimum 1” spring vibration isolators.

G. Contractor shall coordinate selection of indoor unit(s) and outdoor unit to provide a complete and operable air conditioning system.

H. Contractor shall install all interconnection control and power wiring between the indoor and outdoor units (and branch boxes if applicable) as required to provide a complete functioning air conditioning system. The control wiring shall be provided by the manufacturer of the air conditioning system to ensure unit compatibility.

I. The indoor and outdoor units shall be installed in accordance with the manufacturer's printed installation instructions. All mounting hardware shall be Type 316 stainless steel. Size and embedment of anchor bolts for outdoor units and wall mounted indoor units shall be determined by the manufacturer.

J. Where interconnection control and power wiring, interconnection refrigerant
piping, and condensate drain piping penetrate building walls, Contractor shall provide rubber sleeves through wall penetrations and seal said penetrations with silicone sealant after installation of wiring and piping. Contractor shall provide Diversitech PVC split channel type ducts, or approved equal.

K. The air conditioning system shall be provided with a NEMA 3R, 240V, 1-phase fused disconnect switch with 120V, 1-phase GFI receptacle mounted adjacent to the outdoor unit.

L. The air conditioning system shall be provided with a 5-year parts and defects warranty and the compressor shall have a 7-year warranty. Warranty shall include labor and travel.

M. Split-ductless air conditioning system shall be Y-Series, M-Series, or P-Series as manufactured by Mitsubishi Electric, or equal.

2.03 REFRIGERANT AND DRAIN PIPING

A. Refrigerant Piping

1. Contractor shall install all refrigerant piping and inline components, such as valves, test ports, air dryers, sight glasses, and related inline components, between the indoor and outdoor units to provide a complete serviceable and functioning air conditioning system.

2. Refrigerant piping shall be nitrogenized, heavy-wall ACR Type K copper tube provided in 10 ft or 20 ft straight lengths.

3. Refrigerant piping shall be UL listed for 700 psi operating pressure and shall meet the requirements of ASTM B280.

4. Refrigerant piping shall be factory cleaned and charged with 99.9% nitrogen, and each end shall be sealed to maintain the nitrogen at low pressure inside the pipe. Pipe end seals shall extend beyond the pipe ends to protect against damage and shall maintain internal nitrogen pressure at temperatures ranging from -20°F to 150°F.

5. Refrigerant piping shall be factory labeled with ink or paint indicating piping is ACR Type K and nitrogen charged.

6. Refrigerant pipe fittings shall be manufactured by the same manufacturer as the refrigerant piping, and shall be appropriate for 700 psi operating pressure and R410a refrigerant system applications.
7. Gas (suction) refrigerant piping system (including valves, fittings, and pipe) shall be insulated with preformed tubular closed-cell elastomeric foam insulation that meets the requirements of ASTM C534 (Preformed Flexible Elastomeric Cellular Thermal Insulation) and ASTM E84 (Surface Burning Characteristics of Building Materials) for smoke and fire. The minimum nominal wall thickness of the insulation shall be 3/4" for pipe with a 1/2" nominal diameter or smaller, and 1" for pipe with a nominal diameter larger than 1/2". Minimum R values shall be 5.2 and 6.5 for 3/4" wall thickness and 1" wall thickness insulation, respectively.

8. Refrigerant piping shall be supported with strut channel-type pipe supports, and shall include insulated pipe support clamps to prevent copper contact with dissimilar metals.

9. Where below grade refrigerant piping is specified on the Drawings, said piping shall be installed in a watertight 4" corrugated HDPE flexible sleeve with pre-formed flexible elastomeric cellular foam insulation.

B. Drain Piping

1. Contractor shall install 3/4" diameter (minimum) condensate drain lines from the outdoor unit(s) to the outside of the building, unless specified otherwise on the Drawings.

2. Unless specified otherwise, condensate drains shall be constructed of Schedule 40 PVC.

3. Condensate drains shall slope to the drain point with a 2% minimum slope.

4. Condensate drains shall be supported with strut channel-type pipe supports.

5. Discharge point of condensate drains shall be 6" above outdoor finish grade unless discharge into indoor equipment drains is specified on the Drawings.

2.04 SHEET METAL DUCTWORK AND MISCELLANEOUS ACCESSORIES

A. Construction
1. Ductwork (ducts and fittings) shall be constructed as shown on the Drawings with airtight joints and seams in accordance with ASHRAE standards and SMACNA Duct Construction Manual. Unless specified otherwise, ductwork shall be fabricated per SMACNA low pressure class, with static pressure rating of 2” w.c. (positive or negative) and suitable for air velocities of up to 2,500 fpm. Ductwork materials shall be galvanized steel per ASTM A527 with coating designation G-90, unless otherwise specified. Minimum duct gauges required are as follows:

<table>
<thead>
<tr>
<th>Maximum Size of Ducts</th>
<th>Galvanized Steel U.S. Standard Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot; and less</td>
<td>24</td>
</tr>
<tr>
<td>13&quot; through 30&quot;</td>
<td>22</td>
</tr>
<tr>
<td>31&quot; through 54&quot;</td>
<td>20</td>
</tr>
</tbody>
</table>

2. All transverse joints shall be sealed per SMACNA Class C requirements with vinyl acrylic duct sealant, nonflammable wet or dry, UL listed, with flame spread O, fuel contributed O, and smoke developed O. Gaskets for flanged duct joints shall be 1/4” thick, full faced, closed cell, expanded neoprene sponge.

B. Supports

Supports for horizontal ducts shall be galvanized steel angles or double struts with threaded hanger rods unless specified otherwise. Supports for vertical ducts shall be band iron strap or angle bracket type. Inlet ducts shall be amply braced to withstand maximum negative pressure.

C. Flexible Connectors

1. Flexible duct connections shall be made at each point where the air conditioning or air handling unit is connected to a duct. Flexible connectors shall be UL listed, waterproof, fire resistant, mildew resistant, air-tight woven fibrous glass cloth, double coated with chloroprene or chlorosulphonated polyethylene, and provided with sheet metal collars. Flexible connectors shall be as manufactured by Ventfabrics, Inc., United McGill, Duro-Dyne Ductmate.

2. Fabric for flexible connections protected from sunlight and the weather shall be suitable for a temperature range of -20 to 180°F and shall weigh at least 27 ounces per square yard.
3. Fabric for flexible connections exposed to sunlight or the weather shall be suitable for a temperature range of -10 to 250°F and shall weigh at least 24 ounces per square yard.

D. Volume Control Dampers

Where shown on the Drawings, provide factory fabricated volume control dampers with locking quadrant and 8" maximum blade width. Volume control dampers shall be Ruskin MD-25 or MD-35 (rectangular), MDRS-25 (round), or equal. Dampers shall be manually adjusted for air balancing.

E. Insulation and Weatherproofing

1. All exterior ductwork shall be provided with an insulation and weatherproofing system suitable for outdoor conditions, including direct sunlight and rain. The insulation system shall be installed in strict accordance with the manufacturer's printed recommendations.

2. Insulation material shall be a flexible, closed-cell, 1" thick (minimum) elastomeric insulation in sheet form. The insulation material shall be AP Armaflex SA, as manufactured by Armacell. Insulation material shall have a maximum thermal conductivity of 0.28 BTU-in/hr-sq ft-deg-F at 90°F. Insulation material shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50.

3. Adhesive shall be a contact adhesive, Armaflex 520 as manufactured by Armacell.

4. Sheet insulation shall be adhered directly to clean, oil-free duct surfaces with a full coverage of contact adhesive. The duct insulation shall be constructed from the bottom up, with the top insulation sized to extend over the side insulation to form a watershed. Butt-edge seams shall be adhered using contact adhesive by the compression fit method to allow for expansion/contraction. Standing metal duct seams shall be insulated with the same insulation thickness as installed on the duct surface. Seams shall be covered using strips of sheet insulation. Standing seams shall be adhered using contact adhesive. Insulation seams shall be staggered when applying multiple layers of insulation.

5. All insulated ductwork shall be weatherproofed with 0.020" thick stucco-embossed aluminum jacketing. Jacketing shall be manufactured from ASTM B-209, Temper H-14 aluminum alloy with factory bonded moisture
barrier. Aluminum jacketing shall be installed with a 2" overlap at longitudinal seams and end joints. Secure jacket with stainless steel sheet metal screws at 6" on center along seams and at end joints. Overlapped longitudinal seams shall be arranged to shed water. All joints shall be sealed with a silicone mastic to provide a continuous weather-tight joint. Strapping shall be 3/4" wide aluminum or stainless steel. Aluminum jacketing shall be as manufactured by Pabco Childers Metals, RPR Products, Inc., or equal.

2.05 WALL LOUVERS

A. General

Louvers shall be intake or exhaust as shown on the Drawings, of the fixed (unless otherwise specified), flat blade, 45° type, having a width and height to fit the opening specified. Coordinate wall thickness and provide louver to fit the requirements.

Louvers shall be suitable for mounting in stud wall, with gypsum board and stucco, concrete walls, or masonry walls as shown on the Drawings. Size, number, and location shall be as shown on the Drawings.

Louvers shall be anchored into walls (from inside of building) at corners, top and side, and bottom and side with wood lag screws or expansion anchors as applicable. Additional anchors shall be provided such that maximum anchorage space shall be 24" O.C.

Louvers shall be weatherproofed. All louver edges, including flashing, in contact with wall surfaces shall be caulked with exterior grade caulking compound.

B. Wall Mounted Stationary (Fixed) Louvers

Fixed blade (stationary) intake or exhaust louvers shall be flat blade type of formed steel with blades at a 45° angle. Frame and blades shall be minimum 16 gauge galvanized steel.

Each louver shall be provided with a removable 1/4" mesh, 23 gauge, wire galvanized insect screen with galvanized steel frame. Screens shall be located on interior side of wall and shall be attached with screws.

Stationary wall louvers shall be Model 609B, as manufactured by the Airolite Co., or equal.
C. Wall Mounted Adjustable Louver

Adjustable blade intake or exhaust louvers shall be of formed steel construction with frame and blade of minimum 18 gauge galvanized steel.

Blades shall be positioned at 45° angles when fully opened. Crank handle shall be provided for adjusting and shall be provided with an extension where wall thickness necessitates.

Insect screen, as specified per Section 2.05B, herein, shall be provided.

Adjustable wall louvers shall be Model AEL-162 as manufactured by Louvers & Dampers, Inc., or equal.

Where shown on the Drawings or specified herein, adjustable louvers shall be provided with electric motor actuators. Actuators shall be operated by 120 VAC power and shall be provided with spring return to fully open or fully close as specified.

Where shown on the Drawings or specified herein, adjustable louvers shall be recessed in the wall and be provided with a vandal protection type louver on exterior.

D. Wall Mounted Automatic Gravity Type Louvers

Intake and exhaust automatic gravity type louvers shall be suitable for high velocity and high static pressure and shall automatically open upon operation of the ventilation system or radiator cooling exhaust fan. Louver shall be intake or exhaust as shown on the Drawings and dictated by the ventilation system. Louvers shall consist of 16 gauge galvanized formed steel frame and 14 gauge aluminum tied blades with felt tip edges. Automatic gravity type louvers shall be as manufactured by Greenheck, or equal.

Intake and exhaust openings shall be provided with weather protection fixed louvers on the exterior face and gravity louvers on the interior face unless otherwise specified.

Where specified, intake and exhaust automatic louvers shall be provided with a fixed vandal protection type louver as shown on the Drawings.

E. Wall Mounted Acoustical Louver
Formed steel acoustical wall louvers shall be provided where specified or shown on the Drawings. Construction shall be similar to fixed wall louvers. Noise side of louver shall include Type 703 fiberglass at 3.0 lb/cu ft density covered with 20 gauge perforated galvanized steel, or equal. Minimum noise reduction of 14 dB at octave band No. 3 shall be provided.

Insect screen, as specified per Section 2.05B, herein, shall be provided.

Acoustic louver shall be 8" or 12” thick as specified herein AFJ by Greenheck, or equal.

F. Wall Mounted Vandal Protection Type Louvers

Where specified herein or shown on the Drawings, fixed louvers of the vandal protection type shall be provided for air supply or exhaust. Louvers shall be as shown on the Drawings. Louvers shall be provided with insect screen as specified in Section 2.05B herein.

G. Removable Isolated Block outs

All louvers in air condition portion of the equipment building shall be provided with removable insulated blockouts for installation during air condition use

2.06 WALL-MOUNTED EXHAUST VENTILATORS

Wall-mounted exhaust ventilators shall be steel direct-drive or belt-drive (interior-mounted only) exhaust fans with galvanized steel enclosure, face flange, and adjustable anchor angle suitable for mounting in building walls of metal building with interior finish, as shown on the Drawings. Ventilators shall be completely assembled and weatherproof, with automatic gravity louvers and bird screen. Ventilators shall be of 18 gauge galvanized steel construction with aluminum propeller blades, Greenheck (wall-mounted direct drive), or equal. Provide seismically rated minimum 1” spring vibration isolators.

2.07 CORROSION-RESISTANT WALL-MOUNTED EXHAUST VENTILATORS

Corrosion-resistant wall-mounted exhaust ventilators shall be fiberglass direct-drive exhaust fans with fiberglass enclosure, face flange, and adjustable anchor angle suitable for mounting in building walls of metal building with interior finish, as shown on the Drawings. Motors shall be totally enclosed chem type. Ventilators shall be completely assembled and weatherproof, with automatic gravity louvers and bird screen. Ventilators shall be of fiberglass construction with fiberglass propeller blades, Hartzell
Series 59 Type, or equal. Provide seismically rated minimum 1” spring vibration isolators.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall examine all equipment and material upon arrival at jobsite and determine that it is as specified and approved, and that it is new and in undamaged condition. Contractor shall verify openings (existing and/or new) in structures and ducts are of suitable size for equipment delivered. Contractor shall install all equipment, piping, ductwork, fittings, and appurtenances in strict accordance with manufacturer's printed instructions and approved shop drawings.

B. Contractor shall connect all necessary electrical power including furnishing of all necessary materials in addition to that included in the specified equipment. Wiring materials and installation shall be in accordance with Division 6 of the District’s Technical Provisions, and controls and instrumentation in accordance with Technical Specification Section 17005, General Instrumentation and Control Components, and as shown on the Drawings.

C. When split systems are specified, Contractor shall furnish, install, and connect all necessary refrigerant piping and components, including valves, test ports, air dryers, sight glasses, and related inline components needed for operation and maintenance of a complete split HVAC system, in addition to that included with the specified equipment.

D. Prior to equipment operation, Contractor shall provide initial lubrication of all mechanical systems, check all belts, pulleys, and other moving parts for alignment and tolerances in accordance with the manufacturer's installation and operation instructions.
3.02 SPLIT SYSTEM REFRIGERANT PIPING INSTALLATION AND TESTING

A. Prior to connecting the refrigerant piping to the outdoor unit, the refrigerant piping shall be installed, pressure tested, and evacuated as described herein.

B. When split systems are specified, Contractor shall install the refrigerant piping as follows:

- Cut copper pipe using pipe/tubing cutter only. Do not use a saw or abrasive wheel.
- Deburr cut ends thoroughly and clean all sharp impurities from pipe when deburring is complete.
- Joints shall be made by brazing (or silver solder) only. Compression joints are only allowed at equipment connections.
- When brazing, pipe and fittings shall be filled with oxygen free nitrogen (OFN).

C. The complete refrigerant piping system, including valves, test ports, air dryers, sight glasses, and all inline components shall be installed and connected to the indoor unit(s) prior to pressure testing. Pressure testing of the refrigerant piping system and indoor unit(s) shall include the following:

- District will witness all pressure testing.
- All pressure testing shall be performed with compressed OFN.
- All tools and gauges required for pressure testing shall be provided by the Contractor.
- Pressure test shall verify the system can hold the following pressures for associated time durations:

  Step 1  45 psi for 3 minutes
  Step 2  220 psi for 3 minutes
  Step 3  450 psi for 24 hours

D. Upon successful completion of the pressure test, Contractor shall evacuate the refrigerant piping system and indoor unit. Evacuation shall include the following:

- District will witness evacuation.
- Contractor shall provide all vacuum pumps, vacuum gauges, and other necessary evacuation equipment.
• Vacuum gauge shall be used at all times; use of a system manifold gauge shall not be allowed.
• OFN shall be used to fill piping when vacuum is broken. Outside air shall not enter the refrigerant piping system.
• Evacuation shall include the following procedure:

  Step 1   Evacuate the entire system to 1,000 microns (micrometer of mercury)
  Step 2   Break vacuum and pressurize to 14 psig using OFN
  Step 3   Evacuate to 500 microns
  Step 4   Break vacuum and pressurize to 14 psig using OFN
  Step 5   Evacuate to 200 microns for 1 hour
  Step 6   Isolate system from vacuum pump and verify refrigerant system will hold vacuum for 30 minutes to demonstrate no moisture remains (i.e. perform rise test)

E. Upon successful completion of evacuation connection of the outdoor unit to the refrigerant piping can be performed.

3.03 STARTUP AND INSTRUCTION

A. Contractor shall arrange for qualified representatives of the manufacturer to inspect the installation and perform start-up of the equipment and to demonstrate required performance to the satisfaction of the District. As a minimum, manufacturer shall field measure air flow rates and specific pressures for each ventilator and air conditioning unit at each operating speed. Manufacturer shall also measure ventilator and air conditioning unit motor amperage, voltage, and power factor for each operating condition. Manufacturer shall furnish all labor and equipment required for field testing and furnish testing results to District in a written report.

B. Contractor shall balance the ventilation and air conditioning systems by adjusting louvers or grills (unless fixed louvers or grills are specified) to obtain even air flow across a room. Contractor shall furnish calibrated (certification required) air velocity meters for such balancing.

C. After the equipment has been installed, tested, and adjusted, and placed in satisfactory operating condition, the equipment manufacturer shall provide classroom instruction to District's operating personnel in the use and maintenance of the equipment. Two (2) hours of instruction shall be provided, unless otherwise specified. Contractor shall give the District formal written
notice of the proposed instruction period at least two weeks prior to commencement of the instruction period. Scheduled training shall be at a time acceptable to the District and the manufacturer. During this instruction period, the manufacturer shall answer any questions from the operating personnel. The manufacturer's obligation shall be considered ended when he and the District agree that no further instruction is needed.

END OF SECTION 15710
SECTION 16620
EMERGENCY DIESEL ENGINE GENERATOR SETS

PART 1 - GENERAL

1.01 DESCRIPTION

This Section outlines the electrical work for permanent emergency stand-by power generation equipment and all the installation, including foundations and complete wiring, and forms a part of all other Specification Sections. The Contractor shall furnish and completely install the fully automatic operating electric generating plant as indicated and specified. The electric generating plant shall be capable of producing a continuous standby source of power during normal power interruption.

1.02 RELATED WORK

A. Construction Methods and Earthwork: 02201.
B. Cast-in-Place Concrete: 03300
C. Painting and Coating: 09900
D. General Electrical Requirements: 16010
E. Induction Motors: 16150
F. General Instrumentation and Control Components: 17005
G. Wiring not integral with the electric generating plant.
H. Diesel engine-driven electrical generator with engine mounted radiator, engine driven fan, exhaust system complete, engine driven fuel transfer pump and all required items of auxiliary electrical equipment.
I. Fuel Tank.
J. Equipment shop drawings.
K. Operation and descriptive data.
L. Testing.
1.03 SUBMITTALS

A. Shop Drawings: Equipment descriptive data, operation and installation data, and shop drawings fully detailing each electric generating plant installation shall be submitted to the Owner for approval, including details for anchor bolts, vibration isolator mountings, particulate filter, oxidation catalyst, silencer, exhaust pipe installations, exhaust ducting with sound trap, connections for fuel, connections for power and control wiring, plans, elevations, equipment arrangements, diagrams, dimensions, weights, locations for conduits and nameplate inscriptions.

B. Instruction Manuals: The Contractor shall obtain data from the electric generating plant manufacturer and submit instruction manuals that outline the complete description, installations and operations of each unit in accordance with Section 01430.

1. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than (a) general, introduction and overall equipment description, purpose, functions, and operation, (b) specifications, (c) installation instruction, procedures, sequences, and precautions, including tolerances for level, horizontal, and vertical alignment, (d) grouting requirements including grout spaces and materials, (e) list showing lubricants, approximate quantities needed per year, and recommended lubrication intervals, (f) start-up and beginning operation procedures, (g) operational procedures, (h) shutdown procedures, (i) short and long term inactivation procedures, (j) maintenance, calibration, and repair instruction, (k) parts lists and spare parts recommendations, (l) prices of spare parts and maintenance materials, (m) lists of all special tools, instruments, accessories, and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration, and (n) other information as may be specified or required for approval.

2. Format: Drawings and pictorials shall be used to illustrate the text as necessary to fully present the information. Where the information covers a family of similar items, the inapplicable information shall be struck out or the applicable portions identified by heavily weighted arrows, boxes, or circles.
C. Equipment Data: For equipment under this Section not covered by the above instruction manuals, the Contractor shall submit complete technical and catalog data giving specified information on performance and operating curves and data, ratings, capacities, characteristics, efficiencies, and other data to fully illustrate and describe the items as may be specified or required for the Owner's approval. Contractor shall include the name, address and phone number of the service organization for the electric generating equipment.

D. Tools and Accessories: The Contractor shall furnish and deliver all special tools, instruments, accessories, and special lifting and handling devices shown in the approved instruction manuals. Unless otherwise specified or directed by the Owner, the items shall be delivered to the Owner, with the Contractor's written transmittal accompanying each shipment, in the manufacturers’ original containers labeled to describe the contents and the equipment for which it is furnished. The Contractor shall deliver a copy of each transmittal to the Owner for record purposes.

E. Certified Data: Submit to the Owner certified copies of reports for each electric generating plant.

1. Test Reports: Copies of the factory test reports shall be certified by the manufacturer and submitted to the Owner.

2. Installation and Operation Reports: Copies of the Manufacturers Certified Report for the equipment installations and operations, as specified in Section 16950, shall be submitted to the Owner.

F. Manufacturer's Specification: Submit manufacturer's standard printed data to show equipment warranty, guaranteed fuel consumption at 25%, 50%, 75%, and full load including exhaust temperature at these same loads, engine brake horsepower, air pollutant emission rates, including but not limited to, nitrogen oxides, carbon monoxides, sulfur oxides, hydrocarbons, and dry particulate matter, and generator efficiency. The manufacturer's data shall include generator insulation class, generator transient and subtransient reactance and generator telephone influence factor.

G. Generator ratings, data and analysis calculations to verify the use of the generator to supply variable frequency drive units for the motor/pump loads indicated on the Drawings.

H. The submittals shall include construction drawings to show detail of installation of anchor bolts in concrete pad complete with specification of material, rating of
bolts and related data to verify the anchor design to meet Uniform Building Code Zone 4.

I. The following submittals and specific information shall be provided.

Air Emissions Data:

1. The Contractor shall submit all engine exhaust emissions data necessary to apply and pay for a Permit to Construct from the Air Quality Management District (AQMD).

2. This data shall include the effects of proposed engine modifications, if any, to meet the AQMD permit and operating conditions.

3. Provide, if required, additional emissions data on short notice in response to Agency demands following their review of the permit application.

J. Provide permitting per Project Specifications. When the selected equipment is an AQMD pre-approved provide AQMD certification.

1.04 CODES AND STANDARDS

The generator set shall conform to the requirements of the following codes and standards:

A. CSA C22.2, No. 14 – M91 Industrial Control Equipment.


C. FCC Part 15, Subpart B.


E. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.


G. IEEE587 for voltage surge resistance.


1.05 FACTORY TESTS

A. Static Tests. Set up and static test the entire unit including control panels and accessories. Verify that all safety devices and control circuits are properly installed and connected.

B. Operating Tests. Test the engine generator unit per applicable portions of ASME PTC-17, NEMA MG1, and NFPA-110. Provide fuel consumption tests.

C. Duration Tests. Test at full rated load for four (4) hours, followed by two (2) hours operating from full load to zero load. Test at 0.80 power factor. Testing at unity power factor is not acceptable.

D. Records. Provide test records as required by the applicable test codes. Also provide the average starting time for not less than 10 cold starts. Indicate the test cell temperatures and the number of cranking cycles before successful start.

E. Test Report. Submit the factory test report for review as specified elsewhere. The engine generator shall not be shipped from the manufacturer’s facility until the factory test report submittal is approved.

F. Factory test reports shall show voltage, frequency and recovery time values when load is applied: from 0 to half load, from 0 to full load, from full load to 0 loads. Testing shall include manual override of governor to reduce speed to half normal while unit is fully loaded, then releasing override and recording time to recover normal speed. Voltage shall be recorded during test. The test report shall indicate the maximum horsepower that the engine generator can start across the line without stalling. The test report shall include the torsional vibration test. A certified report indicating the maximum noise rating of engine generator in dBA, ac 25%, 50% and 100% load.

1.06 JOB CONDITIONS
The exact space requirements for all required equipment shall be determined by the approved equipment for the project. The Drawings indicate the major components that shall be included in the electric generating systems. Should there be a need to deviate from the Drawings and Specifications, all proposed changes shall be detailed in writing and submitted to the Owner for approval.

1.07 QUALITY ASSURANCE

A. Requirements. All the equipment and materials, including their fabrication, assembly, testing and installations shall conform to the applicable codes and standards that are listed in Section 16010-"General Electrical Requirements". The equipment shall be approved by the Air Quality Management District (AQMD).

B. In addition, the installations shall comply with applicable requirements of National Fire Protection Association No. 37, Stationary Combustion Engines and Gas Turbines.

C. The Contractor shall assign unit responsibility for all the diesel engine driven generating system components to the engine generator manufacturer. Engine - Generator set mounted subassemblies such as cooling system, base, air intake system, fuel system and tank, exhaust outlet fittings and equipment, and generator remote mounted controls shall also be designed, built, and assembled as a complete unit by the engine generator manufacturer.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

The electric generating plant shall be delivered to the site as a complete factory-assembled unit including structural base, with factory-applied weather protection. Units shall be stored under cover or shall be fully protected until installed.

1.09 SERVICE AND WARRANTY

The manufacturer shall have a local authorized dealer who can provide factory trained servicemen, the required stock of replacement parts, technical assistance, and warranty administration.

A. PROXIMITY TO JOB SITE

The manufacturer’s authorized dealer shall have a parts and service facility within 75 miles of the job site.
B. WARRANTY ADMINISTRATION

The manufacturer’s authorized dealer shall be capable of administering the manufacturer’s and dealer’s warranty for all components supplied by the selling dealer, including but not limited to the genset system, Diesel particulate Filter, and resistive load bank (who may or may not be the same as the servicing dealer).

C. WARRANTY TERMS

The manufacturer’s and dealer’s extended comprehensive warranty shall in no event be for a period of less than five years from date of initial start-up of the system or 1,500 operating hours, whichever comes first. It shall include repair parts. Labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Applicable deductible costs shall be specified in the manufacturer’s warranty. Submittals received without written warranties as specified will be rejected in their entirety.

D. WARRANTY NAMEPLATE

A warranty nameplate of not less than 6 inches by 8 inch must be affixed to the generator set with the following data:

Warranty Period: Start-up Date: Termination Date: Supplier Name: Supplier Address:
24-Hour Emergency Number:
Preventive maintenance to be performed by:

E. PARTS AVAILABILITY

The generator set supplier shall guarantee 100 percent parts availability within 48 hours from the time an order is entered with the dealer.
PART 2 - MATERIALS

2.01 CENTRAL TREATMENT PLANT GENERATOR

The generator shall provide emergency standby power as indicated and specified Unit, including all components, shall be new, fabricated, assembled complete, tested and shipped by the manufacturer of the generator so there is one source of supply and responsibility. The performance of the generating set shall be certified by an independent testing laboratory as to the set’s full power rating, stability and voltage and frequency regulation. It shall have fixed louvers for the air intake and discharge with screens to prevent birds and rodents from entering the engine-generator compartment.

The electric plant shall be designed to start automatically on normal power failure and supply emergency power to all indicated loads. Components that are required to satisfactorily complete the generating systems and not described in this Section shall be provided by the Contractor. Diesel engine-driven plants shall be manufactured by Caterpillar, Generac, or Cummins, no equal. The plants shall be fabricated and assembled by a manufacturer with a minimum of 10 years experience in producing electric generating plants of similar size.

A. Ratings:

1. Capacity. Each single electric generating unit shall have continuous 650 kilowatt standby rating at 0.80 power factor as specified on drawings.

2. Electrical Characteristics. The electric generating plants shall provide emergency power at 277/480 volts, three phase and 60 hertz as shown on the drawings.

3. The rating of the engine shall be based upon a satisfactory operation at an elevation to 1,600 feet above sea level, an atmospheric temperature of 120 degrees Fahrenheit and a barometric pressure of 28.25 inches of mercury.

B. Engines: The engine shall be standby continuous duty, four cycle, water cooled with mounted radiator, fan and pump, and shall be equipped with all the required components that provides satisfactory operation. The engine shall be fueled with diesel fuel No. 2 (ASTM D 975) and shall have oil filters, oil pumps, water pumps and air filters. Engine shall have rigid supports and heavy structural base. The base shall be installed level, anchored to the concrete foundation and
finished with grout. The grout shall be non-shrink type with a minimum compressive strength of 4,000 pounds per square inch after 28 days.

1. **Engine Controls**: The engine driven electric generating unit shall contain a complete engine start-stop control, which automatically starts the engine on closing contact and stops the engine on opening contact. Once started, the engine shall remain in operation for a minimum, adjustable period of 5 to 45 minutes. A cranking limiter shall be provided to open the starting circuit in approximately 30 to 90 seconds if the engine is not started within that time. Engine controls for each engine shall also include a four-position selector switch (TEST-OFF-MANUAL-AUTOMATIC) complete with wiring. High engine temperature, low oil pressure, low tank fuel supply, over crank and overspeed devices that shut down the engine and close the fuel line shall be provided with local signal lights, an audible alarm and terminals for remote alarm wiring. A switch shall be provided to silence the audible alarm until the alarm condition has been corrected. After the alarm condition has been corrected, the audible alarm shall sound until the switch is moved to the normal position.

2. **Engine Instruments**: The engine generator control panel shall contain a fuel oil pressure gauge, lubricating oil pressure gauge, engine temperature gauge, and battery charge rate ammeter.

3. **Engine Lubrication System**: The engine shall be provided with a complete pressure lubrication system. The system integral with the engine shall be complete with all equipped pipes, valves, heaters, fittings, pump, pressure gauge, filters and other necessary components to complete the system.

4. **Governor Controls**: The governor shall be a load sensing electric actuator electronic solid-state type Barber Colman with magnetic speed pick-up, and a mechanical governor for backup. The electronic governor shall incorporate isochronous operation. The governor shall be adjustable for speed drop of 0% (isochronous) to 5%. A remote speed adjustment switch shall be mounted in the control panel. Governor controls shall be provided complete for satisfactory operation.

5. **Cooling System**: An engine-mounted radiator with engine driven fan shall be provided for the cooling system. Radiator shall be at 110% rated load in 100°F ambient temperature against 0.5 inches of water as maybe imposed by enclosure. The engine driven cooling water pump shall have ample capacity to circulate the required flow of engine jacket water
through the radiator to remove the heat rejected from the engine to the jacket water and to maintain the water temperatures as recommended by the manufacturer.

6. Antifreeze: The engine cooling system shall contain an environmentally friendly, long life solution of propylene glycol or equivalent for protection to minus 10°F.

7. Jacket Water Heater: A unit mounted thermal circulation type water heater incorporating a thermostat and switch shall be provided to maintain engine jacket water to 90 degrees Fahrenheit in an ambient temperature of plus 10°F. The heater shall be single phase, 120/240 volts; 60 hertz rated minimum 2500 watts.

C. Generators: The generator shall be brushless, revolving field type, 277/480 volts, three phase, 60 hertz with tandem rotating permanent magnet generator (PMG), rotating exciter with rotating rectifiers and solid-state voltage regulator. The stator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semiflexible driving flange to ensure permanent alignment. The insulation shall be Class F as defined in NEMA MG1-1.65 with a temperature rise of 70°C above ambient. The stator winding shall be arranged for "wye" connection with both line and neutral leads of each 3-phase winding brought out into the terminal box on the generator frame. The generator shall be mounted on a common base with the engine and shall be equipped with the required supports and hardware.

D. Performance: The frequency regulation shall not exceed three hertz from no load to full load. Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full rated load. The instantaneous voltage dip shall be less than 15 percent of rated voltage when full three-phase load and rated power factor is applied to the generator. Recovery to stable operation shall occur within 3 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus one percent of the rated voltage. A rheostat shall provide a minimum of plus or minus 5 percent voltage adjustment from the rated voltage. Temperature rise shall be within the NEMA MG1-22.40 standard.

E. Generator Control Panels: The control panels shall be totally metal enclosed, assembled, wired, tested and shock mounted on the engine driven electric generating plant by the manufacturer. The panel shall contain the main circuit breaker, as shown on the Drawings and a digital control panel complete with programming and functions as follows:
1. **Circuit Breaker**: The main emergency power circuit breaker shall be enclosed, molded case, thermal-magnetic, trip free, manual, quick-make, quick-break, 1600-volt, three poles, with current trip ratings as shown on the Drawings.

2. **Generator Mounted Control Panel**: Provide a generator mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation; adjustable cycle cranking, digital AC metering (0.5% true rms accuracy) with phase selector switch, digital engine monitoring, shutdown sensors and alarms with horn and reset, adjustable cooldown timer and emergency stop push-button. Panel shall incorporate self-diagnostics capabilities and fault logging. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Control panel shall be UL 508A Listed.

a) **Digital Readouts**:
   i. Engine oil pressure
   ii. Coolant temperature
   iii. Engine RPM
   iv. System DC volts
   v. Engine running hours
   vi. Generator AC volts
   vii. Generator AC amps
   viii. Generator frequency
   ix. kW meter
   x. Percentage of rated power
   xi. KVA meter
   xii. KVAR meter
xiii. Power factor meter
xiv. KWHR meter

b) Alarms

i. Low oil pressure
ii. High water temperature
iii. Low coolant level
iv. Overspeed
v. Over crank
vi. Emergency stop depressed
vii. Approaching high coolant temperature
viii. Approaching low oil pressure
ix. Low coolant temperature
x. Low voltage in battery
xi. Control switch not in auto. position
xii. Low fuel main tank
xiii. Battery charger ac failure
xiv. High battery voltage
 xv. EPS supplying load
xvi. Alarm generator running
xvii. Spare
c) Programmable Control Panel: Provide programmable protective relay functions inside the control panel to include the following:

i. Undervoltage
ii. Overvoltage
iii. Over frequency
iv. Underfrequency
v. Reverse power
vi. Overcurrent (phase and total)
vii. KW level (overload)
viii. Three spare LED’s
ix. Four spare inputs

3. Meter Switches: Phase selector switches with standard block knobs shall be panel type, heavy duty, non-illuminated with four positions (off-A-B-C).

4. Indicating Lights: Indicating lights shall be transformer type, 60 hertz with 6-volt lamps and color caps with lamps removable without entering the generating panel.

5. Wiring: Each panel wiring shall be complete to all equipment and terminal blocks. Alarm contacts shall be wired to terminals for connections to remote wiring. Wire shall be copper, single conductor, 600 volt, 90 degrees centigrade minimum. Provide the neutral and equipment grounding as indicated, specified and required.

6. Nameplates: Provide all the required nameplates as specified in Section 16010- “General Electrical Requirements.” The nameplates shall have inscriptions that identify the equipment and all its positions.

F. Earthquake Design Data. Submit with the shop drawings complete seismic calculations, details of construction, and method of attachment for generator set
mounting to base and for anchor bolts for anchoring base to concrete slab. The calculations and details shall be signed by a Professional Engineer who has demonstrated proficiency in Structural Engineering or Civil Engineering and is registered in the State of California. Mounting system shall be capable of withstanding earthquake forces of seismic zone 4 in accordance with the Uniform Building Code, latest edition.

G. Load Bank with Controls:

1. The load bank shall be a complete system with all necessary power, controls, wiring, and devices to provide a functional system to maintain a controlled, fixed load on the generator during both exercising and emergency use conditions.

2. The load bank system equipment shall be mounted and installed by the manufacturer as an integral part of the engine generator unit.

3. The adjustable resistor load bank, capable of absorbing 60% minimum of the full generator output, shall be mounted on the exhaust side of the engine radiator within the enclosure for the engine-generator. Load bank resistive elements shall be stainless steel alloy mounted on ceramic insulators. The load bank shall be capable of continuous operation.

4. The load bank assembly shall consist of at least three individual sections (steps) of resistors, each step shall be controlled by contactor connected to the generator output.

5. The load control panel shall consist of devices and components to control the contactors for the step loads in accordance with the manufacturer's standard design. The panel, mounted within the engine-generator enclosure, shall have the following features:

   a) A MANUAL-OFF-AUTOMATIC mode selector switch

   b) Individual load step ON/OFF switches

   c) Individual load step ON indicating light

6. In AUTO mode, the minimum generator load level shall be the sum of the individual load step switches that are ON. As the generator output increases due to the addition of plant load, a generator output current transformer senses the increased load in order to signal the load control
to automatically remove a load step when the load increase is greater than a load step.

7. In MANUAL mode, the individual load step switches are used to add or remove load as needed.

8. During conditions when normal power fails and the engine generator is being exercised, an external dry contact for loss of normal power shall cause all load steps to be removed. After a time, delay to allow the engine generator to stabilize and when in the AUTO mode, the steps shall be added as needed to meet the load level setting. In MANUAL mode, load steps would be added manually as needed.

9. Acceptable Manufacturers: Load Technology, Inc., Radiator Type 4 - Auto Loading Control, or equal.

H. Battery and Charger

1. Battery: The electric generating plant shall be provided with a heavy duty, 24 vdc lead acid starting battery. The battery voltage shall be compatible with the starting system. The battery shall have sufficient capacity for two- and one-half minutes total cranking time without recharging. Provide the battery racks and required cables.

2. Battery Charger: A current limiting 24-vdc battery charger shall be furnished to automatically recharge the battery. The charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell, and shall be equipped with overload protection, silicon diode full wave rectifier, voltage surge suppressor, DC ammeter and fused AC power supply.

I. Exhaust System: The exhaust system shall be complete and shall include a flexible exhaust connection, exhaust piping and muffler located within Generator room. The exhaust system shall be provided with a means to prevent rain from entering the exhaust outlet and shall include a condensate trap and drain valve in the exhaust piping.

1. Flexible Exhaust Section: The flexible exhaust section shall consist of convoluted, seamless tube, without joints or packing. The section shall be capable of absorbing vibration from the engine or turbine and of compensating for the expansion and contraction caused by thermal expansion of exhaust gases.
2. Exhaust Muffler (Silencer): The exhaust muffler shall be critical hospital grade and mounted inside the generator room and shall be adequately supported. The muffler shall be capable of reducing the exhaust sound level to a point that is acceptable for critical areas. The muffler shall be zinc coated and insulated on the outside to maintain temperatures lower than 120 degrees Fahrenheit.

3. Provide an active regeneration type diesel particulate filter system with all necessary appurtenances, including but not limited to the particulate filter, filter controller, and electrical heater, such that the generator emissions levels meet air regulatory agency requirements. Diesel Particulate filter shall be Johnson Matthey with SootAlert monitor, or approved equal.

4. Stainless steel piping shall be used, with radii of 90° bends at least 1 1/2 times the pipe diameter. Piping shall be installed with 9 in minimum clearance from combustible material or incorporate appropriate insulation and shielding. Provide a stainless-steel flexible connection between the engine, exhaust piping, and wall thimble.

5. Piping shall be supported and braced to prevent weight or thermal growth being transferred to the engine and flexible expansion fittings provided to accommodate thermal growth. Support dampers and springs shall be included where necessary to isolate vibration.

6. Long runs of pipe shall be pitched away from the engine and water traps installed at the lowest point. Exhaust stacks shall be extended to avoid nuisance fumes and odors, and outlets to a chimney with a vent cap.

7. Specified thermal wrap is for the purpose of insulating the hot surfaces on generator engines for personnel and structure safety. These surfaces are turbocharger; exhaust manifold; exhaust pipe, DOP, particulate filter, and pipe flanges from the generator. This shall protect personnel and the structure.

   a. The thermal wrap shall consist of, but not limited to, the following materials in layers:

      Outer fiberglass cloth.
      One (1) inch fiberglass mat.
      Stainless steel mesh liner on interior surface.
      Lashing hooks.
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Stainless steel mechanical wire for lashing.
Velcro strips sewn on for fastening open seam.

b. Outer fiberglass cloth - The cloth shall be silicone impregnated with a specially formulated silicone rubber designed to meet rigid requirements of the Military Specification, MIL-Y-1140C. This special high temperature, flame retardant silicone.

c. Fiberglass mat shall be noncombustible, no alkaline, chemically stable, and resist corrosion. Fiberglass mat shall meet Military Specification MIL-1-16411-E and Navy certifiable MIL-1-24244. The mat blanket shall be made of long textile chopped fibers, no binders, high density and strong physical properties in applications up to 1,200 degrees F.

d. Exhaust piping and manifold - All edges of the thermal blanket are to be machine stitched. Permanently mounted stainless steel hooks (binding hooks) as fasteners shall also be fixed to edges for binding blanket edges together. This is to allow for easy removal and replacement of the thermal blanket without destroying the blanket during maintenance and/or repair of the engine. Stainless steel mechanical wire shall be provided as a part of the package. Use of “hot rings” is unacceptable for binding edges or securing blankets.

J. Fuel Tank

1. Fuel tank shall be as manufactured by Trusco Tank FL Series 'SUPERVAULT'; Convault; or equal.

2. Tank and accessories shall be as follows: Fuel storage tank shall comprise of a primary storage tank with fireproof insulation, leakproof membrane liner, and monolithic shell. Tank components shall be of materials listed below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank (Primary)</td>
<td>Carbon steel</td>
</tr>
<tr>
<td>Insulation</td>
<td>Styrofoam</td>
</tr>
<tr>
<td>Membrane liner</td>
<td>30-mil high-density polyethylene membrane</td>
</tr>
<tr>
<td>External shell</td>
<td>6-inch-thick 5,000-psi reinforced concrete, monolithic pour</td>
</tr>
</tbody>
</table>
3. All tank and tank equipment materials shall be chemically inert to diesel fuel products (i.e. Diesel Fuel No. 2). Threaded fittings shall be made of material that is consistent with the UL label. All openings, including leak detection tube, shall be from the top only.

4. The tank shall be of the rectangular horizontal type and shall be supplied with the UL label permanently fixed to the tank. The fuel tank shall have an adequate number of fittings of sufficient diameter to allow insertion of a primary and emergency tank vent, a fuel tank fill connection with overfill protection and spill containment, a generator fuel oil supply line (FOS), a generator fuel oil return line (FOR), and an annular space leak detector tube, a clock-type level gauge, and a dipstick-style level gauge.

5. The steel tank shall have powder coating on all metal exposed to wetted materials to inhibit corrosion.

6. The tank shall be surrounded by concrete filled 4” diameter guard posts to protect for vehicle traffic.

7. Tank Fittings: All tank openings shall be threaded, except for the leak detector tube. All unused tank openings shall be securely capped.

8. Accessories:
   a. Fill inlet tank connection: The tank system shall have a four (4) inch fill inlet tank connection and will include a spill containment pan, fill adapter, and fill cap. The containment pan shall have a drain tube that drains any spillage back into the tank and shall be mounted flush to the top of the tank. The containment pan shall have a 15-gallon capacity. The cover shall have a lockable hasp. Fill inlet assembly shall include: OPW Model 634-TT cap, No. 633-T adapter; Emco-Wheaton Model A-0049 cap, No. A-0030 adapter; or equal.

   b. Generator Fuel Oil Supply/Return Connection and Foot Valve Assembly: The external fuel supply piping connection to the engine-generator shall be a 1-1/2-inch-diameter threaded pipe, capped during shipping, extending into a 3-inch tank opening, and terminating at its connection to a foot valve and strainer assembly, installed by the tank manufacturer prior to shipping. The bottom of the inlet strainer shall be set 3 inches above the floor of the steel tank compartment. Foot valve and strainer
assembly shall be Pomeco OPW 85, or equal. The 1-1/2-inch pipe shall be supplied with an adapter for connection to the 3-inch tank opening.

c. An Anti-Siphon Valve: An anti-siphon valve with pressure relief shall be installed at the high point of the fuel oil supply piping to the engine-generator. Valve body shall be of cast iron construction with brass seats, stainless steel spring, nitrile poppet seal and Buna-N O-ring seals. Valve shall be Pomeco OPW 99 ASV Series; or equal.

d. Overfill Protection Valve and Drop Tube: The fuel fill pipe shall be 2-inch-diameter. The fill pipe (drop tube) shall extend into the tank through a 4-inch external connection to the tank. Drop tube outlet shall be cut at 45-degree angle relative to pipe diameter, terminating at a level 3 inches above the floor of the steel tank compartment. Drop tube shall include tank overfill prevention valve. Overfill prevention valve shall be Pomeco OPW Model 61fSTOP1000, or equal. Fill pipe outlet shall be threaded for extension to Ground-level Fill and Spill Containment Unit.

e. Tank Vents:

1. Primary Vent: The primary vent for the tank shall be of 2-inch diameter and installed as shown on the Drawings. The vent body shall be constructed of aluminum. The vent shall be provided with a 40-mesh, brass, flame arrestor screen. The vent cap shall be removable with a grooved drain lip for water drain-off. Vent shall be Pomeco OPW 515ML Series; or equal. The primary vent shall be installed on a steel riser and set at a height not less than 12 feet above ground level.

2. Emergency Vent: A UL-listed emergency vent of 6-inch diameter shall be installed on the tank for vapor release upon internal pressure buildup to 2.5 psi. Vent shall be Pomeco OPW 202S Series; or equal.
f. Liquid Monitoring and Liquid Leak Detection System: Provide a leak detection system for the tank and piping system.


2. The system shall be able to detect a release through the inner tank wall in any portion of the tank and the piping system providing any visual and audible indication of any fuel leaks detected.

3. The system is to include, but not limited to, the following:

   a. Monitoring Console: The console shall be in a NEMA 4 Enclosure, UL and FM approved, and capable of monitoring liquid level of up to four tanks and leak status of up to eight sensors. The face of the console shall have a five-digit display to indicate level of each tank to 0.1-inch accuracy, alarm indication for high and low level at each tank, and status (dry, water leak, fuel leak) of each leak sensor. Alarm contacts for leak sensor and 4-20 mA proportional signals for each tank level transmitter input shall be provided for remote indication or telemetry. Unit shall be pre-assembled and ready to wire to 120 VAC power sources. Pneumercator LDE740; Emco Electronics Q1500-400N; or equal.

   b. Leak Sensors: Five UL-listed capacitance sensors with differentiating capability between air, water, and fuel. The sensor shall pass through a minimum 2-inch NPT or larger interstitial opening. The sensor shall be able to differentiate between liquid water and liquid fuel to a minimum depth of 0.3 inch and operate from -40°F to 130°F. Pneumercator Model 9-902; Emco Electronics Q3-003; or equal.

   c. Level Transmitter: The tank shall contain a resistive sensor/transmitter element, bonded to a
10% glass-filled polycarbonate track, and hermetically sealed within a stainless-steel vertical tube suspended into the tank through a 4-inch NPT opening. A magnetic float guided along the tube shall sense liquid level position to 0.1-inch accuracy, unaffected by material properties of the liquid being sensed. Sensor shall be rated for service at 50 psig and 180° F. Sensor wiring shall be 3-conductor, 18 AWG, with connection at junction box integral to unit, Pneumercator 2-412; Emco Electronics Q400-series; or equal.

g. Contractor is responsible for the controls including wiring and all necessary components to complete an operable system.

h. Other Tank Accessories and Appurtenances
   a. Annular Space Leak Detector Tube: Incorporated into the tank design shall be a 2-inch diameter leak detector tube for physically monitoring leakage from the steel primary tank.
   b. Furnish galvanized steel earthquake restraints with anchoring hardware for seismic design parameters as shown on the plans.
   c. Manually operated pump with bypass piping/valves for emergency use.

K. Accessories: All accessories including hardware that shall be needed for the complete installation and proper operation of each electric generating plant shall be furnished.

1. Transfer Switch: The automatic transfer switches shall be installed as specified in Section 16250.

2. Screening shall be provided for all 1/4" mesh, openings into the generator housing, screening shall be stainless steel.

3. Provide Modbus TCP Ethernet communication between generator panel to local PLC/RTU/SCADA. The minimum amount of data displayed on
SCADA shall be as indicated in the Control Description, including but not limited to:

a) Oil Pressure

b) Fuel Level

c) Output Voltage

d) Battery Voltage

Manufacturer shall provide all conversion instruments needed for communication. Communication shall transmit all signals shown in Section 16200 2.1.D.

L. Finish: Metal surfaces shall be finished with Coating System as specified in Section 09900.

PART 3 - EXECUTION

3.01 INSTALLATION

Provide the concrete foundation. Install engine driven electric generating plant in accordance the approved submittals. All fuel, coolant, exhaust and electrical conduit must have flexible connections so that vibration is not transmitted along these lines. Install all required wiring for the components, including interconnections, for each electric generating plant.

3.02 FIELD TESTING

Prior to final acceptance, a field test shall be conducted on the engine-generator set by simulating a normal treatment plant power failure. The Contractor shall fill the fuel tank before start-up. The Contractor, a representative of the engine-generator supplier, and the Owner’s Representative will be present. Checks shall be made of fuel use, KW output, voltage regulation, and automatic operation of the unit. The Contractor shall be responsible for the proper conduct of the tests and to furnish equipment required to make the tests.

A. The Contractor shall provide all materials, supplies, and instruments required for the tests, including, but not limited to, fuel and all metering equipment.
B. Load test banks shall be moved to the site and the entire engine-generator unit, including cooling system and controls shall be tested for eight continuous hours.

C. If the equipment of engine-generator set and accessories do not operate in a satisfactory manner, the trouble shall be located and promptly repaired by the Contractor and all cost thereof shall be borne by the Contractor.

D. An analysis of the actual field test will determine the acceptability of the unit. If the unit does not perform in conformity with these Specifications and/or the certified test data, the Contractor shall be required to remove, replace, and restore the equipment to full compliance with these Specifications at his expense.

E. Upon completion of the test, final adjustment shall be made to the equipment, fuel and oil filters shall be replaced, and belt tensions checked.

3.03 TRAINING

The Contractor shall cause the generating system manufacturer, as part of the commissioning services, to provide not less than 6 hours of on-the-job training per installation. Training shall include the following at a minimum:

1. Diesel Engine theory
2. AC Generator theory
3. General operational information for the specific equipment provided under this section.
4. Troubleshooting.
5. Operation of the equipment in automatic and manual modes.
6. Routine maintenance.

END OF SECTION 16620
SECTION 17050

CONTROL DESCRIPTION

PART 1 – GENERAL

1.01 DESCRIPTION

This Section briefly describes the system operation of the Central Treatment Facility (CTF) and the coordination, testing, and system controls required to achieve said operation. The Contractor shall refer to the Drawings and applicable Specifications for detailed descriptions of work requirements. Additional Contractor's work listed herein does not limit the Contractor's work or exempt the Contractor from work required by other Specifications or the Drawings.

The District will furnish and program the Kingfisher RTU that shall be installed by the Contractor in the Contractor provided RTU panel (CP-1). Contractor shall install the Kingfisher RTU and terminate all conductors. Prior to the control system startup, the Contractor shall pre-test all pumps, variable frequency drives (VFDs), valves, pressure transmitters, flow meters, and all related instrumentation and control equipment.

The Filter System Supplier will furnish and program the treatment system PLC (also referenced as “filter PLC”) which will control and monitor all processes of the treatment plant, including but not limited to the Filters, Filter Feed Panel, Surface Wash Pumps, the Backwash Recycle Pumps, the Filter Effluent Panel, and the Sodium Hypochlorite Feed System. For local control at the treatment plant, as opposed to control via SCADA, the filter PLC shall be provided with a panel mounted HMI. Contractor shall install the treatment system PLC (filter PLC) and terminate all conductors. Prior to pressure filter system, backwash system, and chemical system startup, the Contractor shall pre-test all pumps, variable frequency drives (VFDs), valves, pressure transmitters, flow meters and all related instrumentation and control equipment.

The treatment system PLC provides control and monitoring for systems of the treatment plant, as well as provides the interface for control and monitoring by the SCADA system. The filter PLC shall communicate via the Kingfisher RTU to the SCADA system using the Modbus TCP/IP protocol.

The control system shall be capable of being configured in a functional hierarchy structure with function group control, sub group control, sub loop control and drive control to meet the degree of automation required for control of the CTF.

The Filter System Supplier shall be engaged by the Contractor as the Instrumentation and Control Subcontractor (ICS) for the treatment plant control system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 11200 – Water Filtration Equipment
2. Section 13446 – Valve and Gate Operators
3. Section 16480 – Distribution Switchgear and Motor Control Centers
4. Section 16160 – Variable Frequency Drives
1.03 SUBMITTALS
A. Submittals shall be in accordance with the Special Conditions
B. Software Package Submittal:
   a. Submit details of all software packages provided with the PLC and the OIT. Indicate all standard and optional features provided.
   b. Indicate the specific software versions that will be provided for each package.
   c. Submit process control narratives prepared specifically for this project.

PART 2 – MATERIALS – NOT USED

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS AND DEFINITIONS
A. The following represent the requirements for all control loops. These Process Control Descriptions shall be used in conjunction with all project drawings.
B. Automatic Functions are described. Each device shall be provided with a Manual Function to allow diagnostic operation while the unit or system is not in automatic mode.

3.02 ALARMS
A. The alarms described herein shall be provided for all devices described below whether the alarm described herein is shown on the Process and Instrumentation Diagrams (P&IDs) or not.
B. For all controlled devices such as pumps, motorized equipment or any device, currently under control by the PCS, that generate a start/stop, or on/off, and have one or two discrete feedback state signals, provide an equipment discrepancy alarm.
   a. The discrepancy alarm shall be generated in the PCS when a device receives a change of state discrete command signal from the PCS, and the device feedback state does not match the commanded state within a preset time.
   b. The equipment discrepancy alarm generated by the PCS shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop or close, as appropriate.
c. If, after attaining the commanded change of state, a device feedback state does not match the commanded state, an equipment deviation alarm shall be generated by the PCS.

d. The equipment deviation alarm generated by the PCS shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop or close, as appropriate.

e. After a deviation alarm occurs, the device cannot be restarted by the PCS until the user has issued a reset at the HMI.

C. For all controlled valves or gates, currently under control by the PCS, that generate an open/close and have one or two discrete open/closed feedback signals, provide an equipment discrepancy alarm.

a. The discrepancy alarm shall be generated in the PCS when a device receives an open/close discrete command signal from the PCS and the device feedback state does not match the commanded state within a preset time.

b. The equipment discrepancy alarm generated by the PCS shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop or close, as appropriate.

c. If a device feedback state does not match the commanded state, after attaining the commanded state, an equipment deviation alarm shall be generated by the PCS.

d. The equipment deviation alarm generated by the PCS shall be displayed and alarmed at the HMI, and the device shall be issued a command to stop or close, as appropriate.

e. After a deviation alarm occurs, the device cannot be restarted by the PCS until the user has issued a reset at the HMI.

D. For all analog modulating valves or gates, currently under control by the PCS, that generate an analog state request and have a position feedback signal, provide an equipment discrepancy alarm.

a. The discrepancy alarm shall be generated in the PCS when a valve receives a signal to open or close to a specific position and the position feedback signal does not indicate the desired position, plus or minus a deadband, within a preset time period.

b. The equipment discrepancy alarm generated by the PCS shall be displayed and alarmed at the HMI.

E. For all variable speed pumps, currently under control by the PCS, that generate an analog speed request and have a speed feedback signal, provide an equipment discrepancy alarm.

a. The discrepancy alarm shall be generated in the PCS when a Variable Frequency Drive (VFD) receives a signal to increase or decrease speed, and the speed feedback signal does not indicate the requested speed, plus or
minus a deadband, within a preset time period.

b. The equipment discrepancy alarm generated by the PCS shall be displayed and alarmed at the HMI.

F. Provide at least two high alarms and two low alarms for each analog input. The quantities and types of alarms shall be configured for each input as appropriate. The alarms generated by the PCS shall be displayed and alarmed at the HMI. To eliminate excessive alarm reporting, the analog point shall remain in alarm until its value returns to its alarm limit, plus or minus its alarm limit deadband.

G. All alarms shall be generated by the PCS. No alarms shall be calculated within the HMI.

H. For each analog point, an alarm shall be generated in the PCS and displayed at the HMI if the PCS detects a loss of signal. For analog points that are used for automatic control, the last “good value” shall be used as the process variable until the alarm is cleared.

I. For each analog point, if the value of the analog point is above or below the instrument range, an out of range alarm shall be generated in the PCS and displayed and alarmed at the HMI.

3.03 INTERLOCKS

Interlocks described below are intended to detail hardware interlocks between processes or sub-processes. The discussion below is not intended to detail the interlocks associated within MCCs, VFDs, etc. For those details, please see the manufacturer supplied information.

3.04 TUNING PARAMETERS

All tuning parameters for each PID in the PCS shall be available at the server/ workstations for monitoring and adjustment even if not shown on the P&IDs. Tuning trends shall be provided to monitor the PID functions. However, these parameter settings shall be password protected to allow access only to users who are given clearance by the Owner.

3.05 EQUIPMENT RUNTIMES

A. Runtimes for all motorized equipment shall be totaled in the PCS and indicated at the HMI with one-hour resolution even if not shown on the drawings.

B. The total runtime shall be reset from the HMI; however, this reset shall be password protected to allow access only to users who are given clearance by the Owner.

C. A second accumulated runtime shall also be provided. The Operator shall not have the capability to reset this accumulated runtime.

3.06 HISTORICAL RECORDING

All analog inputs shall be recorded historically even if not shown on the P&IDs.
3.07 FLOW TOTALIZATION

A. All flows shall be totalized in the PCS. Yesterday’s total flow and today’s total flow shall be indicated at the HMI even if not shown on the P&IDs. To eliminate errors due to noise or calibration issues, flows will not be totalized when an associated valve or pump is in the closed or off state. Flow less than an operator adjustable Low Flow Rate shall not be totalized. Low Flow Rate setpoints shall be available at the HMI.

B. The total flows shall have the ability to be reset from the HMI. However, this reset shall be password protected to allow access only to users who are given clearance by the Owner.

3.08 INDIVIDUAL CONTROL LOOP DESCRIPTIONS

A. Request for Water from Well System

a. Well No. 201, 202, 203, and 205 will operate based on run and flow setting signals sent by the District telemetry and received by the local RTU at each wellhead. The well pumping unit will be equipped with a variable frequency drive (VFD) to allow the pump speed to be varied to maintain the selected flow.

B. Treatment Flow Rate Setpoint and Bypass Control

a. The treatment plant flow rate setpoint will operate based on well run signals sent by the District telemetry and received by the PLC. Depending on the run status of each Well Pump the treatment plant will operate at either 4,000 gpm to the filters, or 2,000 gpm to the filters. The remainder will bypass to the water distribution line.

b. The bypass flow control valve will use a PID controller to maintain a treatment flow rate setpoint as 2,000 gpm or 4,000 gpm depending on the combination of wells that are online.

c. The bypass flow control valve PID controller will be defined as follows.

- One Proportional-Integral-Derivative (PID) controller FC-1020 shall be provided for the control of the bypass around treatment.
- The setpoint shall be selectable as operator adjustable from the HMI (range [xx] – [xx] gpm) or as a look-up value according to the table below. The default mode with be using the look-up table.
- The process variable is the combined treatment flow rate (FIT_3100 + FIT_3200).
- The control output shall be used to modulate the position of the bypass control valve.
- The PID action shall be direct. When the process variable decreases the output decreases causing the valve to open. When the process variable increases the output increases causing the valve to close.
The output shall be scaled 0 – 100 percent.

Setpoint shall be according to the following look-up table and the well pump status:

<table>
<thead>
<tr>
<th>Bypass Control Valve (MOV-1020)</th>
<th>Well No. 201</th>
<th>Well No. 202</th>
<th>Well No. 203</th>
<th>Well No. 205</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Open</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>TREATMENT SETPOINT: 0 GPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PID SETPOINT: 2,000 GPM</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>PID SETPOINT: 4,000 GPM</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>PID SETPOINT: 4,000 GPM</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>PID SETPOINT: 2,000 GPM</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>PID SETPOINT: 4,000 GPM</td>
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<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>PID SETPOINT: 4,000 GPM</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>PID SETPOINT: 2,000 GPM</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>PID SETPOINT: 2,000 GPM</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>PID SETPOINT: 4,000 GPM</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>PID SETPOINT: 2,000 GPM</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>PID SETPOINT: 2,000 GPM</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Closed</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Full Open</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>PID SETPOINT: 4,000 GPM</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

C. Feed Sodium Hypochlorite Control
a. Sodium hypochlorite is dosed at the CTF influent header for oxidation of the iron and manganese and disinfection of the water throughout the distribution system.

b. The sodium hypochlorite storage and pumping system consists of two storage tanks TNK-6100 and TNK-6200 and three chemical addition pumps PMP-6300 is dedicated to the Filter Feed Header, PMP-6500 is dedicated to the effluent distribution header, and PMP-6400 (is a shared manual standby. Level elements and transmitters LIT-6100 and LIT-6200 is provided for local and PCS monitoring of chemical levels in the storage tanks.

c. Fill Station: A 2-in quick disconnect shall be provided to outside of the building for tank filling. The tank level will be displayed at the truck fill location.

d. Feed Pump Auto Control - Main: The PCS shall control the speed and operation of the chemical feed pumps based on the Sodium Hypochlorite feed rate equation and the pump operation sequence.

e. Sodium Hypochlorite Feed Rate Equation:

\[ Q_{FDR} = \frac{62.55 \cdot D \cdot Q_F}{C_{SH}} \]

Where:

- \( Q_{FDR} \) Sodium Hypochlorite Feed Pump flow rate (GPH)
- \( D \) Dose (mg/L)
- \( Q_F \) Combined Treatment Flow Rate, FIT_3100 + FIT_3200 (gpm)
- \( C_{SH} \) Percent Weight Concentration (decimal form - unitless)

f. The constant 62.55 is derived from all the unit conversions to reduce the units to gallons per hour and account for various strengths of sodium hypochlorite (based on 1 lb Cl2 to 1 gal 12.5% sodium hypochlorite solution).

g. The operator will enter a chlorine residual target setpoint and initial dose, \( D_i \). Chlorine residual will be monitored.

h. The operator will enter an acceptable chlorine residual deadband, such as +/- 0.1 mg/L.

i. If chlorine residual > chlorine residual target, \( D = D_i - I \), where I is an operator inputted incremental dose step unit, such as 0.5 mg/L.

j. If chlorine residual < chlorine residual Target, \( D = D_i + I \), where I is an operator inputted incremental dose step unit, such as 0.5 mg/L.

k. The applied dose, \( D \), and the dosing rate in gph will be displayed on the control system display. (Following a system shutdown, the last applied
dose will remain as the initial dose setpoint for the proceeding system startup, unless changed by the operator).

l. The operator will be allowed to enter a time delay for the control loop (i.e. the period of time between a dosage change and a reading on the chorine analyzer).

m. Feed Pump Auto Control - Auxiliary: The PCS shall vary the pump speed linearly based on the operator specified 100% speed capacity.

Example:

Operator entered maximum pump capacity: 2 gph

Calculated chemical delivery rate: 1 gph

Resulting pump speed: 50%

D. CTF Influent Header Analyzers

a. Downstream of the chemical addition by sodium hypochlorite the CTF feed is monitored continuously for pH (AIT-1300) and Turbidity (AIT-1200).

b. System Alarms (Applies to Pumps PMP-201, PMP-202, PMP-203, and PMP-205 when in operation).


E. Packaged Filter System (by Filter System Supplier under Section 11200).

a. After pre-treatment by sodium hypochlorite the water is routed the package iron and manganese filtration system. The filter media is designed to assist with the oxidation of iron and / or manganese and then captures the particulates. Particulate iron and manganese are removed from the filters through a backwash.

b. General: The Filter System Supplier shall furnish an automatic control system consisting of an Allen Bradley PLC-based control panel with operator interface terminal (OIT), necessary hardware, components, timers, OIT, enclosure, relays, switches, alarms, I/O, and other items necessary for a complete operational system. The automatic filter control system shall be essentially as described below.

c. The automatic filter control system shall provide control and monitoring of all equipment indicating on the Drawings, including the monitoring of the Filter Feed Panel, the control and monitoring of the Surface Wash Pumps, the Backwash Recycle Pumps, the Filter Effluent Panel, the Sodium Hypochlorite Feed System, and full valve control.

d. The treatment plant control system shall be provided in one (1) PLC cabinet, as shown on the drawings. The RTU shall be provided in a separate cabinet as shown in the drawings.
e. The PLC for the Pressure Filter System provides control and monitoring for all of the pressure vessels, the backwash recycle system, as well as providing the interface for control and monitoring by the SCADA system (via the Kingfisher RTU). The filter PLC shall be connected to the Kingfisher RTU through the Modbus TCP/IP protocol.

F. Backwash Waste Tank (by Filter System Supplier under Section 11200).
   a. The Backwash Waste Tank is filled with backwash daily over the course of 2-hours. The tank is sized to accept the backwash from the entire filter system, settle the solids for 12-hours or longer and then return the decant to the CTF influent header. As required, solids that accumulate at the bottom of the tank will be discharged to the sewer system via the backwash waste pumps.
   b. The Backwash Waste Tank is equipped with an ultrasonic level control element LIT-5000.

   a. Filters discharge backwash waste to fill the Backwash Waste Tank daily over the span of 30 minutes to 2 hours, depending on the size of the filter vessels.
   b. Backwash Tank Alarms
      • Low-Low LIT-5000 of [xx] ft for [xx] seconds [Shut Down Backwash Return Pump Station]
      • High-High LIT-5000 of [xx] ft for [xx] seconds [Prevent Filter System Backwash]

G. Backwash Return Pumps (by Filter System Supplier under Section 11200)
   a. The backwash return pumps are designated as PMP-5100 and PMP-5200. Flowmeter FIT-5400 measures flow returned to the CTF Influent Header.
   b. The backwash return pumps can be selected as Duty or Standby at the HMI. There must always be one (1) pump selected as Duty and one (1) pump selected as Standby.
   c. When a Pump Interlocking Alarm (as defined below) is active for the duty pump and the standby pump is available, the PCS will automatically reassign the standby pump to be the duty pump and the duty pump to be the standby pump. The standby pump shall be considered available if no alarms are active and the pump remote signal is active.
   d. Pump Interlocking Alarms (Applies to individual Pumps when in operation. When any of the following alarms are active the running pump will be called to stop and shall not be permitted to start).
      • UA-5100/ UA-5200 Pump Fail
      • High-High II-5100/II-5200 of [xx] amps for [xx] seconds
      • TAH-5100 / TAH-5200 High Motor Temperature
e. Pump Warning Alarms (Applies to individual Pumps).
   - HOA-5100/ HOA-2100 Not in Remote [Interlock to start permissive]
   - High-High SI-5100 / SI-5200 Speed of [100] percent for [xx] seconds

f. Backwash Return Auto Control (by Filter System Supplier under Section 11200)
   - In the Auto mode of control the duty backwash return pump will be called to start if any of the following criteria are met:
     An operator adjustable period of time has passed since the last backwash was completed, or
     The Backwash Waste Tank High level of [xx] ft alarm is active.
   - In the Auto mode of control the duty backwash return pump will be called to stop if any of the following criteria are met:
     The Backwash Waste Tank stop level of [xx] ft is active.

g. Backwash Return Flow Rate Controller (by Filter System Supplier under Section 11200)
   - One Proportional-Integral-Derivative (PID) controller FC-5400 shall be provided for the control of return flow rate to the CTF Influent Header.
   - The setpoint shall be selectable as operator adjustable from the HMI (range [xx] – [xx] gpm) or as a calculated value according to the formula below.
   - The process variable is the backwash return flow rate (FIT-5400).
   - The control output shall be used to modulate the speed of the running Backwash Return Pump (PMP-5100, PMP-5200).
   - The PID action shall be indirect. When the process variable decreases the output increases causing the pump speed to increase. When the process variable increases the output decreases causing the pump speed to decrease.
   - The output shall be scaled 0 – 100 percent.
   - Calculated Setpoint:
     \[
     Q_{BW} = 0.10 \times Q_F
     \]
     Where:
     \( Q_{BW} \) Backwash Return Setpoint (gpm)
     \( Q_F \) CTF Feed Water Feed Flow Rate (gpm)
H. CTF Effluent Header Analyzers

a. Downstream of the filter system the CTF effluent is monitored continuously for pH (AIT-7300), free chlorine (AIT-7200), total chlorine (AIT-7400), and Turbidity, (AIT-7100).

b. System Alarms (Applies to Filter System when in operation).
   - Low-Low Chlorine (AIT-7200) of [xx] ppm for [xx] seconds [Shut-Down]

I. Effluent Sodium Hypochlorite Dosing

a. Sodium hypochlorite is dosed at the effluent header for disinfection of the treatment bypass water throughout the distribution system.

b. The sodium hypochlorite storage and pumping system consists of two storage tanks TNK-6100 and TNK-6200 and three chemical addition pumps PMP-6300 is dedicated to the Filter Feed Header, PMP-6500 is dedicated to the effluent distribution header, and PMP-6400 (is a shared standby). Level elements and transmitters LIT-6100 and LIT-6200 is provided for local and PCS monitoring of chemical levels in the storage tanks.

c. Fill Station: A 2-in quick disconnect shall be provided to outside of the building for tank filling. The tank level will be displayed at the truck fill location.

d. Feed Pump Auto Control - Main: The PCS shall control the speed and operation of the chemical feed pumps based on the Sodium Hypochlorite feed rate equation and the pump operation sequence.

e. Sodium Hypochlorite Feed Rate Equation:

\[
Q_{FDR} = \frac{62.55 \cdot D \cdot Q_F}{C_{SH}}
\]

Where:
- \( Q_{FDR} \) Sodium Hypochlorite Feed Pump flow rate (GPH)
- \( D \) Dose (mg/L)
- \( Q_F \) Bypass Flow Rate, \( FIT_{1000} - [FIT_{3100} + FIT_{3200}] \) (gpm)
- \( C_{CS} \) Percent Weight Concentration (decimal form - unitless)

f. The constant 62.55 is derived from all the unit conversions to reduce the units to gallons per hour and account for various strengths of sodium hypochlorite (based on 1 lb Cl2 to 1 gal 12.5% sodium hypochlorite
g. The operator will enter a chlorine residual target setpoint and initial dose, \( D_i \). Chlorine residual will be monitored.

h. The operator will enter an acceptable chlorine residual deadband, such as +/- 0.1 mg/L.

i. If chlorine residual > chlorine residual target, \( D = D_i - I \), where \( I \) is an operator inputted incremental dose step unit, such as 0.5 mg/L.

j. If chlorine residual < chlorine residual Target, \( D = D_i + I \), where \( I \) is an operator inputted incremental dose step unit, such as 0.5 mg/L.

k. The applied dose, \( D \), and the dosing rate in gph will be displayed on the control system display. (Following a system shutdown, the last applied dose will remain as the initial dose setpoint for the proceeding system startup, unless changed by the operator).

l. The operator will be allowed to enter a time delay for the control loop (i.e. the period of time between a dosage change and a reading on the chlorine analyzer).

m. Feed Pump Auto Control - Auxiliary: The PCS shall vary the pump speed linearly based on the operator specified 100% speed capacity.

Example:

Operator entered maximum pump capacity: 2 gph

Calculated chemical delivery rate: 1 gph

Resulting pump speed: 50%
SECTION 17310.1
SLIDE GATE OPERATOR

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install a complete microprocessor based maximum security vehicular slide gate operator system, with a solid-state board to control all functions of the slide gate operator, as described herein and shown on the plans. Include all necessary control boards, power supplies, loop detectors, connectors, and accessories for a complete operational system.

B. This section provides specific details regarding the slide gate operators at Well No. 201, 202, 203, and 205 and is to be utilized in conjunction with Specification Section 17310, Site Access System. Data included herein, including specified materials, shall supersede data specified in Specification Section 17310.

1.02 RELATED WORK

A. Section 02833 Ornamental Steel Fencing and Gates

B. 17310 Site Access System

1.03 QUALITY ASSURANCE

A. Installation shall comply with all applicable codes.

B. All equipment shall be new, in current production, and the standard products of a manufacturer of vehicular gate operator equipment.

C. Manufacturer shall guarantee availability of parts, for a minimum of seven (7) years from date of shipment.

D. If required, manufacturer shall be able to demonstrate features, functions and operating characteristics to the Owner.

E. System shall be installed by a factory authorized contractor, with technicians specifically trained in this system.

F. On-site maintenance and repair service shall be available locally and within four (4) hours of notification for emergency condition.
1.04 REFERENCE STANDARDS


B. Vehicular slide gate fabrication, construction and installation shall conform to ASTM F2200; Standard Specification for Automated Vehicular Gate Construction.

1.05 SUBMITTALS

A. Shall include an equipment list, data sheet(s), system description, block diagrams on equipment to be furnished and electrical wiring diagrams for installation.

B. Shall include all data necessary to evaluate design, quality and configuration of proposed equipment and system(s).

PART 2 - PRODUCTS

2.01 SLIDE GATE OPERATOR SYSTEM

A. The system as described herein is the 9220 series vehicular slide gate operator system, manufactured by DoorKing, Inc., Inglewood, California, or equal.

2.02 SYSTEM DESCRIPTION

A. Slide Gate Operator:

1. The slide gate operator shall use a microprocessor based solid-state control board and speed controller that controls all functions of the slide gate operator. Operator shall be rated for continuous duty for use in commercial and industrial maximum security applications.

2. Gate operator speed shall be adjustable and shall incorporate a slow-start and slow-stop function, except Model 9210, which has a fixed speed of 1-ft/sec. Variable speed operators shall be adjustable from 1-ft/sec to 2-ft/sec.; high speed operators shall be adjustable from 1-ft/sec to 4-ft/sec.

3. Motor shall be directly coupled to the primary gear reduction system.

4. Primary reduction and power transfer shall be provided by a heavy-duty worm gear running in a continuous oil bath.
5. Operator limit switches shall be internally driven and shall not be accessible, easily tampered with or activated from outside the operator cabinet.
6. Pulling medium shall provide a positive mechanical connection to the gate system. Friction driven rail type pulling mediums shall not be allowed. Roller chain pulling medium shall be minimum size #50.
7. Operator shall function as a fail-secure device and shall provide a positive gate lock without the need of additional hardware or equipment.
8. Operator shall be capable of being mounted at the front or center of the gate system and shall be designed for either left or right hand mount.
9. Operator housing shall be G90 galvanized steel painted per color schedule, to protect internal components.
10. Operator shall have two 115 VAC convenience outlets available for accessory transformer power and shall have a built-in lockable power disconnect and reset switch.

B. Control Circuit:

1. A warn-before-operate function shall activate the internal operator alarm 3-5 seconds prior to gate movement.
2. Control board shall have connections for optional Gate Tracker board. Gate tracker shall record operator cycles (x100), input errors, loop detector errors, obstruction hits, and power up events. Record shall be time and date stamped.
3. Control board shall allow a stop or a stop and reverse function (settable) from a reverse related input.
4. Control board shall have two ports for plug in of vehicular loop detectors, (DoorKing, Models 9409 or 9410).
5. A dry set of relay contacts shall be available for external use, and shall have four programmable functions.
6. A special input shall allow the gate to be partially opened.
7. A timer override function shall cause an opening gate to stop and then reverse direction when the reverse loop(s) or reverse input is clear even if the gate has not reached the full open position, to help reduce tailgating.
8. Control board shall have separate inputs for external contact and non-contact entrapment protection devices.
9. Functions will be user programmable by DIP-switches located on the control board.

C. Fail-Secure Operation

1. To prioritize security, operator shall assume a fail-secure (gate remains locked) mode in the event of a power loss.
D. **Entrapment Prevention**

1. Non-contact sensors, or contact sensors, or combination thereof, shall be utilized to prevent persons from becoming entrapped in the gate system.
2. Warning signs shall be installed in accordance with manufacturer’s installation instructions and UL 325 guidelines.

E. A complete operational system shall be provided.

### 2.03 EQUIPMENT

A. **Model 9220 Maximum Security Vehicular Slide Gate Operator Variable Speed.**

   1. Maximum gate weight.
      a. 2,000 Lb. maximum gate weight using #60 roller chain.
   2. 2 HP Continuous duty motor
   3. UL Class of Operation III, IV.
   4. 30:1 heavy-duty gear reducer running in a continuous oil bath.
   5. Enclosed tamper proof limit switches.
   7. Gate speed adjustable 1-2 ft / sec.
   8. Adjustable partial open limit switch.

### 2.04 SECONDARY ENTRAPMENT PREVENTION

A. **Non-Contact Sensors (Photo Cells)**


B. **Vehicle Loop Detectors**

   1. P/N 9409-010 Two channel detector.

### 2.05 OPTIONS REQUIRED

A. Chain tray kit (P/N 2601-270) available in 10-ft sections.

B. Red/Green traffic signal (P/N 1603-208).
C. Key pad actuator type and memory to be determined. Contractor shall install two (2).

D. Gate Tracker Data

1. P/N 2351-010 Gate Tracker control board.

E. Doorking Magnetic Lock, Model No. 1216-081 with 1812-139 24v DC power transformer.

F. Heavy-Duty Pedestal Mounting Stand. Doorking (P/N 9200-135)

PART 3 - EXECUTION

3.01 INSTALLATION

A. This product be shall installed by a qualified technician who is certified by the Institute of Door Dealer Education and Accreditation (IDEA) as a Certified Automatic Gate Operator Installer (CAGOI). Follow manufacture’s installation specifications.

B. Model 9220 series operator shall be mounted on a heavy-duty pedestal mounting stand secured to the concrete mounting pad.

C. Wiring shall be uniform and in accordance with national electric codes and manufacturers instructions.

D. All splices shall be in easily accessible junction boxes or on terminal boards.

E. All cable runs in all junction boxes shall be tagged and identified.

F. Install magnetic lock complete with all required connections.

G. Coordinate all work with other effected trades and contractors.

3.02 SYSTEM INITIALIZING AND PROGRAMMING

A. System shall be turned on and adjustment made to meet requirements of specifications and on-site conditions.

B. System shall function as specified.
3.03 SYSTEM TEST PROCEDURES

A. System shall be completely tested to assure that all components and accessories are hooked-up and in working order.

B. System shall be pre-tested by contractor and certified to function in accordance with plans and specifications.

C. System shall be tested in presence of owner’s representative.

3.04 OWNER INSTRUCTIONS

A. Installation contractor shall conduct up to (1) hour of instruction in use and operation of the system to designated owner representatives, within (30) days of acceptance.

B. Installation contractor shall conduct up to (1) hour of technical training, in troubleshooting and service of the system, to designated owner representatives within (90) days of system acceptance.

3.05 MANUALS AND DRAWINGS

A. Contractor shall provide owner with (2) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.

B. Contractor shall provide owner with (2) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.

END OF SECTION 02574
APPENDIX A

Approved Materials List
Appendix A

APPROVED MATERIALS LIST
(Capital & Developer Projects)

UPDATED
1.11.2021
Eastern Municipal Water District
Approved Materials List

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Appendix A
Rev: 1/11/21
Purpose and General Notes

The purpose of the Approved Materials List is to streamline the materials submittal and review process during construction. Contractors are strongly encouraged to use materials from the Approved Materials List as these will be expedited and do not require a full technical submittal for review by the District prior to material approval, except for pipe submittals. All pipe materials shall be submitted for review and approval. However, Contractors must submit and identify that materials to be used comply with the approved list and/or current Specifications.

Use of “or equal” materials will require a formal and complete submittal subject to review by the Materials Approval Committee (MAC) prior to approval. Any schedule delays as a result of a submittal or use of “or equal” materials will be the sole responsibility of the Contractor.

In the event of a conflict between approved/contract drawings and the Approved Materials List, the approved/contract drawings shall take precedence.

All materials used for potable water systems must meet California Health and Safety Code 116875 (previously AB1953). All materials that come into contact with potable water must be NSF certified or approved (http://www.nsf.org/). All potable water material submittals must include evidence of NSF certification. Please contact staff if any Model numbers listed are out of date or no longer available.

Vendors and Manufacturers wishing to add materials or products to the Approved Materials List shall follow the Vendor Submittal Requirements (https://www.emwd.org/sites/main/files/file-attachments/approvedmaterialsvendorsub.pdf?1578671296) to make a formal submittal to the MAC. Please contact staff for more information.
I. GENERAL
## 1. BACKFLOW PREVENTION & DETECTOR ASSEMBLIES

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Double Check Assemblies (¾” thru 10”) (For Non-Toxic Service)</td>
<td>AMES</td>
</tr>
<tr>
<td></td>
<td>FEBCO</td>
</tr>
<tr>
<td>2. Double Check Detector Assemblies (¾” thru 10”) Std. Drawing. No. B-657</td>
<td>MUELLER</td>
</tr>
<tr>
<td>(For Automatic Sprinkler Systems Containing Non-Toxic Substance)</td>
<td>PRATT-WATTS</td>
</tr>
<tr>
<td></td>
<td>WILKINS</td>
</tr>
<tr>
<td>3. R.P. – Reduced Pressure Assemblies (¾” thru 10”) (For High Hazard Service)</td>
<td>Note: Backflow prevention materials and detector assemblies shall be one of the above listed manufacturers and shall be listed per latest edition of USC-Foundation for Cross-Connection Control and Hydraulic Research “List of Approved Backflow Prevention Assemblies” A web link to the USC list is located at:</td>
</tr>
<tr>
<td>4. R.P. – Reduced Pressure Detector Assemblies (2 ½” thru 10”) (For Automatic Fire Sprinkler Systems Containing Toxic Substances)</td>
<td><a href="https://fccchr.usc.edu/list.html">https://fccchr.usc.edu/list.html</a></td>
</tr>
</tbody>
</table>
## 2. FIRE HYDRANTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BLOW-OFF HYDRANT</td>
<td>JONES</td>
</tr>
<tr>
<td>Model: J-344 – 4” x 1-2 ½”</td>
<td>(EMWD Std. Drawings B-568 &amp; B-561)</td>
</tr>
<tr>
<td>Model: J-342 – 2” x 1-2 ½”</td>
<td>(EMWD Std. Drawing B-374)</td>
</tr>
<tr>
<td>2. BREAK-OFF CHECK VALVE</td>
<td>LONG BEACH IRON WORKS</td>
</tr>
<tr>
<td>Model 400 (for special locations only as determined by Water Operations)</td>
<td></td>
</tr>
<tr>
<td>3. INTERMEDIATE HYDRANT 6” x 2-2 ½”</td>
<td>CLOW</td>
</tr>
<tr>
<td>Std. Drawings B-360 &amp; B-354</td>
<td>Model: Clow Rich Ranger 945</td>
</tr>
<tr>
<td></td>
<td>JONES</td>
</tr>
<tr>
<td></td>
<td>Model: J-3720</td>
</tr>
<tr>
<td></td>
<td>LONG BEACH IRON</td>
</tr>
<tr>
<td></td>
<td>Model: 601-613 Rich East Bay</td>
</tr>
<tr>
<td>4. STANDARD HYDRANT 6” x 1-4” x 12 ½”</td>
<td>AVK</td>
</tr>
<tr>
<td>Std. Drawings B-362 &amp; B-356</td>
<td>Model: 70 (24-70) Series 24</td>
</tr>
<tr>
<td></td>
<td>CLOW</td>
</tr>
<tr>
<td></td>
<td>Model: El Rancho 2050 Bronze</td>
</tr>
<tr>
<td></td>
<td>Model: Ranger 850</td>
</tr>
<tr>
<td></td>
<td>Model: F850, F860 Cast Iron</td>
</tr>
<tr>
<td></td>
<td>JONES</td>
</tr>
<tr>
<td></td>
<td>Model: J-3700 Bronze</td>
</tr>
<tr>
<td></td>
<td>Model: J-4040, J-4060 Cast Iron</td>
</tr>
<tr>
<td></td>
<td>LONG BEACH IRON</td>
</tr>
<tr>
<td></td>
<td>Model: Series 125 Bronze (New Pattern)</td>
</tr>
<tr>
<td></td>
<td>Model: 611 East Bay</td>
</tr>
</tbody>
</table>
## 2. FIRE HYDRANTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 5. SUPER HYDRANT  
6” x 1-4” x 2-2 ½”  
Std. Drawings B-516 & B-517 | AVK  
Model: 90 (24-90) Series 24  
CLOW  
Model: El Rancho 2060 Bronze  
Model: 860  
JONES  
Model: J-3765 Bronze  
LONG BEACH IRON  
Model: LBIW 615  
Model: Series 130 Bronze (New Pattern) |
| 6. WARFHEAD HYDRANT  
4” x 1-2 ½”  
Std. Drawings B-368 & B-357 | JONES  
Model: J-344 HP |
### 3. GASKETS & GROMMETS
**Detailed Provisions Section 15081**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hand Hole Liner Grommets</td>
<td>DIVE/CORR, INC.</td>
</tr>
<tr>
<td>For reservoir roof openings</td>
<td></td>
</tr>
<tr>
<td>2. Meter Gaskets</td>
<td>JONES</td>
</tr>
<tr>
<td>For water meter installations</td>
<td>Model 136: ¾” x 1/16” Leather Meter Washers</td>
</tr>
<tr>
<td></td>
<td>Model 137: 1” x 1/16” Leather Meter Washers</td>
</tr>
<tr>
<td></td>
<td>1 ½” &amp; 2” Rubber-Cloth-Inserted Drop-In Meter Gasket</td>
</tr>
<tr>
<td>3. Ring and Full-Face Gaskets</td>
<td>GARLOCK</td>
</tr>
<tr>
<td>Gaskets for steel and cast-iron flanges shall conform to the requirements of EMWD Std. Drawing B-288 and shall be standard full face for pipe 27” diameter and larger.</td>
<td>TRIPAC Style 5000, non-asbestos</td>
</tr>
</tbody>
</table>
### 4. METER BOXES & VAULTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Meter Boxes</strong></td>
<td></td>
</tr>
<tr>
<td>Concrete or Polymer</td>
<td>ARMORCAST PRODUCTS</td>
</tr>
<tr>
<td>Concrete EMWD Std.</td>
<td></td>
</tr>
<tr>
<td>Drawing B-590, B-591, B-342, B-344</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASSOCIATED CONCRETE PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>12” x 20” A6000485SA (No.37) ½” Polymer Concrete</td>
</tr>
<tr>
<td></td>
<td>13” x 24” A6001946PC-12 (No.38) 1” Polymer Concrete</td>
</tr>
<tr>
<td></td>
<td>BROOKS PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>17” x 30” Model No. 66</td>
</tr>
<tr>
<td></td>
<td>30” x 48” Model No. 68</td>
</tr>
<tr>
<td></td>
<td>EISEL ENTERPRISES (H &amp; C)</td>
</tr>
<tr>
<td></td>
<td>17” x 30” Model No. 666B</td>
</tr>
<tr>
<td></td>
<td>30” x 48” Model No. 68MB</td>
</tr>
<tr>
<td></td>
<td>J &amp; R CONCRETE</td>
</tr>
<tr>
<td></td>
<td>12” x 20” Model No. 4 ½ (No. 37) Polymer Concrete</td>
</tr>
<tr>
<td></td>
<td>13” x 24” Model No. W5 ¼ P (No.38) Polymer Concrete</td>
</tr>
<tr>
<td></td>
<td>17” x 30” Model No. 6B</td>
</tr>
<tr>
<td></td>
<td>30” x 48” Model No. 8</td>
</tr>
<tr>
<td><strong>2. Meter Box Lid Covers</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARMOR CAST PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>Domestic Meter Box Lid Covers (A6000484-H1)</td>
</tr>
<tr>
<td></td>
<td>J&amp;R CONCRETE</td>
</tr>
<tr>
<td></td>
<td>Domestic Meter Box Lid Covers (PC 412 QRP)</td>
</tr>
</tbody>
</table>

Appendix A
Rev: 1/11/21

EASTERN MUNICIPAL WATER DISTRICT
## 4. METER BOXES & VAULTS

### 3. Utility Vaults

<table>
<thead>
<tr>
<th>SIZE</th>
<th>BROOKS CONCRETE PRODUCTS</th>
<th>EISEL ENTERPRISES</th>
<th>J&amp;R PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4' x 4'</td>
<td>#W-300 Series</td>
<td>#EM 4848</td>
<td>#4400-1W</td>
</tr>
<tr>
<td>4' x 6'6”</td>
<td>#W-500 Series</td>
<td>#EM 4878</td>
<td>#4660-2W</td>
</tr>
<tr>
<td>4' x 7'9”</td>
<td>#W-510 Series</td>
<td>#EM 60108</td>
<td>#4686-1W</td>
</tr>
<tr>
<td>4'6” x 8’6”</td>
<td>#W-600 Series</td>
<td>#EM 4896</td>
<td>#4700-1W</td>
</tr>
<tr>
<td>4'6” x 10’6”</td>
<td>#W-610 Series</td>
<td>#EM 60132</td>
<td>#5106-1W</td>
</tr>
<tr>
<td>6’ x 8’</td>
<td>#W-680 Series</td>
<td>#EM 7296</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 4. Valve Boxes

<table>
<thead>
<tr>
<th></th>
<th>BROOKS CONCRETE PRODUCTS</th>
<th>EISEL ENTERPRISES</th>
<th>J&amp;R PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1-RD</td>
<td></td>
<td>#1R-VB-CC</td>
<td>#1-R</td>
</tr>
<tr>
<td>#1-RT</td>
<td></td>
<td>#2VB-VC</td>
<td>#2-R</td>
</tr>
<tr>
<td>#3-RT</td>
<td></td>
<td>#10VB-VC</td>
<td>#3-R</td>
</tr>
<tr>
<td>#4-TT</td>
<td></td>
<td>#4TT VB-VC</td>
<td>#4-T</td>
</tr>
<tr>
<td>#1-SP</td>
<td></td>
<td>#1RVB-CC</td>
<td>#5-R</td>
</tr>
</tbody>
</table>

### 5. Vaults

<table>
<thead>
<tr>
<th></th>
<th>ASSOCIATE CONCRETE</th>
<th>ARMORCAST PRODUCTS</th>
<th>BEST CONCRETE PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>As approved by Engineering</td>
<td></td>
<td></td>
<td>Models MCT-4 and MCT-5</td>
</tr>
<tr>
<td>Polymer Concrete Only</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please note: All meters must be grounded in accordance with manufacturer’s recommendations.

5. **METERS & METER COMPONENTS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Compound Meters 3” thru 6” (cubic-feet register)</td>
<td>SENSUS TECH. INC. Omni C-2 (AMI/AMR Sensus Flex Net, ERC Register)</td>
</tr>
<tr>
<td>2. Electromagnetic Meter 4” thru 10” (domestic) (cubic-feet register)</td>
<td>SENSUS TECH. INC. Model Series DRFS &amp; CFS (Must be with ECR 2 or 3 registers &amp; Absolute Encoder Technology)</td>
</tr>
<tr>
<td>3. Fire Service Meters (Cubic-feet registers) strainer required</td>
<td>ABB Electromagnetic Flowmeter WaterMaster FEP/FET300 Flowmeter system, optimized full bore Remote Mounted Transmitter i) Three-line back-lit graphical display ii) NEMA 4X / remote wall mounted housing or Panel mount depending on application/location iii) Power Supply: 120 VAC iv) Input/Output Signal Type: HART + 20 mA + pulse + contact output ENDRESS &amp; HAUSER Promag 53 W Electromagnetic Flowmeter Remote Mounted Transmitter i) Input/Output Signal Type: Current/HART, frequency, relay, and status input (flexible module) ii) NEMA 4X/remote wall mounted housing or Panel mount depending on application/location iii) 120 VAC, with display, touch control operation SIEMENS Sensor SITRANS F M MAG 5100 W MAG 6000, Polyamide, 120 VAC i) Remote Mounted Transmitter ii) NEMA 4X / remote wall mounted housing or Panel mount depending on application/location Cables Required FDK001STCAB_ _ _ FDK001SPCAB_ _ _ iii) MODBUS RTU/RS 485 Input/Output Signal Type: 4-20 mA output, pulse/frequency and relay output</td>
</tr>
</tbody>
</table>
## 5. METERS & METER COMPONENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. Multi-Jet Water Meter</strong>&lt;br&gt;AWWA (cubic-feet register) Std. Drawings B-590, B-591, B-342, &amp; B-344</td>
<td>MASTER METER&lt;br&gt;½” x ¾”: BL05-2VA-NAA-2 MJ Meters with Acculinx Registers Lead Free Body w/Plastic Bottom, Cubic Feet W/Sensus 520m TP6 Potted&lt;br&gt;¾” x 1 ½” BLO5-2VA-NNA-2 MJ. Meters with Acculinx Registers Lead Free Body w/Plastic Bottom, Cubic Feet W/Sensus 520m TP6 Potted&lt;br&gt;1” meter: BLO5-2VA-NNA-2 MJ. w/Acculinx register, Lead free body w/bronze bottom, CCF registration, w/Sensus 520M TP6 Potted&lt;br&gt;1½” meter: MJ11-2VA-NNA-2 w/Acculinx register. Lead free body w/bronze bottom, CCF registration, w/Sensus 520M TP6 Potted&lt;br&gt;2” meter: MJ13-2VA-NNA-2 w/Acculinx register. Lead free body w/bronze bottom, CCF registration, w/Sensus 520M TP6 Potted</td>
</tr>
<tr>
<td><strong>6. Propeller Flow Meters</strong>&lt;br&gt;Pumping Plants &amp; Agriculture&lt;br&gt;(ECR Register AMI/AMR, FlexNet compatible, acre-feet register)</td>
<td>MCCROMETER&lt;br&gt;MG-900-series&lt;br&gt;MW-900-series&lt;br&gt;MW-500-series&lt;br&gt;SENSUS Tech, Inc.&lt;br&gt;101&lt;br&gt;102</td>
</tr>
<tr>
<td><strong>7. Sports Hydrant Meters</strong></td>
<td>PERFORMANCE METER INC.&lt;br&gt;Model No. FHS20 (Must be with a 2” gate valve)</td>
</tr>
</tbody>
</table>
### 5. METERS & METER COMPONENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Turbine Meters</td>
<td></td>
</tr>
<tr>
<td>A. Landscape</td>
<td>PERFORMANCE METER INC.</td>
</tr>
<tr>
<td>Strainer required</td>
<td>Model No. FHS20 (Must be with a 2” gate valve)</td>
</tr>
<tr>
<td>2” &amp; smaller to have cubic-feet registers</td>
<td>SENSUS TECH. INC.</td>
</tr>
<tr>
<td>3” &amp; larger to have acre-feet register</td>
<td>Model Omni T2 (Turbine) 1.5” thru 6”</td>
</tr>
<tr>
<td>B. Domestic</td>
<td>(ECR Register AMI/AMR Flex Net)</td>
</tr>
<tr>
<td>Cubic-feet register</td>
<td></td>
</tr>
</tbody>
</table>
## 6. NUTS & BOLTS

**Detailed Provisions Section 15089**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nuts &amp; Bolts for Flanged Fittings</td>
<td></td>
</tr>
<tr>
<td>Shall be bare steel conforming to SAE-J429 Grade 5 or ASTM A449 medium carbon steel quenched and tempered, meeting the following requirements, and shall have hex heads and lite pattern hex nuts</td>
<td></td>
</tr>
<tr>
<td>¼” thru 1” Diameter</td>
<td></td>
</tr>
<tr>
<td>Proof Strength – 85,000 PSI</td>
<td></td>
</tr>
<tr>
<td>Yield Strength – 92,000 PSI</td>
<td></td>
</tr>
<tr>
<td>Tensile Strength – 120,000 PSI</td>
<td></td>
</tr>
<tr>
<td>1” thru 1 ½” Diameter</td>
<td></td>
</tr>
<tr>
<td>Proof Strength – 74,000 PSI</td>
<td></td>
</tr>
<tr>
<td>Yield Strength – 81,000 PSI</td>
<td></td>
</tr>
<tr>
<td>Tensile Strength – 105,000 PSI</td>
<td></td>
</tr>
<tr>
<td>2. Nuts &amp; Bolts for 1 ½” &amp; 2” Meter Installations</td>
<td>MARS</td>
</tr>
<tr>
<td>⅝” x 2 ½” Silicon Bronze Hex head. Bolts w/ Bronze Hex Nuts</td>
<td>RELIANCE</td>
</tr>
<tr>
<td>3. Zinc Caps</td>
<td></td>
</tr>
</tbody>
</table>
7. **PAINT SCHEDULE***

<table>
<thead>
<tr>
<th>Item</th>
<th>Color*</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aerator &amp; Clarifier Spray Headers, Effluent Pumps, &amp; Piping</td>
<td>OSHA Safety Red</td>
<td>Sherwin-Williams</td>
</tr>
<tr>
<td>2. Air Valve Assemblies</td>
<td>Koala Bear</td>
<td></td>
</tr>
<tr>
<td>3. Chlorine</td>
<td>OSHA Safety Orange</td>
<td></td>
</tr>
<tr>
<td>4. Electrical</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>5. Fire Hydrants</td>
<td>OSHA Safety Yellow</td>
<td></td>
</tr>
<tr>
<td>6. Fire Hydrant Tops and Nozzle Caps</td>
<td>Red = 500 gpm or less</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Orange = 500-999 gpm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green = 1000-1499 gpm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Light Blue = 1500 gpm or greater</td>
<td></td>
</tr>
<tr>
<td>7. Natural Gas Pipe</td>
<td>OSHA Safety Yellow</td>
<td></td>
</tr>
<tr>
<td>8. Hydrogen Peroxide (H2O2) Equipment</td>
<td>OSHA Safety Yellow</td>
<td></td>
</tr>
<tr>
<td>9. High- &amp; Low-Pressure Air</td>
<td>OSHA Safety Green</td>
<td></td>
</tr>
<tr>
<td>10. Oil</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>11. Potable Water – Pumps, Piping and Appurtenances</td>
<td>Pale Blue / Desert Tan</td>
<td></td>
</tr>
<tr>
<td>12. Reclaimed Water – Piping and Appurtenances</td>
<td>Pantone Purple #513 C or #522 C</td>
<td></td>
</tr>
<tr>
<td>13. Sludge Sewage - Pumps, Piping, and Appurtenances</td>
<td>Rich Brown</td>
<td></td>
</tr>
<tr>
<td>14. Steam Lines</td>
<td>Pale Blue</td>
<td></td>
</tr>
<tr>
<td>15. Water Storage Tanks</td>
<td>Fawn / Buffalo</td>
<td></td>
</tr>
<tr>
<td>16. Water Valve Caps</td>
<td>Pale Blue</td>
<td></td>
</tr>
</tbody>
</table>

*Color shall be selected by Engineering Department staff such that facility blends in with the surroundings (existing terrain) or to ensure permit requirements/conditions of approval are satisfied.
8. **SERVICE SADDLES & TAPPING SLEEVES**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. *Service Saddles for A.C. Pipe 4” thru 12”</td>
<td>JONES</td>
</tr>
<tr>
<td></td>
<td>Model: J-975</td>
</tr>
<tr>
<td></td>
<td>Model: J-979</td>
</tr>
<tr>
<td>2. Service Saddle for C-900 Pipe ¾” thru 2”</td>
<td>CAMBRIDGE BRASS</td>
</tr>
<tr>
<td></td>
<td>Model: 800 Series Hinged Bronze Saddle</td>
</tr>
<tr>
<td>3. *Service Saddles for C-900 Pipe 4” thru 12”</td>
<td>FORD</td>
</tr>
<tr>
<td></td>
<td>Model: S902 and S912 (Style B2 piece bolted design)</td>
</tr>
<tr>
<td></td>
<td>JONES</td>
</tr>
<tr>
<td></td>
<td>Model: J-996-R</td>
</tr>
<tr>
<td></td>
<td>Model: J-996</td>
</tr>
<tr>
<td></td>
<td>MCDONALD</td>
</tr>
<tr>
<td></td>
<td>Model: 3805</td>
</tr>
<tr>
<td></td>
<td>MUELLER</td>
</tr>
<tr>
<td></td>
<td>Model: H-13000</td>
</tr>
<tr>
<td></td>
<td>ROMAC IND.</td>
</tr>
<tr>
<td></td>
<td>Model: B-101</td>
</tr>
<tr>
<td></td>
<td>Model: B-202</td>
</tr>
<tr>
<td>4. *Service Saddles for Ductile Iron Pipe 4” thru 36”</td>
<td>FORD</td>
</tr>
<tr>
<td></td>
<td>Model: F-101</td>
</tr>
<tr>
<td></td>
<td>Model: F-202</td>
</tr>
<tr>
<td></td>
<td>ROMAC IND.</td>
</tr>
<tr>
<td></td>
<td>Model: Romac 101</td>
</tr>
<tr>
<td></td>
<td>Model: Romac 202</td>
</tr>
<tr>
<td></td>
<td>SMITH-BLAIR</td>
</tr>
<tr>
<td></td>
<td>Model: Rockwell 311</td>
</tr>
<tr>
<td></td>
<td>Model: Rockwell 313</td>
</tr>
</tbody>
</table>

*Note: Size 10” & above require double-strap service saddles.*
### 8. SERVICE SADDLES & TAPPING SLEEVES

2 of 2

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. Service Saddles for Steel Pipe Connections</strong></td>
<td><strong>INTERNATIONAL FABRICATORS</strong></td>
</tr>
<tr>
<td>Weld Saddles 1 - ¼” x 4” thru 48”</td>
<td><strong>NORTHWEST PIPE COMPANY</strong></td>
</tr>
<tr>
<td>Weld Saddles 2 - ½” x 4” thru 48”</td>
<td><strong>SOUTHLAND PIPE CO.</strong></td>
</tr>
<tr>
<td>Refer to Std. Drawing B-271</td>
<td><strong>WEST COAST PIPE</strong></td>
</tr>
<tr>
<td><strong>6. Tapping Sleeves for A.C., PVC, &amp; D.I.</strong></td>
<td><strong>FORD PRODUCTS</strong></td>
</tr>
<tr>
<td>4” thru 24”</td>
<td>Model: Fast-Sleeve” 18-8 All Stainless Steel</td>
</tr>
<tr>
<td></td>
<td><strong>JCM IND.</strong></td>
</tr>
<tr>
<td></td>
<td>Model: JCM-432 All Stainless Steel</td>
</tr>
<tr>
<td></td>
<td>Model: JCM-452 All Stainless Steel (14” &amp; above)</td>
</tr>
<tr>
<td></td>
<td><strong>POWERSEAL PRODUCTS</strong></td>
</tr>
<tr>
<td></td>
<td>Model: 3490 All Stainless Steel</td>
</tr>
<tr>
<td></td>
<td><strong>ROBAR</strong></td>
</tr>
<tr>
<td></td>
<td>Model: 6606</td>
</tr>
<tr>
<td></td>
<td><strong>ROMAC IND.</strong></td>
</tr>
<tr>
<td></td>
<td>Model: SST 18-8 All Stainless Steel</td>
</tr>
<tr>
<td></td>
<td><strong>SMITH BLAIR. INC.</strong></td>
</tr>
<tr>
<td></td>
<td>Model: 663 (4” thru 24”)</td>
</tr>
<tr>
<td></td>
<td>Model: 665 (6” thru 12”)</td>
</tr>
<tr>
<td><strong>7. Weld Saddles</strong></td>
<td><strong>INTERNATIONAL FABRICATORS</strong></td>
</tr>
<tr>
<td>Std. Drawing B-271</td>
<td><strong>NORTHWEST PIPE COMPANY</strong></td>
</tr>
<tr>
<td>Epoxy, Coated Fabricated Steel Outlet</td>
<td><strong>SOUTHLAND PIPE CO.</strong></td>
</tr>
<tr>
<td>Scotch 3M – #206N</td>
<td><strong>WEST COAST PIPE</strong></td>
</tr>
<tr>
<td>Schedule 40 Pipe on 4” thru 10”</td>
<td></td>
</tr>
<tr>
<td>½” Wall Pipe on 12” &amp; above</td>
<td></td>
</tr>
</tbody>
</table>
## 9. **UNDER-GROUND UTILITY MARKING TAPE**  
(Non-Detectable Only)

<table>
<thead>
<tr>
<th>Description</th>
<th>Color Code: A.P.W.A.</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAFETY BLUE – Potable Water Systems</td>
<td>Terra Tape</td>
</tr>
<tr>
<td></td>
<td>SAFETY GREEN – Sanitary and Storm Sewer Systems</td>
<td>SHIELDTEC</td>
</tr>
<tr>
<td></td>
<td>SAFETY ORANGE – Telephone, Cable &amp; Telegraph Systems</td>
<td>Thor</td>
</tr>
<tr>
<td></td>
<td>SAFETY PURPLE – Reclaimed Water Lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAFETY RED – Electric Power &amp; Systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAFETY YELLOW – Gas &amp; Oil</td>
<td></td>
</tr>
</tbody>
</table>

Underground utility marking tape shall be in accordance with the A.P.W.A. National Color Code and shall be imprinted with an appropriate legend to define the type of utility line it protects.

Tape shall be of a pigmented polyolefin film with a printed message on one side. The ink used to print the materials shall be permanent and cannot be removed by normal handling or upon underground burial.

The polyethylene shall be chemically inert and shall not degrade when exposed to alkalies, acids, and other destructive substances commonly found in soils.

Tape shall consist of a 4.0 mil overall thickness or as approved by Engineering.
## 10. WATER PIPE & TUBING

### WATER PIPE

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ductile Iron Pipe</td>
<td>PACIFIC STATES</td>
</tr>
<tr>
<td><a href="#">Detailed Provisions Section 15057</a></td>
<td>U.S. PIPE</td>
</tr>
<tr>
<td>AWWA C-600, C-151, C-150, &amp; C-104</td>
<td></td>
</tr>
<tr>
<td>2. High Density Polyethylene Pipe</td>
<td>CHEVRON PHILLIPS CHEMICAL COMPANY</td>
</tr>
<tr>
<td></td>
<td>J-M MANUFACTURING COMPANY, INC.</td>
</tr>
<tr>
<td>3. High Density Polyethylene Pipe</td>
<td>CHEVRON PHILLIPS CHEMICAL COMPANY</td>
</tr>
<tr>
<td></td>
<td>J-M MANUFACTURING COMPANY, INC.</td>
</tr>
<tr>
<td>4. Polyvinyl Chloride (PVC)</td>
<td>CARLON PIPE</td>
</tr>
<tr>
<td><a href="#">Detailed Provisions Section 15064</a></td>
<td>DIAMOND PLASTICS CORP. 4” thru 24”</td>
</tr>
<tr>
<td>4” thru 36” – C900</td>
<td>JOHN-MANSVILLE CO. – “JM”</td>
</tr>
<tr>
<td></td>
<td>NORTH AMERICAN PIPE CORP. (NAPCO, formerly CERTAIN-TEED CORP)</td>
</tr>
<tr>
<td></td>
<td>PW PIPE CO.</td>
</tr>
<tr>
<td></td>
<td>VINYL-TECH – “White Knight”</td>
</tr>
<tr>
<td>5. Steel Pipe (Bare)</td>
<td></td>
</tr>
<tr>
<td>3” thru 10” – standard wall thickness</td>
<td></td>
</tr>
<tr>
<td>12” thru 54”, ⅛” wall thickness minimum</td>
<td></td>
</tr>
<tr>
<td>Steel Certification Required</td>
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</tr>
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</table>
## 10. WATER PIPE & TUBING

### WATER PIPE

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Steel Pipe (CML&amp;C)</td>
<td>CONTINENTAL PIPE MAN</td>
</tr>
<tr>
<td><strong>Detailed Provisions Section 15061</strong></td>
<td>IMPERIAL PIPE</td>
</tr>
<tr>
<td>AWWA C-200, C-205 &amp; C-303 (all classes)</td>
<td>MID AMERICA PIPE</td>
</tr>
<tr>
<td>4” thru 54”</td>
<td>NORTHWEST PIPE COMPANY</td>
</tr>
<tr>
<td></td>
<td>ROSCOE MOSS</td>
</tr>
<tr>
<td></td>
<td>WEST COAST PIPE</td>
</tr>
</tbody>
</table>
## TUBING

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Copper Tubing – Type K Soft Water Service Installations</td>
<td></td>
</tr>
<tr>
<td>ASTM B-88</td>
<td></td>
</tr>
<tr>
<td>¾ thru 2”</td>
<td></td>
</tr>
<tr>
<td>2. Copper Tubing – Type L Rigid Backflow Installations</td>
<td></td>
</tr>
<tr>
<td>ASTM B-88</td>
<td></td>
</tr>
<tr>
<td>¾ thru 3”</td>
<td></td>
</tr>
<tr>
<td>3. Liner Insert (Stainless Steel)</td>
<td>FORD CO.</td>
</tr>
<tr>
<td></td>
<td>#72</td>
</tr>
<tr>
<td></td>
<td>JONES CO.</td>
</tr>
<tr>
<td></td>
<td>J-2806</td>
</tr>
<tr>
<td></td>
<td>MCDONALD</td>
</tr>
<tr>
<td></td>
<td>#6136</td>
</tr>
<tr>
<td></td>
<td>MUELLER CO.</td>
</tr>
<tr>
<td></td>
<td>#505142</td>
</tr>
<tr>
<td>4. Polyethylene Water Service Pipe 1”</td>
<td>DRISCO</td>
</tr>
<tr>
<td></td>
<td>#5100 Ultraline</td>
</tr>
<tr>
<td></td>
<td>WESTFLEX</td>
</tr>
<tr>
<td></td>
<td>Gold Label – Class 200</td>
</tr>
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</table>
II. FITTINGS
1. **BRASS SERVICE FITTINGS**  
**Std. Drawings B-590 – B-591A**  
**1” thru 2” B-342 – B344B**  
1 of 2

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturers</th>
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</thead>
<tbody>
<tr>
<td>1. 1/4-BEND (90 Ell)</td>
<td><strong>CAMBRIDGE</strong></td>
</tr>
<tr>
<td>105 (Series)</td>
<td>L04-44-NL</td>
</tr>
<tr>
<td>105 (Series)</td>
<td>C04-44-NL</td>
</tr>
<tr>
<td>1. Angle Meter Stop</td>
<td><strong>210 (Series)</strong></td>
</tr>
<tr>
<td><strong>FB700-NL</strong> (series)</td>
<td><strong>FV23-666W-NL</strong></td>
</tr>
<tr>
<td><strong>FB1000-NL</strong> (series)</td>
<td><strong>FV23-777W-NL</strong></td>
</tr>
<tr>
<td><strong>FB1100-NL</strong> (series)</td>
<td><strong>FV43-666W-NL</strong></td>
</tr>
<tr>
<td><strong>FB1100-NL</strong> (series)</td>
<td><strong>FV43-777W-NL</strong></td>
</tr>
<tr>
<td>3. Corp Stop Ballcorp</td>
<td><strong>FB700-NL</strong> (series)</td>
</tr>
<tr>
<td><strong>FB1000-NL</strong> (series)</td>
<td><strong>J-1930 (series)</strong></td>
</tr>
<tr>
<td><strong>FB1100-NL</strong> (series)</td>
<td><strong>J-1935</strong></td>
</tr>
<tr>
<td>4. Corp Stop Keycorp</td>
<td><strong>301 (Series)</strong></td>
</tr>
<tr>
<td><strong>F-600 (series)</strong></td>
<td><strong>J-1500 (series)</strong></td>
</tr>
<tr>
<td><strong>F-1000 (series)</strong></td>
<td><strong>J-1505 (series)</strong></td>
</tr>
<tr>
<td><strong>F-600 (series)</strong></td>
<td></td>
</tr>
<tr>
<td>5. Liner Inserts</td>
<td><strong>Ford-72</strong></td>
</tr>
<tr>
<td><strong>Full Circle</strong></td>
<td><strong>316 SS</strong></td>
</tr>
<tr>
<td><strong>Full Circle</strong></td>
<td><strong>#505142</strong></td>
</tr>
<tr>
<td>6. Meter Bushings 1 3/4” x 1”</td>
<td><strong>FORD-34-NL</strong></td>
</tr>
<tr>
<td>7. Meter Flange</td>
<td></td>
</tr>
<tr>
<td>8. Meter Tail Piece (Meter Couplings)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Service Curb Stops (gas-cock)</td>
<td><strong>252NL</strong></td>
</tr>
<tr>
<td></td>
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</tr>
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</table>
# 1. BRASS SERVICE FITTINGS

Std. Drawings B-590 – B-591A
1” thru 2” B-342 – B344B

## 10. Splicing Couplings

<table>
<thead>
<tr>
<th>Item</th>
<th>CAMBRIDGE</th>
<th>FORD</th>
<th>JONES</th>
<th>MCDONALD</th>
<th>MUELLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splicing Couplings</td>
<td>C44-44-NL</td>
<td></td>
<td>J-2609</td>
<td>4758</td>
<td>H-15403</td>
</tr>
<tr>
<td></td>
<td>C22-66-NL</td>
<td></td>
<td>J-2610</td>
<td>4758-22</td>
<td>H-15456</td>
</tr>
<tr>
<td></td>
<td>C44-66-NL</td>
<td></td>
<td>J-1528</td>
<td>4758-33</td>
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<tr>
<td></td>
<td>C22-77-NL</td>
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<td></td>
<td>4756</td>
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<tr>
<td></td>
<td>C44-77-NL</td>
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<td></td>
<td>C84-44-NL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C66-44-NL</td>
<td></td>
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</table>
## 2. DUCTILE IRON FITTINGS

**Detailed Provisions Section 15057**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fittings shall be Ductile Iron and shall conform to ANSI/AWWA C153 / A21.53, ANSI/AWWA C111/A21.11, and ANSI/AWWA C110/A21.10.</td>
<td>ASTM / A536 Restraint Joint</td>
</tr>
<tr>
<td></td>
<td>ONE BOLT, INC.</td>
</tr>
<tr>
<td>Fittings shall be Mechanical Joints or Push-on Joints.</td>
<td>PACIFIC STATES</td>
</tr>
<tr>
<td>Fittings shall be Tar (seal) coated and Cement Mortar lined per ANSI A21.4 (AWWA C104).</td>
<td>PIPELINE COMPONENTS, INC.</td>
</tr>
<tr>
<td></td>
<td>M.J. Compact Fittings – All Sizes</td>
</tr>
<tr>
<td></td>
<td>M.J. Full Body Fittings – All Sizes</td>
</tr>
<tr>
<td></td>
<td>Push-on Fittings – 4” thru 8”</td>
</tr>
<tr>
<td></td>
<td>SERAMPORE INDUSTRIES PRIVATE LTD, INC.</td>
</tr>
<tr>
<td></td>
<td>SIP Industries C110 MJ</td>
</tr>
<tr>
<td></td>
<td>SIGMA CORPORATION</td>
</tr>
<tr>
<td></td>
<td>Sigma/Nappco</td>
</tr>
<tr>
<td></td>
<td>STAR PIPE PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>TYLER UNION</td>
</tr>
<tr>
<td></td>
<td>TufGrip Dual Wedge, Series 1500</td>
</tr>
<tr>
<td></td>
<td>U.S. PIPE</td>
</tr>
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## 3. FLANGES

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Companion Flange</td>
<td>JONES</td>
</tr>
<tr>
<td>Cast Iron, Threaded</td>
<td>Model: J-129. Size: 1 ½” &amp; 2”</td>
</tr>
<tr>
<td>2. Ring Flange</td>
<td>RETECH INC. &amp; CONTINENTAL MANUFACTURING</td>
</tr>
<tr>
<td>Std. Drawing B-288</td>
<td>No. A-36 Steel Ring Flange</td>
</tr>
<tr>
<td>1 ½” thru 54”</td>
<td>No. A-283 “C” Steel Flange</td>
</tr>
<tr>
<td></td>
<td>No. A-283 “D” Steel Flange</td>
</tr>
<tr>
<td>3. Meter Flange</td>
<td>MCDONALD</td>
</tr>
<tr>
<td>Bronze</td>
<td>#610-F. Size: 1 ½” &amp; 2”</td>
</tr>
<tr>
<td>Std. Drawing B-342 thru B-344-B</td>
<td>3” Class “D” Plate Flange with four ⅝” I.D. Bore</td>
</tr>
<tr>
<td></td>
<td>For use on 3” Compound Meter Connection.</td>
</tr>
<tr>
<td>4. Meter Flange</td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td></td>
</tr>
<tr>
<td>Std. Drawing B-633</td>
<td></td>
</tr>
</tbody>
</table>
## 4. FLEX COUPLINGS & FLEXIBLE EXPANSION JOINTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flex Couplings (Compression)</td>
<td>FORD METER PRODUCTS</td>
</tr>
<tr>
<td>Steel &amp; Cast Iron</td>
<td>Model: F-Ringwall Series</td>
</tr>
<tr>
<td>½” thru 36”</td>
<td>ROMAC</td>
</tr>
<tr>
<td></td>
<td>Model: Romac 501 Series</td>
</tr>
<tr>
<td></td>
<td>Model: Macro HP 4” thru 12”</td>
</tr>
<tr>
<td></td>
<td>Alpha Series</td>
</tr>
<tr>
<td></td>
<td>SMITH-BLAIR</td>
</tr>
<tr>
<td></td>
<td>Model: SB-411, SB-441</td>
</tr>
<tr>
<td>2. Flex Expansion Joints</td>
<td>EBBA IRON</td>
</tr>
<tr>
<td>3” thru 36”</td>
<td>Flex-tend</td>
</tr>
<tr>
<td>min. offset: 11” for ≤ 12” diameter</td>
<td></td>
</tr>
<tr>
<td>min. offset: 18” for &gt; 12” diameter</td>
<td></td>
</tr>
</tbody>
</table>
## 5. PIPELINE FITTINGS

### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 1. Joint Restraints | **EBAA IRON**  
2000 PV Series: 4” thru 24” (C-900)  
Model 1100 Series: 3” thru 48”  
2100 Series: 4” thru 12” (C-900)  
2800 Series: 14” thru 36” (C-900)  

**FORD**  
Uni-flange Series Model 200, 900, 1300 & 1400  
Uni-flange Series Model 1500 restraint joint for PVC pipe 4” thru 12”  
Uni-flange Series Model 1390 restraint joint for PVC pipe  

**NAPPCO/SIGMA CORP.**  
Model PV-Lok PVM: 2” thru 12”  
Model PV-Lok PVP: 2” thru 12”  
Model ONE LOK: 4” thru 36”  

**ROMAC INDUSTRIES**  
Grip Ring 4” thru 12”  
Alpha Restrained Joints 4” thru 12”  
Flanged Coupling Adaptor, Coupling, and End Cap  

**SIP INDUSTRIES**  
EZ-Grip  

**SMITH BLAIR**  
Model C111/C120  

**STAR**  
Allgrip 3600: 4” thru 12” for C900 and ductile iron pipe  
Series 1000: 4” thru 12” for C900  
Series 1100: 4” thru 48” for C900 PVC Grip 3500: 4” thru 16” for C-900  
Stargrip 3000: 4” thru 36” for D.I.P.  
PVC Stargrip 4000: 4” thru 36” for C900  

**U.S. PIPE**  
Field Lok Gaskets: 4” thru 12” |
### 5. PIPELINE FITTINGS

2 of 2

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Pipeline Adapters</td>
<td>IMPERIAL PIPE</td>
</tr>
<tr>
<td></td>
<td>NORTH AMERICAN PIPE CORP. (NAPCO, formerly CERTAIN-TEED CORP.)</td>
</tr>
<tr>
<td></td>
<td>ROBAR</td>
</tr>
<tr>
<td></td>
<td>Models 1506, 1508, 1908</td>
</tr>
<tr>
<td></td>
<td>ROMAC IND.</td>
</tr>
<tr>
<td></td>
<td>Model 500 Series</td>
</tr>
<tr>
<td></td>
<td>Alpha Series</td>
</tr>
<tr>
<td></td>
<td>SIGMA CORP.</td>
</tr>
<tr>
<td></td>
<td>Model Sigma/NAPPCO</td>
</tr>
<tr>
<td></td>
<td>SMITH-BLAIR</td>
</tr>
<tr>
<td></td>
<td>Model SB-900 Series</td>
</tr>
<tr>
<td></td>
<td>TYLER UNION</td>
</tr>
</tbody>
</table>
### 6. **VICTAULIC COUPLINGS & FITTINGS**  
*Detailed Provisions Section 15077*

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 1. Grooved Victaulic Couplings and Fittings | **GUSTIN-BACON**  
Model: 100-IPS  
Model: 500-Ductile Iron  
**VICTAULIC CO.**  
Style 31 – Coupling - 3” to 36”  
Style 307 – Transition Coupling – 3” to 12”  
Style 341 – Flange Adaptor – 3” to 24”  
Style 107N – QuickVic Rigid Coupling – 2” to 12”  
Style 177N – QuickVic Flexible Coupling – 2” to 12”  
Style W07 – AGS Rigid Coupling – 14” to 50”  
Style W77 – AGS Flexible Coupling – 14” to 72”  
   w/ Grade “E” Gasket  
Style W741 – AGS Vic-Flange Adapter |
# 7. WELDED STEEL FITTINGS

**Detailed Provisions Section 15059**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Steel Fittings</td>
<td></td>
</tr>
<tr>
<td>Domestic Steel</td>
<td></td>
</tr>
<tr>
<td>Various Sizes</td>
<td></td>
</tr>
<tr>
<td>Shall be fabricated as shown on the contract</td>
<td></td>
</tr>
<tr>
<td>drawings, and/or as specified in the Special</td>
<td></td>
</tr>
<tr>
<td>Conditions.</td>
<td></td>
</tr>
<tr>
<td>Flanges shall conform to the requirements of</td>
<td></td>
</tr>
<tr>
<td>EMWD Std. Drawing B-288 made a part hereof by</td>
<td></td>
</tr>
<tr>
<td>reference.</td>
<td></td>
</tr>
<tr>
<td><strong>Steel Certification Required</strong></td>
<td></td>
</tr>
</tbody>
</table>
III. VALVES
## 1. AIR VALVES

**Detailed Provisions Section 15136**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 1. Air Release Valve ¾” | APCO VALVE CO.  
Model: APCO #65 |
| 2. Air Release and Vacuum Valve Std. Drawings B-598 & B-367 1” & 2” | APCO VALVE CO.  
Model: 143C and 145C  
CLA-VAL CO.  
Model: 361-CAV564B and 362-CAV332  
CRISPIN VALVE CO.  
Model: UL-10 and UL-20  
EMPIRE VALVE CO.  
Model: 940  
VALVMATIC VALVE CO.  
Model: 201C and 202C |
| 3. Air Release and Vacuum Valve Std. Drawing B-578 4” & 6” | APCO VALVE CO.  
Model: 149-C and 150-C  
CLA-VAL CO.  
Model: 364-CAV332 and 366-CAV732-3  
CRISPIN VALVE CO.  
Model: UL-41 (4”) and AL-61/PL-10 (6”) |
| 4. Air Valve Suction Screens Std. Drawings. B-598 & B-367 | FLOW EZY FILTERS, INC.  
M-6-8 (¾”) – Stainless Steel  
M-8-8 (1”) – Stainless Steel  
M-16-8 (2”) – Stainless Steel |
| 5. Pump Air Valve | ARMSTRONG MACHINE WORKS – Model: 21 |
## 2. APPURTEANCES

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| **1. Hose Bibbs (Brass)**  
300-lbs working water pressure  
For Treatment Plants | **CALIFORNIA BRASS MFG. CO.**  
Calco Fig. 101  
**FAIRBANKS VALVE CO.**  
Model: 150-S |
| **2. Valve Cap & Riser**  
Std. Drawing B-668 |  
6” C.I. Valve Cap  
Marked “Water” for Potable Water  
Marked “Recycled” for Recycled Water  
Galv. Split Valve Can Top Section – 6” O.D. x 22Ga. Slip Can length 12”, 18” or 24”, as required.  
Valve Can – 6 ⅝” O.D. x 10 Ga. Double-Dip Pipe |
### 3. BALL VALVES
**Detailed Provisions Section 15104**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ball Valves</td>
<td>LUNKENHEIMER COMPANY</td>
</tr>
<tr>
<td>AWWA C507</td>
<td>MARPAC, INC.</td>
</tr>
<tr>
<td></td>
<td>VALVE TECHNOLOGY CO.</td>
</tr>
<tr>
<td></td>
<td>Models: D7410 – 7420 Series</td>
</tr>
<tr>
<td></td>
<td>Models: D7421 – 7432 Series</td>
</tr>
<tr>
<td>2. Meter Ball Valves (with Handles)</td>
<td>A.Y. MCDONALD</td>
</tr>
<tr>
<td></td>
<td>Model: 6101 MWH (¾” and 1”)</td>
</tr>
<tr>
<td></td>
<td>JAMES JONES CO.</td>
</tr>
<tr>
<td></td>
<td>Jones Model: J1908W (¾” and 1”)</td>
</tr>
<tr>
<td></td>
<td>THE FORD METER BOX CO., INC.</td>
</tr>
<tr>
<td></td>
<td>Model: B13-332 W (¾”)</td>
</tr>
<tr>
<td></td>
<td>Model: B13-444 (1”)</td>
</tr>
</tbody>
</table>
## 4. **BUTTERFLY VALVES**

### Class 150

- **Detailed Provisions Section 15103**
  - AWWA C-504

  Coatings: valves shall have all ferrous parts epoxy coated per AWWA-C550 (fusion bonded).

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Class 150</td>
<td>AMERICAN FLOW CONTROL</td>
</tr>
<tr>
<td>Detailed Provisions Section 15103</td>
<td>Model: A.D. 150 Size: 4”-48”</td>
</tr>
<tr>
<td>AWWA C-504</td>
<td>CLOW CO.</td>
</tr>
<tr>
<td></td>
<td>Model: Clow BFV. Class 150, Size: 4” thru 72”</td>
</tr>
<tr>
<td></td>
<td>CRISPIN (Previously CMB Industries)</td>
</tr>
<tr>
<td></td>
<td>K-FLO Model: 500 Series, 3” thru 20”</td>
</tr>
<tr>
<td></td>
<td>K-FLO Model: 47 Series, 24” thru 48”</td>
</tr>
<tr>
<td></td>
<td>DEZURIK CO.</td>
</tr>
<tr>
<td></td>
<td>Model: Dezurik BFV. Class 150, Size: 4” thru 20”</td>
</tr>
<tr>
<td></td>
<td>KENNEDY</td>
</tr>
<tr>
<td></td>
<td>Model: Kennedy BFV. Class 150 Size: 4” thru 72”</td>
</tr>
<tr>
<td></td>
<td>KUBOTA</td>
</tr>
<tr>
<td></td>
<td>Model: Kubota BFV. Class 150, Size: 24” thru 48”</td>
</tr>
<tr>
<td></td>
<td>M &amp; H CO.</td>
</tr>
<tr>
<td></td>
<td>Model: 4500, Class 150, Size 4” thru 24”</td>
</tr>
<tr>
<td></td>
<td>Model: 1450, Class 150B, Size 30” thru 48”</td>
</tr>
<tr>
<td></td>
<td>MUELLER CO.</td>
</tr>
<tr>
<td></td>
<td>Model: Mueller Lineseal III, Size: 4” thru 24”</td>
</tr>
<tr>
<td></td>
<td>Model: Mueller Lineseal III, Size: 30” thru 48” (with Ductile Iron Disc.)</td>
</tr>
<tr>
<td></td>
<td>PRATT VALVE CO.-</td>
</tr>
<tr>
<td></td>
<td>Model: Pratt Ground Hog BFV. Class 150 with no Power Operation Allowed, Size: 4” thru 12”</td>
</tr>
<tr>
<td></td>
<td>Model: Pratt Ground Hog with Power operation allowed with knowledge of turns. Size: 14” thru 48”</td>
</tr>
<tr>
<td></td>
<td>Model: Pratt Triton XR-70 with Handwheel. Size: 24” thru 48”</td>
</tr>
</tbody>
</table>
### 4. BUTTERFLY VALVES

#### 2 of 2

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Class 250</td>
<td><strong>CRISPIN</strong> (Previously CMB Industries)</td>
</tr>
<tr>
<td></td>
<td>Model: K-FLO 500 Series</td>
</tr>
<tr>
<td></td>
<td><strong>DEZURIK</strong></td>
</tr>
<tr>
<td></td>
<td>Model: BAW Series</td>
</tr>
<tr>
<td></td>
<td><strong>PRATT</strong></td>
</tr>
<tr>
<td></td>
<td>Model: H.P. 250</td>
</tr>
</tbody>
</table>

Coatings: valves shall have all ferrous parts epoxy coated per AWWA-C550 (fusion bonded).
## 5. CHECK VALVES

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bronze Threaded Swing Check Valve ¾” thru 2”</td>
<td>HAMMOND VALVE CO. Model: 946 Bronze</td>
</tr>
<tr>
<td></td>
<td>MILWAUKEE VALVE CO. Model: 510 &amp; 511</td>
</tr>
<tr>
<td></td>
<td>STOCKHAM VALVE CO. Model: B-320</td>
</tr>
<tr>
<td>2. Flanged Swing Check Valves shall be single disc type with spring and lever when so specified on the Bidding Sheet.</td>
<td>APCO VALVE CO.</td>
</tr>
<tr>
<td></td>
<td>CLOW CO.</td>
</tr>
<tr>
<td></td>
<td>KENNEDY VALVE CO.</td>
</tr>
<tr>
<td></td>
<td>M &amp; H CO.</td>
</tr>
<tr>
<td></td>
<td>MUELLER CO./PRATT</td>
</tr>
<tr>
<td></td>
<td>STOCKHAM CO.</td>
</tr>
<tr>
<td>3. Wafer Check Valve w/Viton O-Ring Seal 4 thru 12”</td>
<td>PENTAIR</td>
</tr>
<tr>
<td></td>
<td>Keystone Prince Figure No. 810 &amp; Figure No. 813-S &amp; L</td>
</tr>
<tr>
<td></td>
<td>Short Wafer Body</td>
</tr>
<tr>
<td></td>
<td>Keystone Prince Figure No. F810-004</td>
</tr>
<tr>
<td></td>
<td>Keystone Prince Figure No. F813-519-S&amp;L</td>
</tr>
</tbody>
</table>
### 6. CONTROL VALVES

**Detailed Provisions Section 15120**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control Valves</td>
<td>CLA-VAL CO.</td>
</tr>
<tr>
<td>All control valves shall be flanged</td>
<td></td>
</tr>
<tr>
<td>diaphragm type globe valves, with</td>
<td></td>
</tr>
<tr>
<td>Cast-Iron Body, as manufactured by</td>
<td></td>
</tr>
<tr>
<td>CLA-VAL Co., or approved equal.</td>
<td></td>
</tr>
<tr>
<td>Epoxy shall be Thermo-Setting,</td>
<td></td>
</tr>
<tr>
<td>Conforming to AWWA C-550.</td>
<td></td>
</tr>
<tr>
<td>Delrin Stem. All Control Valves</td>
<td></td>
</tr>
<tr>
<td>other than pressure reducing</td>
<td></td>
</tr>
<tr>
<td>valves shall have Bronze Trim.</td>
<td></td>
</tr>
<tr>
<td>Pressure Reducing Valves shall have</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel Trim.</td>
<td></td>
</tr>
<tr>
<td>2. Pressure Regulators</td>
<td>AMES CO.</td>
</tr>
<tr>
<td>Model: Ames 900 Series</td>
<td>Model: Ames 800 Series</td>
</tr>
<tr>
<td>CLA-VAL CO. Model: Clayton 90</td>
<td></td>
</tr>
<tr>
<td>Series</td>
<td>Model: Clayton 610 Series</td>
</tr>
<tr>
<td>PRATT/WATT CO. Model: Globe</td>
<td></td>
</tr>
<tr>
<td>Fig. 115 – Class 125</td>
<td></td>
</tr>
<tr>
<td>Fig. 1115 – Class 250</td>
<td></td>
</tr>
<tr>
<td>WATT CO.</td>
<td>Model: Watts 25 AUB, Bronze</td>
</tr>
<tr>
<td>WILKINS</td>
<td>Model: Wilkins, 600 Cold Water &amp; Air</td>
</tr>
</tbody>
</table>
### 6. CONTROL VALVES

**Detailed Provisions Section 15120**

#### 3. Pressure Relief Valves

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMES CO.</td>
<td>Model: Ames 800 Series</td>
</tr>
<tr>
<td>CLA-VAL</td>
<td>Model: Series 50 &amp; 51</td>
</tr>
</tbody>
</table>

#### 4. Pump Control Valves

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMES</td>
<td>Model Ames 800 Series</td>
</tr>
<tr>
<td>CLA-VAL</td>
<td>Model: 61-G</td>
</tr>
<tr>
<td>PRATT/WATTS</td>
<td>Model: Globe 513, Class 125</td>
</tr>
<tr>
<td></td>
<td>Model: Angle 1513, Class 250</td>
</tr>
</tbody>
</table>
### 7. GATE VALVES
Std. Drawing Nos. B-590 thru B-344-B

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 1. Bronze Threaded NRS-½” | HAMMOND VALVE CO.  
Model: 606-125 PSI  
MILWAUKEE VALVE CO.  
Model: 105-200 PSI  
STOCKHAM VALVE CO.  
Model: B-103-200 PSI |
| 2. Bronze Threaded NRS ¾” thru 1” | AMERICAN VALVE CO.  
Model: Milano, M-300  
FAIRBANKS VALVE  
Model: 125-S 250  
*F&F VALVE  
Model: 710-Brass  
*KITZ VALVE  
Code No. 27 Fig. AKH  
MILWAUKEE VALVE  
Model: 1105M & #105  
NIBCO VALVE  
Model: T-113-Domestic  
*PIONEER ENTERPRISES  
Model: GTI-0102 & 0103  
RED AND WHITE VALVE  
Model: 206  
STOCKHAM VALVE  
Model: B-103  
WOLVERINE VALVE  
Model: 50293 |
### 7. GATE VALVES
Std. Drawing Nos. B-590 thru B-344-B

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Bronze Threaded NRS 1 ½” thru 2”</td>
<td><strong>AMERICAN VALVE</strong>&lt;br&gt;Model: 3-F Bronze&lt;br&gt;<strong>MILWAUKEE VALVE</strong>&lt;br&gt;Model: 1105M &amp; 105&lt;br&gt;<strong>NIBCO VALVE</strong>&lt;br&gt;Model: T-113, Domestic&lt;br&gt;<strong>STOCKHAM VALVE</strong>&lt;br&gt;Model: B-103</td>
</tr>
<tr>
<td>4. Cast Iron With 2” Operating Nuts for 2” Blow-offs</td>
<td><strong>CLOW VALVE CO.</strong>&lt;br&gt;<strong>IOWA VALVE</strong>&lt;br&gt;Model: List 14&lt;br&gt;<strong>MUELLER VALVE</strong>&lt;br&gt;Model: A-2380-8 &amp; A-2380-6&lt;br&gt;<strong>RENSSELSER VALVE</strong>&lt;br&gt;Model: Ludlow, list 13A&lt;br&gt;<strong>STOCKHAM VALVE CO.</strong></td>
</tr>
<tr>
<td>5. Flange x Hub End Resilient Gate Valves AWWA C-509</td>
<td>Ring-Tite, Fluid-Tite, or Approved Equal</td>
</tr>
</tbody>
</table>
7. GATE VALVES  
Std. Drawing Nos. B-590 thru B-344-B  
3 of 3

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 6. Resilient Seat Gate Valves Flanged AWWA C-509, C-515 and AWWA C-550 EMWD Detailed Provisions Section 15102 4” thru 36” | ACIPCO  
Model: 82-200W-77785-7  
AMERICAN AVK CO.  
Model: 25 AVK  
AMERICAN FLOW CONTROL CO.  
Model: AFC-500 for 4” thru 12”  
Or Series 2500 for 4” thru 36”  
CLOW CO.  
Model: Clow RW, Class 150  
KENNEDY  
Model: Kennedy RS-Class 150  
M & H  
Model: M & H #A-4067  
MUELLER CO.  
Model: A-2360  
STOCKHAM CO.  
Model: Stockham #G700-0  
TYLER  
Model: DRS 250  
U.S. PIPE  
Model: Metroseal, RS Class 150  
WATEROUS CO.  
Model: Waterous #AFC-500 |
8. **PLUG VALVES**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eccentric Fullport Non-Lubricated Plug Valves</td>
<td><strong>DEZURIK</strong></td>
</tr>
<tr>
<td>3” thru 24”</td>
<td>Model: G Series</td>
</tr>
<tr>
<td></td>
<td><strong>HENRY PRATT CO.</strong></td>
</tr>
<tr>
<td></td>
<td>Pratt Keystone 580 Series, #898</td>
</tr>
</tbody>
</table>
IV. SEWER
## 1. MANHOLES & CLEAN-OUTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 1. Clean-Outs (Residential)         | BROOKS PRODUCTS  
Model: 1-RD  
CHRISTY CONCRETE PRODUCTS  
Model: F8  
EISEL ENTERPRISES  
Model: 1VB-VC  
J&R CONCRETE  
Model: V1-R  
LONG BEACH IRON WORKS  
Model: Apex |
| 2. Manhole Covers & Frames 24” & 36”  | ALHAMBRA FOUNDRY  
Model: A-1251 & A-1254  
EVERETT ENTERPRISES  
Model: GTS – Pont-A-Mousson  
FAMEX FOUNDRY  
Model: F-1251 & F-1254  
NATIONAL CASTING CORP.  (formerly NORFOLK CASTING) CORP  
Model: NC-2531  
Model: NC-254  
NEENAH FOUNDRY  
Model: R-1593  
RIVERSIDE FOUNDRY  
Model: 1251 & 1254  
SOUTHBAY FOUNDRY  
Model: SBF-1251 & 1254  
Model: SBF-1348 with Pick Hole for EMWD Standard Drawing SB-30 |
| Std. Drawing SB-61                   | Note: Cast-iron lid to be marked “EMWD Sewer”      |
## 1. MANHOLES & CLEANOUTS

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<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Manhole Covers &amp; Frames Locking Std. Drawing SB-8</td>
<td>ALHAMBRA FOUNDRY</td>
</tr>
<tr>
<td></td>
<td>Model: No. A-1175</td>
</tr>
<tr>
<td>Note: Cast-iron lid to be marked “EMWD Sewer”</td>
<td>FAMEX FOUNDRY</td>
</tr>
<tr>
<td></td>
<td>Model: F-1251</td>
</tr>
<tr>
<td></td>
<td>LONG BEACH IRON WORKS</td>
</tr>
<tr>
<td></td>
<td>Model: RE85R3PD GTS</td>
</tr>
<tr>
<td></td>
<td>NATIONAL CASTING CORP.</td>
</tr>
<tr>
<td></td>
<td>Model: NC-2531</td>
</tr>
<tr>
<td></td>
<td>NEENAH FOUNDRY</td>
</tr>
<tr>
<td></td>
<td>Model: R-1251</td>
</tr>
<tr>
<td></td>
<td>SOUTHBAY FOUNDRY</td>
</tr>
<tr>
<td></td>
<td>Model: SBF-1251</td>
</tr>
</tbody>
</table>
# 1. MANHOLES & CLEANOUTS

## 3 OF 3

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Manhole Shafts, Cones, Flat Tops &amp; Grade Rings 24” thru 48”</td>
<td>AMERICAN HIGHWAY PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>AMERICAN PIPE</td>
</tr>
<tr>
<td></td>
<td>ASSOCIATED CONCRETE</td>
</tr>
<tr>
<td></td>
<td>B &amp; W PRECAST CONSTR.</td>
</tr>
<tr>
<td></td>
<td>HOWARD ENTERPRISES</td>
</tr>
<tr>
<td></td>
<td>INLAND CONCRETE</td>
</tr>
<tr>
<td></td>
<td>MANHOLE BUILDERS</td>
</tr>
<tr>
<td></td>
<td>MAR-CON PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>OLSEN PRECAST</td>
</tr>
<tr>
<td></td>
<td>RIALTO CONCRETE</td>
</tr>
<tr>
<td></td>
<td>SAN DIEGO PRECAST</td>
</tr>
<tr>
<td></td>
<td>SOUTHWEST CONCRETE</td>
</tr>
<tr>
<td>5. Manhole Steps</td>
<td>SOUTHWEST CONCRETE PRODUCTS</td>
</tr>
<tr>
<td></td>
<td>Model: X040PS</td>
</tr>
<tr>
<td></td>
<td>Model: X038PS</td>
</tr>
</tbody>
</table>
### Appendix A

#### 2. SEWER PIPE & FITTINGS

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
</table>
| 1. Reinforced Concrete Pipe | NORTHWEST PIPE  
HYDRO CONDUIT  
RIALTO PIPE |
| 2. Sewer Pipe  
Polyvinyl Chloride (PVC) & Acrylonitrile-Butadiene-Styrene (ABS) | ARMCO PIPE - (CONTECH)  
CARLON PIPE  
DIAMOND PLASTICS CORP.  
SDR 35 PVC |
|  | JM EAGLE  
NORTH AMERICAN PIPE CORP. (NAPCO, formerly CERTAIN-TEED CORP.)  
PRIME CONDUIT VYLON  
21” thru 48”  
VINYL TECH  
White Knight |
| a. PVC sewer fittings  
4” thru 8”  
gravity use only | BUILDING PRODUCTS CO.  
GPK  
JCP COMPRESSION JOINTS  
JM EAGLE  
MULTI-FITTINGS CORP.  
TIGRE  
SDR 35 PVC |
# 2. SEWER PIPES & FITTINGS

## 2 OF 2

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. PVC sewer fittings</td>
<td>SYROCO INC</td>
</tr>
<tr>
<td>4” thru 8”</td>
<td>SDR 35</td>
</tr>
<tr>
<td>gravity use only</td>
<td></td>
</tr>
<tr>
<td>3. Sewer Repair Couplings</td>
<td>MISSION RUBBER</td>
</tr>
<tr>
<td>PVC</td>
<td>MR56 44 ARC MR56 66 ARC MR56 88 ARC MR56 1212 ARC</td>
</tr>
<tr>
<td>Clay</td>
<td>MR01 44 ARC MR01 66 ARC MR01 88 ARC MR01 1212 ARC</td>
</tr>
<tr>
<td>4. Tapping Saddle</td>
<td>JOINTS COUPLINGS</td>
</tr>
<tr>
<td>TAP-N-TEE (Conditional/Emergency use only)</td>
<td></td>
</tr>
<tr>
<td>5. Vitrified Clay Pipe (VCP)</td>
<td>BUILDING PRODUCTS CO.</td>
</tr>
<tr>
<td>Note: fittings to be from same manufacturer as pipe.</td>
<td>JCP Compression Joints</td>
</tr>
<tr>
<td></td>
<td>GLADDING MCBEAN CO.</td>
</tr>
<tr>
<td></td>
<td>“Speed-Seal”</td>
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<td>MISSION CLAY PRODUCTS</td>
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<td>“Band-Seal”</td>
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<td>PACIFIC CLAY PRODUCTS</td>
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<td>“Wedgelock”</td>
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V. ELECTRICAL
## 1. WIRING & BASIC ELECTRICAL MATERIALS

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   Std. Drawing B-660 & B-662                                                                                                                        |               |
|   #4 HMW – PE (High Molecular Wt-Polyethylene Coated)  
   Stranded Wire Black                                                                                                                               |               |
|   #12 TW – Solid Wire – Green or Yellow                                                                                                              |               |
| 2. Locating Wire  
   Std. Drawing B-656                                                                                                                              |               |
|   #14-1 UF Black Copper-Insulated Locating Wire                                                                                                      |               |
### 1. WIRING & BASIC ELECTRICAL MATERIALS

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<td>ALCATEL DEDW</td>
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<tr>
<td>Std. Drawing B-533</td>
<td>Telemetry wire, double-jacketed, filled polyethylene jacket for burial 5-mil copper shield, solid strand 6-pair, 19-gauge copper wire Alcatel DEDW. (Approximately 5,000-foot. Rolls)</td>
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<td></td>
<td>ROYAL WHOLESALE ELECTRIC</td>
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APPENDIX B

Geotechnical Report
In accordance with your authorization and per our proposal dated July 5, 2017, we completed our desktop geotechnical/geology review for the proposed well facilities and alignment. This report summarizes our findings and presents our opinions regarding any potential geotechnical/geologic constraints associated with this project. The results of our review indicate that the constructability of the proposed facilities and pipelines is considered feasible and comparable to similar pipeline construction projects in this area. However, our preliminary findings and conclusions included in this report will be further verified and confirmed during our proposed geotechnical exploration.

If you have any questions regarding this report, please do not hesitate to contact the undersigned. We appreciate this opportunity to be of service on this project.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Simon I. Saiid, GE 2641  
Principal Engineer

Robert F. Riha, CEG 1921  
Senior Principal Geologist

Distribution: (3) Addressee (plus one PDF)
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ACCOMPANYING FIGURES

Figure 1 – Site Location
Figure 2 – Proposed Boring Location Plan (Phase 2 Investigation)
Figure 3 – Regional Geologic Map
Figure 4 – Regional Fault Hazard Map
1.0 EXECUTIVE SUMMARY

Based on our review of published geologic hazard maps, combined with our field observations from a limited site reconnaissance, the constructability of the proposed pipelines and well facilities is considered feasible from a geotechnical perspective. A summary of the main geologic/geotechnical findings or factors that may affect the design and constructability of the proposed improvements is as follows:

- The overall site is underlain by alluvial deposits and surficial fill and/or pavement. These materials should be considered as OSHA soil Type C. Shored excavation should be anticipated.

- The native soils are expected to be suitable for reuse as compacted fill.

- Trench excavation should generally be feasible with heavy-duty conventional excavators in good working condition.

- Groundwater is not expected along the alignment within the anticipated depth of pipeline (shallower than 10 feet).

- The upper 3 to 5 of near surface soils at proposed well equipment and treatment facilities are expected to be relatively loose and potentially compressible if subjected to additional loads. These materials may require removal and recompaction prior to foundation construction.

- This site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone or County of Riverside Fault Zone.

- Actual subsurface exploration (part of our proposed scope) will be required to confirm the above findings and provide pertinent geotechnical/geologic information for proper design and construction of the proposed pipelines.
2.0 INTRODUCTION

2.1 Purpose and Scope

The purpose of this desktop review was to evaluate the geotechnical/geologic conditions based on our in-house and published data and discuss potential geotechnical/geologic concerns and factors that may impact the design and constructability of the proposed improvements. The scope of work included the following activities:

- **Desktop Review**: Review of relevant published geologic reports/maps (see references.).
- **Site Reconnaissance**: Perform a limited site reconnaissance along critical portions of the alignments and well facilities to observe surface/geologic conditions.
- **Report**: Preparation of this report presenting overall geologic conditions within the proposal alignment limit such as site geology, anticipated groundwater depth, active faulting, etc.

2.2 Pipeline Location and Project Description

Based on information provided, we understand that the project consists of equipping 5 groundwater extraction well facilities (well sites 27, 201, 202, 203, and 205), associated conveyance pipelines, and requisite (centralized) groundwater treatment facility. More specifically, the proposed project consists of the following:

- A proposed treatment plant located northeast of East Evans Street and South Hewitt Street in San Jacinto, California. The types of facilities on this site include filter tanks with slab on grade foundations, a small masonry block building for electrical and chemical storage, a booster pump station, and a 0.87 MG steel or concrete storage tank which may be either at grade or partially buried.
- Miscellaneous improvements at 4 well sites (201, 202, 203, and 205) located within less than a mile of the treatment facility.
- Three separate transmission pipelines from the well sites to the treatment plant site at Hewitt Street, approximately 10,000 Linear Feet in total length.
3.0 SITE GEOLOGY

3.1 Site Geology

As shown on Figure 3, Regional Geology Map, the proposed alignment/sites are primarily underlain by alluvial deposits (Qa). These deposits are most likely covered with surficial fill along the alignments within existing streets and can be further described as follows:

- **Artificial Fill:** Artificial fills are expected along the alignments and well facilities and may vary depth and characteristics. Fill within public streets are expected to consist of existing pavement and compacted subgrade.

- **Alluvial-Valley Deposits:** As indicated above, the proposed alignment/sites are primarily underlain by alluvial deposits (Qa). These deposits are expected to consist of sand and silt sand. The engineering characteristics of these materials will require actual field verification.

3.2 Groundwater

Groundwater is not expected to be encountered along the alignment within planned shallow pipeline depths. However, depending on rainfall and seasonal variation, shallow groundwater may exist at shallow depths in the alluvial valley deposits. Historic groundwater data recorded in a nearby well #337761N1169515W001 (California DWR, 2018) indicates groundwater to exist at elevation 1126.42 msl or approximately 448 feet below ground surface (BGS).
4.0 SEISMIC CONDITIONS / FAULTING

4.1 General

The proposed alignment, like the rest of Southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. Based on published data, the most significant known active Fault Zone that is capable of seismic ground shaking and can impact the proposed improvements is the adjacent San Jacinto Fault Zone.

4.2 Fault Rupture

As indicated on Figure 4, the eastern portion of the proposed pipelines, more specifically Well Site 202, is located within a mile of a County and State designated fault hazard zone. This Claremont Segment of the San Jacinto Fault is considered to be active by California Geologist Survey criteria. However, this geologic hazard is typical of many similar pipelines and facilities in Southern California.

4.3 Ground Shaking

The intensity of earthquake ground shaking along the alignment will vary from one location to another depending primarily upon the distance to the fault, the magnitude of the earthquake, and the site-specific geology. The effect of seismic shaking on future facilities along the alignment should be evaluated based on location and/or site-specific geology.

4.4 Secondary Seismic Hazards

The potential for secondary hazards such as ground rupture, seiches and tsunamis, landsliding, rockfalls, ground fissuring, and liquefaction are considered very low for all proposed alignments/sites. The potential for seismic densification due to the presence of relatively loose fill/alluvium should be expected. However, such phenomenon is likely to be regional and differential settlement along pipeline is not expected to exceed 0.5-inch over a distance of 30 feet.
5.0 GENERAL CONCLUSIONS AND RECOMMENDATIONS

The results of our review indicate that the construction of the proposed pipelines/facilities is considered feasible from a geotechnical perspective. The findings and conclusions presented in this report should further evaluated and verified in our next phase of geotechnical exploration.

5.1 Temporary Excavations

Existing alluvial soils and/or artificial fill along portions of the alignment should be considered as OSHA soil Type C. Therefore, unshored temporary cut slopes should be no steeper than 1½:1 (horizontal:vertical), for a height no-greater-than ($\leq$) 20 feet (California Construction Safety Orders, Subchapter 4, Section 1541.1). During construction, exposed earth material conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and geotechnical consultant should be maintained to facilitate construction while providing safe excavations.

5.2 Temporary Shoring

If open cut excavation is not feasible based on requirements above and due to existing structures, excavations for the proposed pipelines should be supported by a temporary shoring system such as cross-braced hydraulic shoring, conventional shields, sheet piles, soldier piles and wood lagging. The choice should be left to the contractor's judgment since economic considerations and/or the individual contractor's construction experience may determine which method is more economical and/or appropriate. The contractor and shoring designer should also perform additional geotechnical studies as necessary to refine the means-and-methods of shoring construction.

5.3 Dewatering during Trenching and Pipeline Construction

Based on the results of this limited review, groundwater is not expected to be a geologic constraint on this project. This condition will be further evaluated and verified in our next phase of geotechnical exploration. If encountered, dewatering will be required to limit instability of the pipeline trench. Dewatering or any other suitable method for stabilizing excavation bottom may be selected by the contractor based on actual groundwater conditions encountered and based on the contractor's chosen means-and-methods of construction.
5.4 **Trenchless Excavation / Bore-and Jack**

Although not anticipated along this alignment, trenchless excavation and/or jack-and-bore operation is feasible from a geotechnical perspective along the alignment. However, further studies should be performed to verify geologic conditions at such locations.

5.5 **Additional Geotechnical Services**

As discussed previously in this report, additional studies (site-specific borings) will be required to further verify the general findings in this report and provide pertinent geotechnical/geologic information for proper design and construction of the proposed pipelines. These additional studies are expected to include a site-specific field explorations (geotechnical borings), and appropriate laboratory testing on representative soils samples to generate basis for design and construction recommendations.
6.0 LIMITATIONS

This report was based primarily upon data obtained from a review of available published data and limited information and observations. Such information is necessarily incomplete. It is understood that site-specific subsurface geotechnical data is necessary for future phases of development. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. This report was prepared in accordance with generally accepted geologic and geotechnical engineering practices at this time in California. No warranty is expressed or implied.

This report was prepared solely for our client for the proposed pipeline alignment. This report is not authorized for use by, and is not to be relied upon by any party except our client with whom Leighton Consulting, Inc. has contracted for the work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton Consulting, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton Consulting, Inc.
REFERENCES


Kennedy, Michael P., 1977, Recency and Character of Faulting along the Elsinore Fault Zone in Southern Riverside County, California, CDMG Special Report 131.

Riverside County Information Technology, 2018, Map My County (website), http://mmc.rivcoit.org/MMC_Public/Viewer.html?Viewer=MMC_Public
SITE LOCATION MAP
EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Approximate Project Alignment
BORING LOCATION MAP
EMWD SJWBE-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Figure 2

Scale: 1" = 400'
REGIONAL GEOLOGY MAP
EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Legend

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Qg</td>
<td>Alluvial sediments: alluvial sand and gravel of major stream channels</td>
</tr>
<tr>
<td>Qa</td>
<td>Alluvial sediments: alluvial sand and clay of valley areas</td>
</tr>
<tr>
<td>Qoa</td>
<td>Older surficial sediments: alluvial gravel and sand of low terrace remnants</td>
</tr>
<tr>
<td>Qog</td>
<td>Older surficial sediments: alluvial gravel and sand of high terrace remnants</td>
</tr>
<tr>
<td>QTs</td>
<td>Bautista beds: sandstone</td>
</tr>
<tr>
<td>gdi</td>
<td>Plutonic rocks: quartz diorite, ranges to granodiorite</td>
</tr>
<tr>
<td>ms</td>
<td>Metasedimentary rocks: schist</td>
</tr>
</tbody>
</table>

Approximate Project Alignment

Scale:
Leighton Base Map: Bing Maps 2018
Thematic Information: Leighton
Map Saved as P:\Drafting\11875\001\Maps\11875-001_F03_RGM_2018-01-23.mxd on 1/23/2018 9:16:11 AM
Author: Leighton Geomatics (mmurphy)
Figure 4

Legend
- Alquist-Priolo Faults
- Riverside County Faults
- County Fault Zone
- San Jacinto Fault Zone

Approximate Project Alignment

REGIONAL FAULT MAP
EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California
GEOTECHNICAL BASELINE REPORT
PROPOSED SAN JACINTO VALLEY WATER
BANKING, ENHANCED RECHARGE AND
RECOVERY PROGRAM PROJECT
PHASE 1 WELL EQUIPPING AND TREATMENT
FACILITIES
EASTERN MUNICIPAL WATER DISTRICT
(EMWD)
SAN JACINTO, CALIFORNIA

Prepared for

TETRA TECH
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Project No. 11875.001

March 27, 2018
March 27, 2018
Project No. 11875.001

TETRA TECH
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Attention: Mr. Steve Ellis, P.E., BCEE
Senior Project Manager – Water/Wastewater

Subject: Geotechnical Baseline Report, Proposed San Jacinto Valley Water Banking, Enhanced Recharge and Recovery Program Project
Phase 1 Well Equipping and Treatment Facilities
Eastern Municipal Water District (EMWD), San Jacinto, California

In accordance with your authorization and our proposals dated July 5, 2017 (revised December 18, 2017), Leighton Consulting, Inc. is pleased to present this Geotechnical Baseline Report (GBR) for the subject project. Primary purpose of the GBR is to establish a contractual statement/baseline of geotechnical/geologic conditions to be encountered during pipeline construction, thereby providing a common basis for bidding. As such, it should be understood that this GBR is meant to reflect a reasonable allocation of risk between EMWD and the Contractor based on available subsurface data to date. Contractors should perform their own exploration, as they deem necessary to characterize this alignment for their intended means and methods of construction. We also recommend that this GBR be read and reviewed in conjunction with our Geotechnical Exploration report performed for this project (Leighton, 2018).

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our Temecula office.

Respectfully submitted,
LEIGHTON CONSULTING, INC.

Simon I. Saiid, GE 2641
Principal Engineer

Robert F. Riha, CEG 1921
Senior Principal Geologist

Distribution: (2) addressee (plus one electronic copy/CD)
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<td>B</td>
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1.0 INTRODUCTION

1.1 Project/Alignment Description

The proposed pipeline alignment is generally located within the right-of-ways (ROW) of existing public roadways as depicted on Figure 1, Site Location Map. The project consists of equipping 5 groundwater extraction well facilities (well sites 27, 201, 202, 203, and 205), associated conveyance pipelines, and requisite (centralized) groundwater treatment facility (see Figure 2). More specifically, this Eastern Municipal Water District’s (EMWD’s) project consists of the following:

- A proposed Hewitt Treatment Plant located northwest of East Evans Street and South Hewitt Street in San Jacinto, California. The types of facilities on this site include filter tanks with slab on grade foundations, a small masonry block building for electrical and chemical storage, a booster pump station, and a 0.87 MG steel or concrete storage tank which may be either at grade or partially buried.

- Miscellaneous improvements at 4 well sites (201, 202, 203, and 205) located within less than a mile of the treatment facility.

- Three separate transmission pipelines from the well sites to the treatment plant site at Hewitt Street, approximately 10,000 Linear Feet in total length. These pipelines will typically have less than 7 feet of cover.

Site topography is generally flat along the proposed alignment and at the well sites.

1.2 Purpose and Scope

Primary purpose of this GBR is to set anticipated geotechnical baseline conditions to be encountered during construction of the proposed pipelines, as a common basis for bidding. This GBR presents an interpretation of geotechnical data collected during our prior subsurface exploration (Leighton, 2018), including estimation/distribution of different materials to be encountered and anticipated behavior of these materials during pipeline construction. Baseline conditions described in this report provide a partial basis for the contractor to prepare construction bids, and serve as the reference for resolution of claims related to differing site conditions. For work affected by subsurface conditions, bids should be based on baseline conditions presented in the GBR and the project plans. For work affected by surface conditions (such as overhead utilities or environmentally restricted areas), bids should be based on observable surface conditions, which can be observed during the site visit and described in contract documents.
Risks associated with conditions consistent with, or less adverse than, these baseline conditions are allocated to the contractor. Those risks associated with conditions more adverse than the baseline conditions are accepted by the Owner. The provision of baseline conditions in the contract is not a warranty that baseline conditions will be encountered. These baseline conditions are rather the contractual standard that the Owner and the successful bidder will agree to use when interpreting differing or unusual site conditions. Owner accepts the risks for conditions that are less favorable than the stated baseline conditions and will negotiate with the contractor for additional compensation if these four conditions exist:

- The contractor has demonstrated that they were able to perform the work within the baseline conditions prior to encountering a change in conditions.
- The actual conditions encountered are more adverse than baseline conditions.
- The contractor can document that the geotechnical conditions are more adverse than those described in this GBR and that exposed conditions materially and significantly increased cost and/or time required to complete the work.
- The contractor has made diligent efforts to complete the work described in the contract documents, including any changes to methods, equipment, labor and materials made necessary by the more adverse conditions.

If all of the foregoing conditions are met, then additional compensation will be negotiated, based on the provisions described in project contract documents.

1.3 Hierarchy of Documents
This GBR was prepared based primarily on our previous subsurface exploration report (Leighton, 2018); which provides details of the geotechnical exploration, drilling methods, laboratory testing procedures and test results, and provides recommendations for design and construction of this pipeline project. Baseline conditions presented in this GBR shall take precedence over geotechnical conditions presented in the referenced report.

1.4 Materials Sources and Reviewed Reports
In addition to our previous subsurface exploration report (Leighton, 2018), we have performed a review of published geologic maps and in-house data relevant to this area (see References).
2.0 GEOTECHNICAL CONDITIONS

Presented below are “baseline” site geologic/geotechnical conditions based on review of pertinent literature and the site-specific field exploration (Leighton, 2018).

2.1 Regional Geology

The overall site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. This province is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the project area is located within the San Jacinto Valley, southwest of the San Jacinto River. The San Jacinto Valley is a relatively flat lying depositional surface flanked by northwest trending hills and mountains. This valley is divided on the east by an alluvial filled graben and on the west by a broad, gently eastward sloping alluvial fan. This northwest trending graben is bounded on the northeast by the main trace of the San Jacinto Fault, and on the southwest by the Casa Loma segment of the San Jacinto Fault Zone.

Sediment from the San Jacinto River has filled the San Jacinto Valley. The thickness of the sediment extends below depths 500 feet in the southwest portion of the valley. Seismic and gravity surveys indicate that approximately 6,500 feet to 7,900 feet of alluvial sediment cover the basement bedrock in the valley (Lofgren, 1975 and 1976).

2.2 Geologic Hazards

Geologic hazards including liquefaction and earthquake faulting are presented in the referenced geotechnical report (Leighton, 2018).

2.3 Subsurface Conditions

The proposed well sites and pipeline alignments are underlain by alluvial valley deposits and surficial fill materials associated with existing streets subgrade/surface improvements. The fill/alluvial soils generally consisted of silty sand (SM) and well- to poorly-graded sand (SW/SP) with few gravel. Interbedded layers of sandy silt (ML) and silty-sandy clay (CL) were also encountered, especially along the western portion of the overall project area. These sandy silt and clay layers were encountered closest to the surface at Hewitt Treatment Plant. Based on available subsurface exploration data, baseline estimates for soils along this alignment in the upper 10 feet below existing ground surface are tabulated below:
Table 1. Baseline Estimates / Ranges (Upper 10 feet)

<table>
<thead>
<tr>
<th>Material</th>
<th>Ranges for Entire Alignment</th>
<th>Baseline Estimate</th>
<th>Basis for Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy Soils SM/SC/SP/SW</td>
<td>70 to 90%</td>
<td>-</td>
<td>Borings Logs</td>
</tr>
<tr>
<td>Silty/clayey Soils ML/CL Materials</td>
<td>10 to 30%</td>
<td>30%</td>
<td>Borings Logs</td>
</tr>
<tr>
<td>Cobbles</td>
<td>1 to 15%</td>
<td>15%</td>
<td>Borings Logs</td>
</tr>
</tbody>
</table>

Where our borings penetrated existing asphalt, the measured thickness of asphaltic concrete and aggregate base layers are listed in Table 2 below.

Table 2. Existing Pavement Thickness

<table>
<thead>
<tr>
<th>Boring #</th>
<th>Location (see Figure 4)</th>
<th>Approx. AC Thickness (Inches)</th>
<th>Approx. Aggregate Base Thickness (Inches)</th>
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</thead>
<tbody>
<tr>
<td>LB-2</td>
<td>E 7th Street</td>
<td>4.0</td>
<td>11.0</td>
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<td>LB-4</td>
<td>E Shaver Street</td>
<td>5.0</td>
<td>5.0</td>
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<tr>
<td>LB-8</td>
<td>Old Second Street</td>
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<td>4.0</td>
</tr>
<tr>
<td>LB-9</td>
<td>E Evans Street</td>
<td>4.5</td>
<td>6.0</td>
</tr>
<tr>
<td>LB-10</td>
<td>E Evans Street</td>
<td>3.5</td>
<td>7.0</td>
</tr>
</tbody>
</table>

*Borings not listed were not drilled through pavement.

2.4 Surface and Groundwater

Groundwater is not expected to be encountered along the pipeline alignment or at the well sites within the depth explored (10 to 25 feet). However, depending on rainfall and seasonal variation, groundwater (or perched water) may exist at shallow depths in these alluvial deposits. Historic groundwater data recorded in a nearby well #337761N1169515W001 (California DWR, 2018) indicates groundwater levels to exist at elevation 1126.42 msl or approximately 448 feet below ground surface (BGS).
3.0 CONSTRUCTION RECOMMENDATIONS

3.1 Summary of Findings
Soils along the pipeline alignment should be readily excavated by conventional trench excavating equipment (backhoes/excavators) in good working conditions using conventional cut-and-cover methods. Soils along this alignment will predominantly be **Type C** Cal OSHA classified soils, as cohesionless and subject to caving.

3.2 Earthwork Considerations
Earthwork associated with the proposed pipelines should be performed in accordance with applicable EMWD Specifications, “Standard Specifications for Public Works Construction” (Greenbook, latest edition) and the project plans and specifications. Trench excavation should be performed in accordance with the project plans, specifications, and all applicable Cal-OSHA requirements. The contractor should expect and consider the following during pipe installation:

- **Pipeline Subgrade**: Where excavation/compaction cause a yielding subgrade or groundwater or very moist soils (typically >15% moisture or more than 4% above optimum per ASTM 1557) are encountered or the subgrade become disturbed due to localized seepage or surface water, the contractor should excavate these soils to a maximum depth of 2 feet and replace with dryer or more suitable materials to provide a stable bottom. Crushed rock (½-inch maximum size) may be used if found necessary to stabilize bottom of trench prior to placing bedding materials.

- **Well Sites / Pad Subgrade**: The subgrade preparation for any settlement sensitive structure at the well sites should consist of over-excavation (OX) of a minimum 5-foot below existing ground surface or 3 feet below design subgrade level, whichever is deeper. Elsewhere for any miscellaneous structures or pavement construction, a minimum of 2-foot OX should be performed. This fill should be compacted to minimum of 90 percent relative compaction per ASTM 1557. Native soils are generally considered suitable as backfill / structural fill for proposed pads.

- **Bedding Materials**: Prior to backfilling, pipes should be bedded in and covered with a uniform, granular material that has a Sand Equivalent (SE) of 30 or greater, and a gradation meeting requirements of the pipe manufacturer. Onsite soils are expected to be too silty to be considered for bedding material. A minimum cover of 12 inches of bedding material should be provided above the top of the pipe.
- Trench Backfill: Native soils are generally considered suitable as backfill materials over the pipe bedding zone. However, in some areas, such as in the vicinity of LB-6 and LB-8 (up to 30 percent of overall excavated soils), the silty/clayey soils may be too moist and require to be dried back to near optimum moisture content in order to achieve relative compaction. In some areas, it might be more cost-effective to remove and replace these moist materials with dryer (or near optimum moisture) soils.

- Shrinkage/Subsidence: Change in volume of excavated and recompa cted soil varies according to initial density, which is a function of soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompa ction. Subsidence occurs as natural ground is moisture-conditioned and densified to receive fill. The baseline estimates for earth volume changes during proper recompa ction are as follows:
  
  ➢ Shrinkage: Shrinkage due to recompa ction of soils will vary with depth (shrinkage typically decreases with depth). We estimate shrinkage to range from 8 to 16 percent in the upper 10 feet BGS.
  
  ➢ Subsidence: Subsidence due solely to scarification, moisture conditioning and recompa ction of the exposed bottom of trench, is estimated to be on the order of 0.1 foot or less. This should be added to the above shrinkage value for the recompa cted fill zone to calculate overall recompa ction lowering of grade.

3.3 Temporary Excavations

During construction, exposed earth material conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor is responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Existing artificial fill and alluvial soils encountered are classified as OSHA soil Type C. Therefore, unshored temporary excavations should be no steeper than 1½:1 (horizontal:vertical), for a height no-greater-than (≤) 20 feet (California Construction Safety Orders, Appendix B to Section 1541.1, Table B-1). These recommended temporary excavations assume a level ground surface for a distance equal to one-and-a-half (x1.5) the depth of excavation. For steeper temporary slopes, deeper excavations, and/or where sloping terrain exists within close proximity to excavation (<1.5xdepth), appropriate shoring methods or flatter slopes may be required to protect the workers in the excavation and adjacent improvements. Such methods should be implemented by the contractor and approved by the geotechnical consultant.
If the sloped open cut excavation is not feasible based on requirements above and due to existing pavements, utilities and/or structures, excavations for the proposed pipeline should be supported by a temporary shoring system such as cross-braced hydraulic shoring, conventional shields, sheet piles, and/or soldier piles and wood lagging. Choice of shoring system should be left to the contractor’s judgment since scheduling, economic considerations and/or the individual contractor’s construction experience may determine which method is more economical and/or appropriate. The contractor and shoring designer should also perform additional geotechnical studies as necessary to refine the means-and-methods of shoring construction.

Shoring systems should be designed by a California licensed civil or structural engineer. As preliminary design guidelines, we present the following geotechnical parameters for shoring design. The following lateral earth pressures are recommended for temporary shoring supporting encountered alignment soils with level ground behind the shoring. Passive pressure also may be used to compute lateral soil resistance, if necessary, for sheet piles. Earth pressures provided are ultimate values and a safety factor should be applied as appropriate.

**Table 3. Static Lateral Earth Pressures**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Static Equivalent Fluid Weight (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active (cantilever)</td>
<td>36</td>
</tr>
<tr>
<td>At-Rest (braced)</td>
<td>55</td>
</tr>
<tr>
<td>Passive</td>
<td>300</td>
</tr>
</tbody>
</table>

1. For temporary excavations only, with level backfill, not including surcharges
2. Passive equivalent fluid pressure may be doubled for isolated soldier piles spaced at least 2½ diameters on-center. Passive resistance should not exceed 3,000 pounds-per-square-foot (psf)

Determination of appropriate design conditions (active or at-rest) depends on shoring flexibility. If a rotation of more than 0.001 radian (0.06 degrees) is allowed, active pressure conditions apply; otherwise, at-rest condition governs.

Surcharge loads (dead or live) should be added to the indicated lateral earth pressures and should be applied uniformly, if such loads are within a horizontal distance that is less-than the exposed shoring height. The corresponding lateral earth pressure will approximately be 33-percent of the vertical surcharge for active conditions, and 50-percent for at-rest conditions. Surcharge pressures from
concentrated loads should be evaluated after geometric constraints and loading conditions are determined on individual basis.

3.4 Dewatering During Trench Excavations

If encountered in trench excavations, groundwater control, such as dewatering, will be required to limit instability of the pipeline and aid in foundation construction and soil backfill. Dewatering or any other suitable method for stabilizing excavation bottom may be selected by the contractor based on actual groundwater conditions encountered and based on the contractor’s chosen means-and-methods of construction. The selected method by the contractor should be able to effectively mitigate bottom-heave for stabilize subgrade soils during pipe installation and backfilling. Discharge of groundwater during excavation should comply with all environmental regulations.
4.0 LIMITATIONS

Baseline conditions were developed using judgment to interpolate and/or extrapolate between exploration locations and laboratory data. This judgment applied in the interpolations and extrapolations reflects the views of the Owner and design consultant team in describing baseline conditions. No amount of exploration, testing, and analysis can precisely predict subsurface characteristics and behavior during construction. Ground behavior in response to construction often depends on the means-and-methods of construction selected by the contractor including equipment, operators, techniques, materials and procedures.

This GBR is only valid for the project described on Figure 2 and in Section 1.1 of this report. Changes in horizontal or vertical alignment or project location will require reevaluation by Leighton Consulting, Inc.
REFERENCES


BORING LOCATION MAP
EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

LEGEND:
- WELL WASTE LINE
- PROPERTY LINE
- EXISTING STORM DRAIN
- PERCOLATION BASIN
- WELL DISCHARGE LINE
- EXISTING PERCOLATION BASIN

Approximate Boring Location
Approximate Percolation Test Location

Scale: 1" = 400'  Date: January 2018

Project: 11875.001  Eng/Geo: SIS/RFR

Map Saved as P:\Drafting\11875\001\Maps\11875-001_F02_BLM_2018-01-17.mxd on 1/31/2018 9:15:16 AM

Figure 2
REGIONAL GEOLOGY MAP
EMWD SJVWB-ERRP Phase 1
Well Equipping and Treatment Facilities
San Jacinto, California

Legend

- **Qg**: Alluvial sediments: alluvial sand and gravel of major stream channels
- **Qa**: Alluvial sediments: alluvial sand and clay of valley areas
- **Qoa**: Older surficial sediments: alluvial gravel and sand of low terrace remnants
- **Qog**: Older surficial sediments: alluvial gravel and sand of high terrace remnants
- **QTs**: Bautista beds: sandstone
- **gdi**: Plutonic rocks: quartz diorite, ranges to granodiorite
- **ms**: Metasedimentary rocks: schist

Approximate Project Alignment
APPENDIX A

Geotechnical Borings

Relatively undisturbed soil samples were obtained at selected intervals within the borings using a California ring sampler, with 2.42-inch inside diameter brass rings, driven into the soil with a 140-pound hammer free falling 30-inches in general accordance with ASTM Test Method D3550. The numbers of blows required for each 6 inches of drive penetration were noted in the field and are recorded on the boring logs. Unless otherwise indicated, the blows per foot recorded on the boring logs represent the number of blows required to drive 18 inches in 6 inch increments. In addition, disturbed bag (or bulk) samples were also obtained from soil cuttings. Types of samples obtained from each location are shown on the boring logs at corresponding depths. Our borings were backfilled with soil cuttings obtained during the drilling. Representative earth-material samples obtained from these subsurface explorations were transported to our Temecula geotechnical laboratory for evaluation and appropriate testing.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.
# GEOTECHNICAL BORING LOG LB-1

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Inches</th>
<th>Dry Density pcf</th>
<th>Moisture, Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>N, S</td>
<td>B-1</td>
<td>R-1</td>
<td>5 12 8</td>
<td>101</td>
<td>3</td>
<td>SM</td>
<td>SA, MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-2</td>
<td>R-2 R-2</td>
<td>4 7 10</td>
<td>100</td>
<td>2</td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-3</td>
<td>R-3</td>
<td>6 12 13</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-4</td>
<td>R-4</td>
<td>8 11 12</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-5</td>
<td>R-5</td>
<td>12 25 31</td>
<td>107</td>
<td>2</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R-5</td>
<td>R-5</td>
<td>13 19 21</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

- **SILTY SAND, medium dense, brown, dry to moist, fine to coarse sand (20% fines, MD: 125.7 @ 9.8%)**
  - with gravel and cobbles, medium dense, grayish brown, moist, fine sand

- **loose, light brownish gray, dry to moist, fine to coarse sand**

- **medium dense, light gray, moist, fine to coarse sand with fine gravel**

- **Well-graded SAND with SILT, medium dense, grayish brown, moist, fine to coarse sand with fine gravel**

- **Well-graded SAND, dense, grayish brown, dry to moist, fine to coarse sand with fine gravel, some gravel**

- **SILTY SAND, medium dense, grayish brown, moist, fine to medium sand, micaceous**

Drilled to 25'. Sampled to 26.5'.

Groundwater not encountered.

Backfilled with soil cuttings (1/8/18)
# GEOTECHNICAL BORING LOG LB-2

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP-SM</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>R-1</td>
<td></td>
<td>7</td>
<td>10T</td>
<td>3</td>
<td>Poorly graded SAND with SILT, medium dense, brown, dry to moist, fine to medium sand, few gravel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B-1</td>
<td></td>
<td>8</td>
<td>10</td>
<td>3</td>
<td>SW</td>
<td>SA, CR, SE, MD</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>R-2</td>
<td></td>
<td>11</td>
<td>112</td>
<td>2</td>
<td>Well-graded SAND, medium dense, light gray, dry to moist, fine to coarse sand with fine gravel, few silt (3% fines, SE=55, MD: 116.8 @ 11.2%)</td>
<td></td>
</tr>
</tbody>
</table>

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Drilled to 10'
Sampled to 11.5'
Groundwater not encountered
Backfilled with soil cuttings and quickrete concrete on top (1/8/18)

## Soil Description

- **Mixture:**
  - Poorly graded SAND with SILT, medium dense, brown, dry to moist, fine to medium sand, few gravel
  - Well-graded SAND, medium dense, light gray, dry to moist, fine to coarse sand with fine gravel, few silt (3% fines, SE=55, MD: 116.8 @ 11.2%)

## Sample Types

- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

## Type of Tests

- DIRECT SHEAR
- SIEVE ANALYSIS
- EXPANSION INDEX
- HYDROMETER
- SPECIFIC GRAVITY
- UNCONFINED COMPRESSIVE STRENGTH
- UNDRAINED TRIAXIAL
- POCKET PENETROMETER

---

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***
### SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Feet</th>
<th>Dry Density pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>91</td>
<td>3</td>
<td>SM</td>
<td>SILTY SAND, loose, light brown, dry, fine to medium sand</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>R-1</td>
<td>5</td>
<td>7</td>
<td>11</td>
<td>SWW</td>
<td>Well-graded SAND with GRAVEL, medium dense, light gray, dry, fine to coarse sand, some silt</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>R-2</td>
<td></td>
<td>5</td>
<td>88</td>
<td>3</td>
<td>medium dense, light yellowish brown, dry to moist, fine to coarse sand, some gravel and trace cobbles</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>R-3</td>
<td></td>
<td>12</td>
<td>18 23</td>
<td>111 3</td>
<td>medium dense, light brownish gray, moist, fine to coarse sand, some gravel, micaceous</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>R-4</td>
<td></td>
<td>23</td>
<td>50-5&quot;</td>
<td>Cl</td>
<td>SANDY Lean CLAY, hard, grayish brown, dry to moist, fine to medium sand, some calcium carbonate</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>R-5</td>
<td></td>
<td>23</td>
<td>36 42</td>
<td>SM</td>
<td>SILTY SAND, dense, grayish brown, dry to moist, fine sand, some interbedded clay layers</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td>R-6</td>
<td></td>
<td>25</td>
<td>40 50</td>
<td>SC-SM</td>
<td>SILTY, CLAYEY SAND, dense, grayish brown, dry to moist, fine sand, few gravel</td>
<td></td>
</tr>
</tbody>
</table>

**Sample Types:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**Type of Tests:**
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE

* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *
## GEOTECHNICAL BORING LOG LB-4

**Project No.** 11875.001  
**Date Drilled** 1-8-18  
**Project** EMWD Well Head Treatment Facilities  
**Logged By** BSS  
**Drilling Co.** 2R Drilling  
**Hole Diameter** 8"  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Boring Location Map  
**Sampled By** BSS

---

## SOIL DESCRIPTION

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<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Attitudes</th>
<th>Soil Class</th>
<th>Moisture Content, %</th>
<th>Dry Density (pcf)</th>
<th>Blows Per 6 Inches</th>
<th>Soil Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>N</td>
<td>SM</td>
<td>-200, CR, SE</td>
<td>5 inches Asphalt over 5 inches Base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S</td>
<td>SM</td>
<td>some gravel (SE = 19, 24% fines)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>S</td>
<td>SM</td>
<td>medium coarse sand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>S</td>
<td>SM</td>
<td>medium dense, olive brown, moist, fine sand, porous (CO = -0.15%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SM</td>
<td>Drilled to 10'</td>
<td>Sampled to 11.5'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>SM</td>
<td>Groundwater not encountered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>SM</td>
<td>Backfilled with soil cuttings and quikrete concrete on top (1/8/18)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**TYPE OF TESTS:**
- Direct Shear (DS)
- Sand Equivalent (SE)
- Sieve Analysis (SA)
- Expansion Index (EI)
- Hydrometer (HD)
- Maximum Density (MD)
- Pocket Penetrometer (PP)
- Undrained Triaxial (UU)

---

*This log is a part of a report by Leighton and should not be used as a stand-alone document.*
<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>R-1</td>
<td></td>
<td>N S</td>
<td></td>
<td>5 9 13</td>
<td>94</td>
<td>5</td>
<td>SM</td>
<td>SILTY SAND, medium dense, brown, dry to moist, fine sand</td>
</tr>
<tr>
<td>10</td>
<td>R-2</td>
<td></td>
<td>N S</td>
<td>7 9 13</td>
<td>115 12</td>
<td></td>
<td></td>
<td>ML</td>
<td>SANDY SILT, stiff, grayish brown, dry to moist, fine sand, some caliche</td>
</tr>
<tr>
<td>15</td>
<td>R-3</td>
<td></td>
<td></td>
<td>13 16</td>
<td></td>
<td></td>
<td></td>
<td>CL-ML</td>
<td>SILTY CLAY with sand, stiff, grayish brown, moist, fine sand, some Silty SAND</td>
</tr>
<tr>
<td>20</td>
<td>R-4</td>
<td></td>
<td>N S</td>
<td>23 28 35</td>
<td></td>
<td></td>
<td></td>
<td>SW</td>
<td>Well-graded SAND, dense, light gray, dry, fine to coarse sand with fine gravel</td>
</tr>
<tr>
<td>25</td>
<td>R-5</td>
<td></td>
<td></td>
<td>13 27 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>dense, light gray, dry, fine to coarse sand with fine gravel, some clay at the bottom</td>
</tr>
</tbody>
</table>

**SOIL DESCRIPTION**

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

**SAMPLE TYPES:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**TYPE OF TESTS:**
- DIRECT SHEAR
- EXPANSION INDEX
- HYDROMETER
- MAXIMUM DENSITY
- UNCONFINED COMPRESSIVE STRENGTH

---

**This log is a part of a report by Leighton and should not be used as a stand-alone document.***
### SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Densitypcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>N</td>
<td>S</td>
<td>R-1</td>
<td>5 6 8</td>
<td>107</td>
<td>3</td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY SAND, loose, grayish brown, dry, fine sand, few gravel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>loose, olive brown, moist, fine sand, some coarse sand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R-2</td>
<td>5 5 7</td>
<td>93</td>
<td>2</td>
<td>ML</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SANDY SILT, stiff, grayish brown, moist, fine sand, (CO = 0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R-3</td>
<td>6 8 10</td>
<td>95</td>
<td>10</td>
<td>CL-ML</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY CLAY with sand, stiff, dark grayish brown, moist, fine sand, micaceous</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R-4</td>
<td>25 25 21</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY SAND, dense, olive brown, dry to moist, fine sand, micaceous, some oxidation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R-5</td>
<td>12 20 30</td>
<td>107</td>
<td>3</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Well-graded SAND, dense, light gray, dry, fine to coarse sand with fine gravel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R-6</td>
<td>15 23 32</td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY SAND, dense, dark olive brown, moist, fine to coarse sand, some interbedded clay layers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Drilled to 25'</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sampled to 26.5'</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Groundwater not encountered</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Backfilled with soil cuttings (1/8/18)</td>
<td></td>
</tr>
</tbody>
</table>

**Sample Types:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**Type of Tests:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***
**GEOTECHNICAL BORING LOG LB-7**

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Densitypcf</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>N</td>
<td>B-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>SA, EI, MD</td>
</tr>
<tr>
<td>5</td>
<td>N</td>
<td>R-1</td>
<td>4 6 11</td>
<td>112</td>
<td>8</td>
<td></td>
<td></td>
<td>SILTY SAND, medium dense, grayish brown, dry to moist, fine to medium sand, trace gravel (44% fines, 1% gravel, EI = 10, MD: 127.3 @ 9.7)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S</td>
<td>R-2</td>
<td>5 11</td>
<td>111</td>
<td>14</td>
<td></td>
<td></td>
<td>medium dense, grayish brown, moist, fine to medium sand</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>S</td>
<td>R-3</td>
<td>8 9 12</td>
<td>105</td>
<td>10</td>
<td></td>
<td></td>
<td>medium dense, olive brown, moist, fine sand, micaceous, some interbedded silt layers</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>S</td>
<td>R-4</td>
<td>8 9 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lean CLAY with SAND, medium stiff, dark grayish brown, moist, fine sand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SILTY SAND, medium dense, dark olive brown, moist, fine sand, micaceous</td>
<td></td>
</tr>
</tbody>
</table>

- **LOGGED BY**: BSS
- **DATE DRILLED**: 1-8-18
- **SAMPLED BY**: BSS

**SOIL DESCRIPTION**

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**SAMPLE TYPES:**
- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**TYPE OF TESTS:**
- DIRECT SHEAR
- EXPANSION INDEX
- HYDROMETER
- MAXIMUM DENSITY
- POCKET PENETROMETER
- UNCONFINED COMPRESSIVE STRENGTH

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# GEOTECHNICAL BORING LOG LB-8

<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Long</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density pcf</th>
<th>Moisture Content %</th>
<th>Soil Class, (U.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>R-1</td>
<td>4</td>
<td>4</td>
<td>93</td>
<td>21</td>
<td>SILTY SAND, medium dense, olive brown, moist, fine sand, some gravel</td>
<td>EI, CR</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>R-2</td>
<td>6</td>
<td>10</td>
<td>93</td>
<td>23</td>
<td>SANDY SILT, stiff, olive brown, dry to moist, fine sand, to Silty SAND</td>
<td></td>
</tr>
</tbody>
</table>

- **4 inches Asphalt over 4 inches Base**
- **SANDY Lean CLAY, medium stiff, dark grayish brown, moist, fine sand, some silty sand layers (EI = 8)**
- **SANDY SILT, stiff, olive brown, dry to moist, fine sand, to Silty SAND**

Drilled to 10'
Sampled to 11.5'
Groundwater not encountered
Backfilled with soil cuttings and quickrete concrete on top (1/8/18)

---

**SOIL DESCRIPTION**

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**CONTENT, %**

<table>
<thead>
<tr>
<th>Graphic Long</th>
<th>Log Type of Tests:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DIRECT SHEAR</td>
</tr>
<tr>
<td></td>
<td>EXPANSION INDEX</td>
</tr>
<tr>
<td></td>
<td>HYDROMETER</td>
</tr>
<tr>
<td></td>
<td>MAXIMUM DENSITY</td>
</tr>
<tr>
<td></td>
<td>POCKET PENETROMETER</td>
</tr>
</tbody>
</table>

---

**SAMPLE TYPES:**

- BULK SAMPLE
- CORE SAMPLE
- GRAB SAMPLE
- RING SAMPLE
- SPLIT SPOON SAMPLE
- TUBE SAMPLE

**TYPE OF TESTS:**

- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER

---

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<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Densitypcf</th>
<th>Moisture %</th>
<th>Soil Class (U.S.C.S.)</th>
<th>Type of Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>4.5 inches Asphalt over 6 inches Base</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>R-1</td>
<td>5</td>
<td>107</td>
<td>11</td>
<td>SM</td>
<td>SILTY SAND, medium dense, dark brown, moist, fine sand, few gravel</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>R-2</td>
<td>3</td>
<td>10</td>
<td>11</td>
<td>CL</td>
<td>Lean CLAY with SAND, medium stiff, dark grayish brown, moist, fine sand</td>
<td></td>
</tr>
</tbody>
</table>

Drilled to 10'
Sampled to 11.5'
Groundwater not encountered
Backfilled with soil cuttings and quikrete concrete on top (1/8/18)
**GEOTECHNICAL BORING LOG LB-10**

<table>
<thead>
<tr>
<th>Project No.</th>
<th>11875.001</th>
<th>Date Drilled</th>
<th>1-8-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>EMWD Well Head Treatment Facilities</td>
<td>Logged By</td>
<td>BSS</td>
</tr>
<tr>
<td>Drilling Co.</td>
<td>2R Drilling</td>
<td>Hole Diameter</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Hollow Stem Auger - 140lb - Autohammer - 30&quot; Drop</td>
<td>Ground Elevation</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>See Boring Location Map</td>
<td>Sampled By</td>
<td>BSS</td>
</tr>
</tbody>
</table>

### SOIL DESCRIPTION

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<table>
<thead>
<tr>
<th>Elevation Feet</th>
<th>Depth Feet</th>
<th>Graphic Log</th>
<th>Attitudes</th>
<th>Sample No.</th>
<th>Blows Per 6 Inches</th>
<th>Dry Density (pcf)</th>
<th>Moisture Content, %</th>
<th>Soil Class, (U.S.C.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>N</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
</tr>
<tr>
<td>5</td>
<td>B-T</td>
<td></td>
<td></td>
<td>4</td>
<td>8</td>
<td>107</td>
<td>2</td>
<td>SILTY SAND, medium dense, light brown, moist, fine to medium sand, some gravel</td>
</tr>
<tr>
<td>10</td>
<td>R-1</td>
<td></td>
<td></td>
<td>8</td>
<td>9</td>
<td></td>
<td></td>
<td>Well-graded SAND with GRAVEL, medium dense, light gray, dry, fine to coarse sand, some cobbles (MD: 128.9 @ 7.0)</td>
</tr>
<tr>
<td>15</td>
<td>R-2</td>
<td></td>
<td></td>
<td>8</td>
<td>11</td>
<td>15</td>
<td></td>
<td>medium dense, light brownish gray, dry to moist, fine to coarse sand with fine gravel, (no recovery)</td>
</tr>
</tbody>
</table>

Drilled to 10’
Sampled to 11.5’
Groundwater not encountered
Backfilled with soil cuttings and quikrete concrete on top (1/8/18)

<table>
<thead>
<tr>
<th>SAMPLE TYPES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BULK SAMPLE</td>
</tr>
<tr>
<td>CORE SAMPLE</td>
</tr>
<tr>
<td>GRAB SAMPLE</td>
</tr>
<tr>
<td>RING SAMPLE</td>
</tr>
<tr>
<td>SPLIT SPOON SAMPLE</td>
</tr>
<tr>
<td>TUBE SAMPLE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TYPE OF TESTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRECT SHEAR</td>
</tr>
<tr>
<td>EXPANSION INDEX</td>
</tr>
<tr>
<td>HYDROMETER</td>
</tr>
<tr>
<td>MAXIMUM DENSITY</td>
</tr>
<tr>
<td>POCKET PENETROMETER</td>
</tr>
<tr>
<td>SIEVE ANALYSIS</td>
</tr>
<tr>
<td>SAND EQUIVALENT</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY</td>
</tr>
<tr>
<td>UNCONFINED COMPRESSIVE STRENGTH</td>
</tr>
</tbody>
</table>

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APPENDIX B

Geotechnical Laboratory Testing Results
**Project Name:** EMWD Wellhead Treatment Phase 1  
**Project No.:** 11875.001

**Boring No.:** LB-1  
**Sample No.:** B-1  
**Depth (feet):** 0.5 - 5.0  
**Soil Type:** Silty Sand (SM), Brown.  
**GR:SA:FI (%)**  
<table>
<thead>
<tr>
<th>Particle Size (mm)</th>
<th>0</th>
<th>80</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Standard Sieve Number</td>
<td>#16</td>
<td>#30</td>
<td>#100</td>
</tr>
<tr>
<td>U.S. Standard Sieve Opening</td>
<td>3.0&quot;</td>
<td>1 1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
</tbody>
</table>

**GR-I-831**: Leighton  
**PARTICLE - SIZE DISTRIBUTION**  
**ASTM D 6913**  
**Sieve: LB-1, B-1 (1-8-18)**
### Project Details

**Project Name:** EMWD Wellhead Treatment Phase 1  
**Project No.:** 11875.001

**Boring No.:** LB-2  
**Sample No.:** B-1  
**Depth (feet):** 5.0 - 8.0  
**Soil Type:** SW  
**Soil Identification:** Well Graded Sand (SW), Light Brown.

**GR:SA:FI (%):** 0 : 97 : 3

---

<table>
<thead>
<tr>
<th>PARTICLE SIZE DISTRIBUTION</th>
<th>ASTM D 6913</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U.S. STANDARD SIEVE OPENING</strong></td>
<td><strong>U.S. STANDARD SIEVE NUMBER</strong></td>
</tr>
<tr>
<td>3.0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>#8</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>#4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Chart Details:**

- **Axes:**
  - X-axis: PARTICLE SIZE (mm)  
  - Y-axis: PERCENT FINER BY WEIGHT

- **Data Points:**
  - Boring No.: LB-2, B-1 (1-8-18)
Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001

Boring No.: LB-7  
Sample No.: B-1  
Depth (feet): 1.0 - 6.0  
Soil Type: SM  
Soil Identification: Silty Sand (SM), Brown.

GR:SA:FI: (%)  
1 : 55 : 44  

PARTICLE - SIZE DISTRIBUTION 
ASTM D 6913  

Jan-18
**SAND EQUIVALENT TEST**

**ASTM D 2419 / DOT CA Test 217**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth (ft.)</th>
<th>Soil Description</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>R1</th>
<th>R2</th>
<th>SE</th>
<th>Average SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB-2</td>
<td>B-1</td>
<td>5.0 - 8.0</td>
<td>Well Graded Sand (SW)</td>
<td>11:15</td>
<td>11:25</td>
<td>11:27</td>
<td>11:47</td>
<td>7.1</td>
<td>3.8</td>
<td>54</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11:17</td>
<td>11:27</td>
<td>11:29</td>
<td>11:49</td>
<td>7.4</td>
<td>4.0</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

T1 = Starting Time  
T2 = ( T1 + 10 min) Begin Agitation  
T3 = Settlement Starting Time  
T4 = ( T3 + 20 min) Take Clay Reading (R1)  
Sand Equivalent = R2 / R1 * 100  
Record SE as Next Higher Integer

---

Project Name: EMWD Wellhead Treatment Phase 1  
Tested By: F. Mina  
Date: 3/9/18

Project No.: 11875.001  
Computed By: F. Mina  
Date: 3/9/18

Client: Tetra Tech  
Checked By: M. Vinet  
Date: 3/12/18

---

**Sample Details**

- **Sample No.:** B-1  
- **Depth (ft.):** 5.0 - 8.0

---

**Soil Description:** Well Graded Sand (SW)
SAND EQUIVALENT TEST
ASTM D 2419 / DOT CA Test 217

Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001
Client: Tetra Tech

Tested By: F. Mina Date: 1/19/18
Computed By: F. Mina Date: 1/19/18
Checked By: M. Vinet Date: 1/26/18

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth (ft.)</th>
<th>Soil Description</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>R1</th>
<th>R2</th>
<th>SE</th>
<th>Average SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB-4</td>
<td>B-1</td>
<td>1.0 - 6.0</td>
<td>Silty Sand (SM)</td>
<td>12:15</td>
<td>12:25</td>
<td>12:27</td>
<td>12:47</td>
<td>10.0</td>
<td>1.9</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12:17</td>
<td>12:27</td>
<td>12:29</td>
<td>12:49</td>
<td>9.8</td>
<td>1.8</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

T1 = Starting Time  
T2 = (T1 + 10 min) Begin Agitation  
T3 = Settlement Starting Time  
T4 = (T3 + 20 min) Take Clay Reading (R1)  
Sand Equivalent = R2 / R1 * 100  
Record SE as Next Higher Integer
**SAND EQUIVALENT TEST**  
*ASTM D 2419 / DOT CA Test 217*

---

**Project Name:** EMWD Wellhead Treatment Phase 1  
**Client:** Tetra Tech  
**Tested By:** F. Mina  
**Computation By:** F. Mina  
**Checked By:** M. Vinet  
**Date:** 1/19/18

**Project No.:** 11875.001  
**Date:** 1/26/18

---

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Depth (ft.)</th>
<th>Soil Description</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>R1</th>
<th>R2</th>
<th>SE</th>
<th>Average SE</th>
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<tbody>
<tr>
<td>LB-9</td>
<td>B-1</td>
<td>5.0 - 8.0</td>
<td>Silt with Sand (ML)s</td>
<td>12:19</td>
<td>12:29</td>
<td>12:31</td>
<td>12:51</td>
<td>11.7</td>
<td>1.2</td>
<td>11</td>
<td>11</td>
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<td></td>
<td>12:21</td>
<td>12:31</td>
<td>12:33</td>
<td>12:53</td>
<td>11.9</td>
<td>1.3</td>
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</tbody>
</table>

- **T1** = Starting Time  
- **T2** = (T1 + 10 min) Begin Agitation  
- **T3** = Settlement Starting Time  
- **T4** = (T3 + 20 min) Take Clay Reading (R1)  
- **Sand Equivalent** = \( \frac{R2}{R1} \times 100 \)  
- Record SE as Next Higher Integer

---

Sand Equivalent: LB-9, B-1 (1-8-18)
MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001
Boring No.: LB-1
Sample No.: B-1
Soil Identification: Silty Sand (SM), Brown.

Preparation Method: Moist, Mechanical Ram

Mold Volume (ft³) 0.03340
Ram Weight = 10 lb.; Drop = 18 in.

<table>
<thead>
<tr>
<th>TEST NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
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<tbody>
<tr>
<td>Wt. Compacted Soil + Mold (g)</td>
<td>5511</td>
<td>5566</td>
<td>5633</td>
<td>5605</td>
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<tr>
<td>Weight of Mold (g)</td>
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<td>3542</td>
<td>3542</td>
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<tr>
<td>Net Weight of Soil (g)</td>
<td>1969</td>
<td>2024</td>
<td>2091</td>
<td>2063</td>
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<tr>
<td>Wet Weight of Soil + Cont. (g)</td>
<td>2369.0</td>
<td>2443.5</td>
<td>2496.4</td>
<td>2748.6</td>
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<tr>
<td>Dry Weight of Soil + Cont. (g)</td>
<td>2262.0</td>
<td>2295.1</td>
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<td>Weight of Container (g)</td>
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<td>420.9</td>
<td>415.1</td>
<td>696.4</td>
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<tr>
<td>Moisture Content (%)</td>
<td>5.8</td>
<td>7.9</td>
<td>9.8</td>
<td>12.0</td>
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<tr>
<td>Wet Density (pcf)</td>
<td>130.0</td>
<td>133.6</td>
<td>138.0</td>
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<tr>
<td>Dry Density (pcf)</td>
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<td>123.8</td>
<td>125.7</td>
<td>121.6</td>
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<td></td>
</tr>
</tbody>
</table>

Maximum Dry Density (pcf) 125.7
Optimum Moisture Content (%) 9.8

PROCEDURE USED

Procedure A
Soil Passing No. 4 (4.75 mm) Sieve
Mold: 4 in. (101.6 mm) diameter
Layers: 5 (Five)
Blows per layer: 25 (twenty-five)
May be used if +#4 is 20% or less

Procedure B
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold: 4 in. (101.6 mm) diameter
Layers: 5 (Five)
Blows per layer: 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

Procedure C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold: 6 in. (152.4 mm) diameter
Layers: 5 (Five)
Blows per layer: 56 (fifty-six)
Use if +3/8 in. is >20% and +3/4 in. is <30%

Particle-Size Distribution: 0:80:20
GR: SA:FI
Atterberg Limits: LL, PL, PI
MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001
Boring No.: LB-2
Sample No.: B-1
Soil Identification: Well Graded Sand (SW), Light Brown.

Tested By: F. Mina
Date: 03/09/18
Input By: M. Vinet
Date: 03/12/18

Depth (ft.): 5.0 - 8.0

Moist  Mechanical Ram
Dry  Manual Ram

Mold Volume (ft³)  0.03340  Ram Weight = 10 lb.;  Drop = 18 in.

<table>
<thead>
<tr>
<th>TEST NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt. Compacted Soil + Mold (g)</td>
<td>5476</td>
<td>5525</td>
<td>5520</td>
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<td></td>
</tr>
<tr>
<td>Weight of Mold (g)</td>
<td>3542</td>
<td>3542</td>
<td>3542</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Weight of Soil (g)</td>
<td>1934</td>
<td>1983</td>
<td>1978</td>
<td></td>
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<tr>
<td>Wet Weight of Soil + Cont. (g)</td>
<td>2620.2</td>
<td>2686.1</td>
<td>2897.5</td>
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<td>Dry Weight of Soil + Cont. (g)</td>
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<td>Weight of Container (g)</td>
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<td>Moisture Content (%)</td>
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<td>14.9</td>
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<td>Wet Density (pcf)</td>
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<td>130.9</td>
<td>130.6</td>
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<tr>
<td>Dry Density (pcf)</td>
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<td>116.3</td>
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</table>

Maximum Dry Density (pcf)  **116.8**
Optimum Moisture Content (%)  **11.2**

PROCEDURE USED

**Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold: 4 in. (101.6 mm) diameter
Layers: 5 (Five)
Blows per layer: 25 (twenty-five)
May be used if #4 is 20% or less

**Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold: 4 in. (101.6 mm) diameter
Layers: 5 (Five)
Blows per layer: 25 (twenty-five) Use if #4 is >20% and +3/8 in. is 20% or less

**Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold: 6 in. (152.4 mm) diameter
Layers: 5 (Five)
Blows per layer: 56 (fifty-six) Use if +3/8 in. is >20% and +1/4 in. is <30%

Particle-Size Distribution: 0:97:3
GR: SA:FI
Atterberg Limits: LL, PL, PI
**MODIFIED PROCTOR COMPACTION TEST**

*ASTM D 1557*

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>EMWD Wellhead Treatment Phase 1</th>
<th>Tested By:</th>
<th>F. Mina</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Project No.:</td>
<td>11875.001</td>
<td>Input By:</td>
<td>M. Vinet</td>
<td>Date:</td>
<td>01/26/18</td>
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<td>Boring No.:</td>
<td>LB-5</td>
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<tr>
<td>Sample No.:</td>
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</table>

**TEST NO.**

<table>
<thead>
<tr>
<th>Mold Volume (ft³)</th>
<th>0.03340</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ram Weight = 10 lb.; Drop = 18 in.</td>
<td></td>
</tr>
</tbody>
</table>

**PROCEDURE USED**

- **Procedure A**
  - Soil Passing No. 4 (4.75 mm) Sieve
  - Mold: 4 in. (101.6 mm) diameter
  - Layers: 5 (Five)
  - Blows per layer: 25 (twenty-five)
  - May be used if +#4 is 20% or less

- **Procedure B**
  - Soil Passing 3/8 in. (9.5 mm) Sieve
  - Mold: 4 in. (101.6 mm) diameter
  - Layers: 5 (Five)
  - Blows per layer: 25 (twenty-five)
  - Use if +#4 is >20% and +3/8 in. is 20% or less

- **Procedure C**
  - Soil Passing 3/4 in. (19.0 mm) Sieve
  - Mold: 6 in. (152.4 mm) diameter
  - Layers: 5 (Five)
  - Blows per layer: 56 (fifty-six)
  - Use if +3/8 in. is >20% and +3/4 in. is <30%

**Particle-Size Distribution:**

- **Atterberg Limits:**
  - LL, PL, PI

**Optimum Moisture Content (%)**

- 13.0

**Maximum Dry Density (pcf)**

- 120.5

**Soil Identification:**

- Poorly Graded Sand with Silt (SP-SM), Yellowish Brown.

**Preparation Method:**

- Moist
- Mechanical Ram

**Moisture Content (%)**

| 0.0 5.0 10.0 15.0 20.0 |
|------------------------|------------------------|
| 110.0                  | 115.0                  |
| 120.0                  | 125.0                  |
| 130.0                  | 135.0                  |

**Dry Density (pcf)**

| 0.0 5.0 10.0 15.0 20.0 |
|------------------------|------------------------|
| 110.0                  | 115.0                  |
| 120.0                  | 125.0                  |
| 130.0                  | 135.0                  |

**Wt. Compacted Soil + Mold (g)**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
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<td>5553</td>
<td>5607</td>
<td>5590</td>
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</table>

**Weight of Mold (g)**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>3542</td>
<td>3542</td>
<td>3542</td>
<td>3542</td>
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</tr>
</tbody>
</table>

**Net Weight of Soil (g)**

<table>
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<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>1929</td>
<td>2011</td>
<td>2065</td>
<td>2048</td>
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**Wet Weight of Soil + Cont. (g)**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</tr>
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<tbody>
<tr>
<td>1971.2</td>
<td>2177.1</td>
<td>2180.5</td>
<td>2270.4</td>
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<td></td>
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</tbody>
</table>

**Dry Weight of Soil + Cont. (g)**

<table>
<thead>
<tr>
<th>1</th>
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<tbody>
<tr>
<td>1812.8</td>
<td>1977.4</td>
<td>1941.8</td>
<td>1998.9</td>
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</table>

**Weight of Container (g)**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>5</th>
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</tr>
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<tbody>
<tr>
<td>44.3</td>
<td>171.1</td>
<td>127.5</td>
<td>227.4</td>
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</tbody>
</table>

**Moisture Content (%)**

| 0.0 5.0 10.0 15.0 20.0 |
|------------------------|------------------------|
| 9.0 11.1 13.2 15.3 |

**Wet Density (pcf)**

<table>
<thead>
<tr>
<th>1</th>
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<th>3</th>
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<th>5</th>
<th>6</th>
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<tbody>
<tr>
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<td>132.7</td>
<td>136.3</td>
<td>135.2</td>
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**Dry Density (pcf)**

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<td>120.5</td>
<td>117.2</td>
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</tr>
</tbody>
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---

**Wt. Compacted Soil + Mold (g)**

<table>
<thead>
<tr>
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**Weight of Mold (g)**

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<th>3</th>
<th>4</th>
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**Net Weight of Soil (g)**

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<tbody>
<tr>
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<td>2011</td>
<td>2065</td>
<td>2048</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Wet Weight of Soil + Cont. (g)**

<table>
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<tr>
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**Dry Weight of Soil + Cont. (g)**

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<td>1977.4</td>
<td>1941.8</td>
<td>1998.9</td>
<td></td>
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</table>

**Weight of Container (g)**

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<tr>
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<td>171.1</td>
<td>127.5</td>
<td>227.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Moisture Content (%)**

| 0.0 5.0 10.0 15.0 20.0 |
|------------------------|------------------------|
| 9.0 11.1 13.2 15.3 |

**Wet Density (pcf)**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
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<td>132.7</td>
<td>136.3</td>
<td>135.2</td>
<td></td>
<td></td>
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</table>

**Dry Density (pcf)**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>116.9</td>
<td>119.5</td>
<td>120.5</td>
<td>117.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**PROCEDURE USED**

- **Procedure A**
  - Soil Passing No. 4 (4.75 mm) Sieve
  - Mold: 4 in. (101.6 mm) diameter
  - Layers: 5 (Five)
  - Blows per layer: 25 (twenty-five)
  - May be used if +#4 is 20% or less

- **Procedure B**
  - Soil Passing 3/8 in. (9.5 mm) Sieve
  - Mold: 4 in. (101.6 mm) diameter
  - Layers: 5 (Five)
  - Blows per layer: 25 (twenty-five)
  - Use if +#4 is >20% and +3/8 in. is 20% or less

- **Procedure C**
  - Soil Passing 3/4 in. (19.0 mm) Sieve
  - Mold: 6 in. (152.4 mm) diameter
  - Layers: 5 (Five)
  - Blows per layer: 56 (fifty-six)
  - Use if +3/8 in. is >20% and +¾ in. is <30%

**Particle-Size Distribution:** 1:55:44

**Atterberg Limits:**
- LL, PL, PI

**Optimum Moisture Content (%)** 9.7

**Maximum Dry Density (pcf)** 127.3

---

<table>
<thead>
<tr>
<th>TEST NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>Wt. Compacted Soil + Mold (g)</td>
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<td>5667</td>
<td>5641</td>
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<td>2099</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wet Weight of Soil + Cont. (g)</td>
<td>2450.8</td>
<td>2249.2</td>
<td>2334.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Weight of Soil + Cont. (g)</td>
<td>2301.5</td>
<td>2051.9</td>
<td>2107.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of Container (g)</td>
<td>408.9</td>
<td>130.4</td>
<td>239.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>7.9</td>
<td>10.3</td>
<td>12.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Density (pcf)</td>
<td>135.0</td>
<td>140.3</td>
<td>138.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>125.1</td>
<td>127.2</td>
<td>123.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**ASTM D 1557**

**Project Name:** EMWD Wellhead Treatment Phase 1

**Project No.:** 11875.001

**Boring No.:** LB-7

**Sample No.:** B-1

**Soil Identification:** Silty Sand (SM), Brown.

**Preparation Method:**
- Moist
- Mechanical Ram

**Mold Volume (ft³)** 0.03340

**Ram Weight = 10 lb.; Drop = 18 in.**
MODIFIED PROCTOR COMPACTATION TEST
ASTM D 1557

Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001
Boring No.: LB-10
Sample No.: B-1
Soil Identification: Silty Sand (SM), Yellowish Brown.

Preparation Method:  X Moist    X Mechanical Ram
                     Dry         Manual Ram

Mold Volume (ft³)  0.03340

Ram Weight = 10 lb.; Drop = 18 in.

<table>
<thead>
<tr>
<th>TEST NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt. Compacted Soil + Mold (g)</td>
<td>5595</td>
<td>5644</td>
<td>5627</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of Mold (g)</td>
<td>3542</td>
<td>3542</td>
<td>3542</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Weight of Soil (g)</td>
<td>2053</td>
<td>2102</td>
<td>2085</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Wet Weight of Soil + Cont. (g)</td>
<td>2338.9</td>
<td>2315.4</td>
<td>2268.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Weight of Soil + Cont. (g)</td>
<td>2226.3</td>
<td>2166.5</td>
<td>2082.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight of Container (g)</td>
<td>290.0</td>
<td>267.6</td>
<td>200.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>5.8</td>
<td>7.8</td>
<td>9.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Density (pcf)</td>
<td>135.5</td>
<td>138.7</td>
<td>137.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>128.1</td>
<td>128.7</td>
<td>125.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum Dry Density (pcf) 128.9
Optimum Moisture Content (%) 7.0

PROCEDURE USED

X Procedure B
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold: 4 in. (101.6 mm) diameter
Layers: 5 (Five)
Blows per layer: 25 (twenty-five)
Use if +¾ in. is <30%

Procedure A
Soil Passing No. 4 (4.75 mm) Sieve
Mold: 4 in. (101.6 mm) diameter
Layers: 5 (Five)
Blows per layer: 25 (twenty-five)
May be used if +¾ in. is 20% or less

Procedure C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold: 6 in. (152.4 mm) diameter
Layers: 5 (Five)
Blows per layer: 56 (fifty-six)
Use if +¾ in. is >20% and +½ in. is <30%

Particle-Size Distribution:
SP: GR = 2.65
SP: GR = 2.70
SP: GR = 2.75

Atterberg Limits:
LL, PL, PI
### Project Information

**Project Name:** EMWD Wellhead Treatment Phase 1  
**Tested By:** F. Mina  
**Date:** 1/18/18  
**Project No.:** 11875.001  
**Checked By:** M. Vinet  
**Date:** 1/26/18  
**Boring No.:** LB-7  
**Depth:** 1.0 - 6.0  
**Sample No.:** B-1  
**Location:** N/A  
**Sample Description:** Silty Sand (SM), Gray.

### Soil Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Wt. of Soil + Cont. (gm.)</td>
<td>2500.2</td>
</tr>
<tr>
<td>Wt. of Container No. (gm.)</td>
<td>0.0</td>
</tr>
<tr>
<td>Dry Wt. of Soil (gm.)</td>
<td>2500.2</td>
</tr>
<tr>
<td>Weight Soil Retained on #4 Sieve</td>
<td>157.8</td>
</tr>
<tr>
<td>Percent Passing # 4</td>
<td>93.7</td>
</tr>
</tbody>
</table>

### MOLDED SPECIMEN

<table>
<thead>
<tr>
<th>Property</th>
<th>Before Test</th>
<th>After Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen Diameter (in.)</td>
<td>4.01</td>
<td>4.01</td>
</tr>
<tr>
<td>Specimen Height (in.)</td>
<td>1.0000</td>
<td>1.0095</td>
</tr>
<tr>
<td>Wt. Comp. Soil + Mold (gm.)</td>
<td>610.5</td>
<td>639.8</td>
</tr>
<tr>
<td>Wt. of Mold (gm.)</td>
<td>208.8</td>
<td>208.8</td>
</tr>
<tr>
<td>Specific Gravity (Assumed)</td>
<td>2.70</td>
<td>2.70</td>
</tr>
<tr>
<td>Container No.</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (gm.)</td>
<td>350.1</td>
<td>639.8</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (gm.)</td>
<td>324.1</td>
<td>366.8</td>
</tr>
<tr>
<td>Wt. of Container (gm.)</td>
<td>50.1</td>
<td>208.8</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>9.5</td>
<td>17.5</td>
</tr>
<tr>
<td>Wet Density (pcf)</td>
<td>121.2</td>
<td>128.8</td>
</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>110.7</td>
<td>109.6</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.523</td>
<td>0.538</td>
</tr>
<tr>
<td>Total Porosity</td>
<td>0.344</td>
<td>0.350</td>
</tr>
<tr>
<td>Pore Volume (cc)</td>
<td>71.1</td>
<td>73.1</td>
</tr>
<tr>
<td>Degree of Saturation (%) [ S meas]</td>
<td>49.0</td>
<td>87.8</td>
</tr>
</tbody>
</table>

### SPECIMEN INUNDATION

In distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Pressure (psi)</th>
<th>Elapsed Time (min.)</th>
<th>Dial Readings (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/18/18</td>
<td>12:00</td>
<td>1.0</td>
<td>0</td>
<td>0.5000</td>
</tr>
<tr>
<td>1/19/18</td>
<td>8:30</td>
<td>1.0</td>
<td>1220</td>
<td>0.5095</td>
</tr>
<tr>
<td>1/19/18</td>
<td>9:30</td>
<td>1.0</td>
<td>1280</td>
<td>0.5095</td>
</tr>
</tbody>
</table>

Expansion Index (El meas) = \( \frac{(\text{Final Rdg} - \text{Initial Rdg})}{\text{Initial Thick.}} \) x 1000

Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height

9.5

10
**EXPANSION INDEX of SOILS**  
ASTM D 4829

**SPECIMEN INUNDATION** in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Pressure (psi)</th>
<th>Elapsed Time (min.)</th>
<th>Dial Readings (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/18/18</td>
<td>12:15</td>
<td>1.0</td>
<td>0</td>
<td>0.5000</td>
</tr>
<tr>
<td>1/18/18</td>
<td>12:25</td>
<td>1.0</td>
<td>10</td>
<td>0.5000</td>
</tr>
</tbody>
</table>

Add Distilled Water to the Specimen

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Pressure (psi)</th>
<th>Elapsed Time (min.)</th>
<th>Dial Readings (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/19/18</td>
<td>8:30</td>
<td>1.0</td>
<td>1205</td>
<td>0.5075</td>
</tr>
<tr>
<td>1/19/18</td>
<td>9:30</td>
<td>1.0</td>
<td>1265</td>
<td>0.5075</td>
</tr>
</tbody>
</table>

Expansion Index (EI meas) = \(((\text{Final Rdg} - \text{Initial Rdg}) / \text{Initial Thick.}) \times 1000\)

Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Height

---

**Dry Wt. of Soil + Cont.** (gm.) | 3780.3  
**Wt. of Container No.** (gm.) | 0.0  
**Dry Wt. of Soil** (gm.) | 3780.3  
**Weight Soil Retained on #4 Sieve** | 18.4  
**Percent Passing #4** | 99.5  

**MOLDED SPECIMEN**

<table>
<thead>
<tr>
<th>Before Test</th>
<th>After Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specimen Diameter (in.)</td>
<td>4.01</td>
</tr>
<tr>
<td>Specimen Height (in.)</td>
<td>1.0000</td>
</tr>
<tr>
<td>Wt. Comp. Soil + Mold (gm.)</td>
<td>588.0</td>
</tr>
<tr>
<td>Wt. of Mold (gm.)</td>
<td>199.2</td>
</tr>
<tr>
<td>Specific Gravity (Assumed)</td>
<td>2.70</td>
</tr>
<tr>
<td>Container No.</td>
<td>7</td>
</tr>
<tr>
<td>Wet Wt. of Soil + Cont. (gm.)</td>
<td>350.1</td>
</tr>
<tr>
<td>Dry Wt. of Soil + Cont. (gm.)</td>
<td>320.4</td>
</tr>
<tr>
<td>Wt. of Container (gm.)</td>
<td>50.1</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>11.0</td>
</tr>
<tr>
<td>Wet Density (pcf)</td>
<td>117.3</td>
</tr>
<tr>
<td>Dry Density (pcf)</td>
<td>105.7</td>
</tr>
<tr>
<td>Void Ratio</td>
<td>0.596</td>
</tr>
<tr>
<td>Total Porosity</td>
<td>0.373</td>
</tr>
<tr>
<td>Pore Volume (cc)</td>
<td>77.3</td>
</tr>
<tr>
<td>Degree of Saturation (%) [S meas]</td>
<td>49.9</td>
</tr>
</tbody>
</table>
One-Dimensional Swell or Settlement
Potential of Cohesive Soils
(ASTM D 4546) – Method 'B'

Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001
Boring No.: LB-4
Sample No.: R-1
Sample Description: Silty Sand (SM), Brown.

Source and Type of Water Used for Inundation: Arrowhead (Distilled)

** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

<table>
<thead>
<tr>
<th>Initial Dry Density (pcf)</th>
<th>104.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Moisture (%)</td>
<td>11.0</td>
</tr>
<tr>
<td>Initial Height (in.)</td>
<td>1.0000</td>
</tr>
<tr>
<td>Initial Dial Reading (in.):</td>
<td>0.0000</td>
</tr>
<tr>
<td>Inside Diameter of Ring (in):</td>
<td>2.416</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure (p) (ksf)</th>
<th>Final Reading (in)</th>
<th>Apparent Thickness (in)</th>
<th>Load Compliance (%)</th>
<th>Swell (+) Settlement (-) % of Sample Thickness</th>
<th>Void Ratio</th>
<th>Corrected Deformation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.050</td>
<td>0.0066</td>
<td>0.9934</td>
<td>0.00</td>
<td>-0.66</td>
<td>0.6018</td>
<td>-0.66</td>
</tr>
<tr>
<td>2.013</td>
<td>0.0129</td>
<td>0.9871</td>
<td>0.00</td>
<td>-1.29</td>
<td>0.5916</td>
<td>-1.29</td>
</tr>
<tr>
<td>H2O</td>
<td>0.0144</td>
<td>0.9856</td>
<td>0.00</td>
<td>-1.44</td>
<td>0.5892</td>
<td>-1.44</td>
</tr>
</tbody>
</table>

Percent Swell / Settlement After Inundation = -0.15

Deformation % - Log Pressure Curve

Inundate With Distilled Water
One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546) – Method 'B'

** Project Name:** EMWD Wellhead Treatment Phase 1
** Project No.:** 11875.001
** Boring No.:** LB-5
** Sample No.:** R-1

** Sample Description:** Poorly Graded Sand with Silt (SP-SM), Grayish Brown.

Source and Type of Water Used for Inundation: Arrowhead (Distilled)

** Note:** Loading After Wetting (Inundation) not Performed Using this Test Method.

<table>
<thead>
<tr>
<th>Pressure (p) (ksf)</th>
<th>Final Reading (in)</th>
<th>Apparent Thickness (in)</th>
<th>Load Compliance (%)</th>
<th>Swell (+) Settlement (-) % of Sample Thickness</th>
<th>Void Ratio</th>
<th>Corrected Deformation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.050</td>
<td>0.0023</td>
<td>0.9977</td>
<td>0.00</td>
<td>-0.23</td>
<td>0.8475</td>
<td>-0.23</td>
</tr>
<tr>
<td>2.013</td>
<td>0.0057</td>
<td>0.9943</td>
<td>0.00</td>
<td>-0.57</td>
<td>0.8412</td>
<td>-0.57</td>
</tr>
<tr>
<td>H2O</td>
<td>0.0092</td>
<td>0.9908</td>
<td>0.00</td>
<td>-0.92</td>
<td>0.8347</td>
<td>-0.92</td>
</tr>
</tbody>
</table>

**Percent Swell / Settlement After Inundation = -0.35**
One-Dimensional Swell or Settlement Potential of Cohesive Soils
( ASTM D 4546) – Method 'B'

Project Name: EMWD Wellhead Treatment Phase 1
Project No.: 11875.001
Boring No.: LB-6
Sample No.: R-2

Sample Description: Silt (ML), Brown.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

<table>
<thead>
<tr>
<th>Initial Dry Density (pcf)</th>
<th>91.0</th>
<th>Final Dry Density (pcf)</th>
<th>92.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Moisture (%)</td>
<td>23.4</td>
<td>Final Moisture (%)</td>
<td>29.6</td>
</tr>
<tr>
<td>Initial Height (in.)</td>
<td>1.0000</td>
<td>Initial Void ratio</td>
<td>0.8516</td>
</tr>
<tr>
<td>Initial Dial Reading (in.)</td>
<td>0.0000</td>
<td>Specific Gravity (assumed):</td>
<td>2.70</td>
</tr>
<tr>
<td>Inside Diameter of Ring (in):</td>
<td>2.416</td>
<td>Initial Degree of Saturation (%)</td>
<td>74.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure (p) (ksf)</th>
<th>Final Reading (in)</th>
<th>Apparent Thickness (in)</th>
<th>Load Compliance (%)</th>
<th>Swell (+) Settlement (-) % of Sample Thickness</th>
<th>Void Ratio</th>
<th>Corrected Deformation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.050</td>
<td>0.0048</td>
<td>0.9952</td>
<td>0.00</td>
<td>-0.48</td>
<td>0.8427</td>
<td>-0.48</td>
</tr>
<tr>
<td>2.013</td>
<td>0.0150</td>
<td>0.9850</td>
<td>0.00</td>
<td>-1.50</td>
<td>0.8238</td>
<td>-1.50</td>
</tr>
<tr>
<td>H2O</td>
<td>0.0150</td>
<td>0.9850</td>
<td>0.00</td>
<td>-1.50</td>
<td>0.8238</td>
<td>-1.50</td>
</tr>
</tbody>
</table>

Percent Swell / Settlement After Inundation = 0.00

Deformation % - Log Pressure Curve
**One-Dimensional Swell or Settlement**  
**Potential of Cohesive Soils**  
*(ASTM D 4546) – Method 'B'*

**Project Name:** EMWD Wellhead Treatment Phase 1  
**Tested By:** M. Vinet  
**Date:** 1/22/18

**Project No.:** 11875.001  
**Checked By:** M. Vinet  
**Date:** 1/26/18

**Boring No.:** LB-9  
**Sample Type:** IN SITU

**Sample No.:** R-1  
**Depth (ft.)** 5.0

**Sample Description:** Sandy Silt s(ML), Brown.

**Source and Type of Water Used for Inundation:** Arrowhead (Distilled)

**Note:** Loading After Wetting (Inundation) not Performed Using this Test Method.

<table>
<thead>
<tr>
<th>Initial Dry Density (pcf)</th>
<th>103.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Moisture (%)</td>
<td>11.4</td>
</tr>
<tr>
<td>Initial Height (in.)</td>
<td>1.000</td>
</tr>
<tr>
<td>Initial Dial Reading (in):</td>
<td>0.000</td>
</tr>
<tr>
<td>Inside Diameter of Ring (in):</td>
<td>2.416</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final Dry Density (pcf):</th>
<th>105.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Moisture (%)</td>
<td>20.5</td>
</tr>
<tr>
<td>Initial Void ratio</td>
<td>0.6268</td>
</tr>
<tr>
<td>Specific Gravity (assumed):</td>
<td>2.70</td>
</tr>
<tr>
<td>Initial Degree of Saturation (%)</td>
<td>49.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure (p) (ksf)</th>
<th>Final Reading (in)</th>
<th>Apparent Thickness (in)</th>
<th>Load Compliance (%)</th>
<th>Swell (+) Settlement (-) % of Sample Thickness</th>
<th>Void Ratio</th>
<th>Corrected Deformation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.050</td>
<td>0.0067</td>
<td>0.9933</td>
<td>0.00</td>
<td>-0.67</td>
<td>0.6159</td>
<td>-0.67</td>
</tr>
<tr>
<td>2.013</td>
<td>0.0149</td>
<td>0.9851</td>
<td>0.00</td>
<td>-1.49</td>
<td>0.6025</td>
<td>-1.49</td>
</tr>
<tr>
<td>H2O</td>
<td>0.0156</td>
<td>0.9844</td>
<td>0.00</td>
<td>-1.56</td>
<td>0.6014</td>
<td>-1.56</td>
</tr>
</tbody>
</table>

**Percent Swell / Settlement After Inundation =** **-0.07**

---

![Deformation % - Log Pressure Curve](image-url)

**Inundate With Distilled Water**
**SOIL RESISTIVITY TEST**  
**DOT CA TEST 643**

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
<th>Moisture Content (%) (MCi)</th>
<th>Wet Wt. of Soil + Cont. (g)</th>
<th>Dry Wt. of Soil + Cont. (g)</th>
<th>Wt. of Container (g)</th>
<th>Container No.</th>
<th>Initial Soil Wt. (g) (Wt)</th>
<th>Box Constant</th>
<th>Minimal Resistivity (ohm-cm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
<th>pH</th>
<th>Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>16.88</td>
<td>15000</td>
<td>15000</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>DOT CA Test 643</td>
<td>12980</td>
<td>25.3</td>
<td>54</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>24.67</td>
<td>13000</td>
<td>13000</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>DOT CA Test 417 Part II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>32.45</td>
<td>14000</td>
<td>14000</td>
<td></td>
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<td></td>
<td>DOT CA Test 422</td>
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</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>DOT CA Test 643</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
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<td></td>
<td>DOT CA Test 643</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

![Graph](image.png)

Min. Resistivity (ohm-cm) | Moisture Content (%) | Sulfate Content (ppm) | Chloride Content (ppm) | Soil pH
--- | --- | --- | --- | ---
12980 | 25.3 | 54 | 20 | 7.75 | 21.3
**SOIL RESISTIVITY TEST**  
DOT CA TEST 643

---

### Project Information
- **Project Name:** EMWD Wellhead Treatment Phase 1  
- **Tested By:** O. Figueroa  
- **Date:** 01/24/18  
- **Project No.:** 11875.001  
- **Data Input By:** J. Ward  
- **Date:** 01/26/18  
- **Boring No.:** LB-4  
- **Sample No.:** B-1

### Soil Identification
- **Soil Identification:** Olive SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.*

### Specimen Data

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>15.92</td>
<td>4900</td>
<td>4900</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>24.19</td>
<td>4100</td>
<td>4100</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>32.46</td>
<td>4300</td>
<td>4300</td>
</tr>
</tbody>
</table>

### Moisture Content (%), Box Constant, and Initial Soil Wt. (g)
- **Moisture Content (%) (MCi):** 7.65  
- **Box Constant:** 1.000  
- **Initial Soil Wt. (g) (Wt):** 130.21

### Table Calculations

- **MC** = \(((1+Mci/100)\times(Wa/Wt+1))-1\)\times100

### Soil Resistivity, Sulfate Content, Chloride Content, and Soil pH

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH (pH, Temp. (°C))</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td></td>
</tr>
<tr>
<td>4075</td>
<td>25.6</td>
<td>160</td>
<td>65</td>
<td>7.72, 21.6</td>
</tr>
</tbody>
</table>

---

### Graph
- **Graph Title:** Soil Resistivity vs. Moisture Content (%)
- **Axes:**  
  - Y-axis: Soil Resistivity (ohm-cm)  
  - X-axis: Moisture Content (%)  
- **Data Points:** Two points are plotted on the graph, indicating the relationship between soil resistivity and moisture content.
**SOIL RESISTIVITY TEST**

**DOT CA TEST 643**

**Project Name:** EMWD Wellhead Treatment Phase 1  
**Tested By:** O. Figueroa  
**Date:** 01/24/18

**Project No.:** 11875.001  
**Data Input By:** J. Ward  
**Date:** 01/26/18

**Boring No.:** LB-8  
**Depth (ft.):** 5-8

**Sample No.:** B-1

**Soil Identification:** Gray SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.*

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>20.32</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>28.90</td>
<td>2900</td>
<td>2900</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>37.48</td>
<td>3100</td>
<td>3100</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td></td>
</tr>
<tr>
<td>2898</td>
<td>28.1</td>
<td>140</td>
<td>34</td>
<td>8.45</td>
</tr>
</tbody>
</table>

**Graph: Soil Resistivity (ohm-cm) vs. Moisture Content (%)**

- **Soil Resistivity (ohm-cm):** 2800, 2850, 2900, 2950, 3000, 3050, 3100, 3150, 3200, 3250, 3300, 3350
- **Moisture Content (%):** 15.0, 20.0, 25.0, 30.0, 35.0, 40.0
### SOIL RESISTIVITY TEST
#### DOT CA TEST 643

**Project Name:** EMWD Wellhead Treatment Phase 1  
**Tested By:** G. Berdy  
**Date:** 01/25/18  
**Project No.:** 11875.001  
**Data Input By:** J. Ward  
**Date:** 01/26/18  
**Boring No.:** LB-9  
**Depth (ft.):** 5-8  
**Sample No.:** B-1

**Soil Identification:** Olive (MLs)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.*

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
<th>Moisture Content (%) (MCi)</th>
<th>Wet Wt. of Soil + Cont. (g)</th>
<th>Dry Wt. of Soil + Cont. (g)</th>
<th>Wt. of Container (g)</th>
<th>Container No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>18.31</td>
<td>10300</td>
<td>10300</td>
<td>9.87</td>
<td>162.26</td>
<td>152.98</td>
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<tr>
<td>2</td>
<td>20</td>
<td>26.74</td>
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<td></td>
</tr>
</tbody>
</table>

\[ MC = \left(1 + \frac{MCi}{100}\right) \times \frac{(Wa/Wt+1)}{100} \]

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td>pH</td>
</tr>
<tr>
<td>8820</td>
<td>29.2</td>
<td>91</td>
<td>44</td>
<td>7.79</td>
</tr>
</tbody>
</table>

![Graph showing relationship between Soil Resistivity (ohm-cm) and Moisture Content (%)](image)
SOIL RESISTIVITY TEST  
DOT CA TEST 643

Project Name: EMWD Wellhead Treatment Phase 1  
Tested By: G. Berdy  Date: 01/25/18
Project No.: 11875.001  
Data Input By: J. Ward  Date: 01/26/18
Boring No.: LB-10  
Depth (ft.): 5-7

Sample No. : B-1

Soil Identification:*  Yellowish brown SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

<table>
<thead>
<tr>
<th>Specimen No.</th>
<th>Water Added (ml) (Wa)</th>
<th>Adjusted Moisture Content (MC)</th>
<th>Resistance Reading (ohm)</th>
<th>Soil Resistivity (ohm-cm)</th>
<th>Moisture Content (%) (MCi)</th>
<th>Wet Wt. of Soil + Cont. (g)</th>
<th>Dry Wt. of Soil + Cont. (g)</th>
<th>Wt. of Container (g)</th>
<th>Container No.</th>
<th>Initial Soil Wt. (g) (Wt)</th>
<th>Box Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>12.52</td>
<td>25500</td>
<td>25500</td>
<td>4.48</td>
<td>202.28</td>
<td>196.10</td>
<td>58.29</td>
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<td>130.05</td>
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<td>17500</td>
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<td></td>
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</tr>
</tbody>
</table>

MC =(((1+MCi/100)x(Wa/Wt+1))-1)x100

<table>
<thead>
<tr>
<th>Min. Resistivity (ohm-cm)</th>
<th>Moisture Content (%)</th>
<th>Sulfate Content (ppm)</th>
<th>Chloride Content (ppm)</th>
<th>Soil pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT CA Test 643</td>
<td>DOT CA Test 417 Part II</td>
<td>DOT CA Test 422</td>
<td>DOT CA Test 643</td>
<td></td>
</tr>
<tr>
<td>16000</td>
<td>22.6</td>
<td>103</td>
<td>42</td>
<td>7.60</td>
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</tbody>
</table>

![Graph showing soil resistivity vs moisture content]
**PROJECT NAME:** EMWD Wellhead Treatment Phase 1  
**Tested By:** G. Berdy  
**Date:** 01/22/18  

**Project No.:** 11875.001  
**Data Input By:** J. Ward  
**Date:** 01/26/18

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>LB-1</th>
<th>LB-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample No.</td>
<td>B-1</td>
<td>B-1</td>
</tr>
<tr>
<td>Sample Depth (ft)</td>
<td>0.5-5</td>
<td>1-6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Identification:</th>
<th>Brown SM</th>
<th>Brown SM</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Wet Weight of Soil + Container (g)</th>
<th>186.43</th>
<th>187.53</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Weight of Soil + Container (g)</td>
<td>181.43</td>
<td>177.79</td>
</tr>
<tr>
<td>Weight of Container (g)</td>
<td>36.58</td>
<td>58.68</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>3.45</td>
<td>8.18</td>
</tr>
<tr>
<td>Weight of Soaked Soil (g)</td>
<td>100.33</td>
<td>100.14</td>
</tr>
</tbody>
</table>

### SULFATE CONTENT, DOT California Test 417, Part II

<table>
<thead>
<tr>
<th>Beaker No.</th>
<th>304</th>
<th>308</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crucible No.</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Furnace Temperature (°C)</td>
<td>860</td>
<td>860</td>
</tr>
<tr>
<td>Time In / Time Out</td>
<td>9:00/9:45</td>
<td>9:00/9:45</td>
</tr>
<tr>
<td>Duration of Combustion (min)</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Wt. of Crucible + Residue (g)</td>
<td>25.0940</td>
<td>25.5523</td>
</tr>
<tr>
<td>Wt. of Crucible (g)</td>
<td>25.0923</td>
<td>25.5511</td>
</tr>
<tr>
<td>Wt. of Residue (g)</td>
<td>0.0017</td>
<td>0.0012</td>
</tr>
<tr>
<td>PPM of Sulfate</td>
<td>69.95</td>
<td>49.38</td>
</tr>
<tr>
<td><strong>PPM of Sulfate, Dry Weight Basis</strong></td>
<td>72</td>
<td>54</td>
</tr>
</tbody>
</table>

### CHLORIDE CONTENT, DOT California Test 422

<table>
<thead>
<tr>
<th>ml of Extract For Titration</th>
<th>(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ml of AgNO3 Soln. Used in Titration</td>
<td>(C)</td>
</tr>
<tr>
<td>PPM of Chloride (C -0.2) * 100 * 30 / B</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>PPM of Chloride, Dry Wt. Basis</strong></td>
<td>N/A</td>
</tr>
</tbody>
</table>

### pH TEST, DOT California Test 643

<table>
<thead>
<tr>
<th>pH Value</th>
<th>N/A</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
[PAGE LEFT INTENTIONALLY BLANK]
MITIGATION MONITORING AND REPORTING PROGRAM FOR THE SAN JACINTO VALLEY WATER BANKING ERRP – PHASE 1 PROJECT:
DEVELOPMENT OF EXTRACTION WELLS 201, 202, 203
<table>
<thead>
<tr>
<th>Project Mitigation Measures</th>
<th>Implementation, Monitoring, and Reporting Actions</th>
<th>Responsibility</th>
<th>Monitoring Schedule</th>
<th>Completion of Implementation (Action/Date Completed/Signed off by)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
AES-MM 1: Design of Aboveground Structures. EMWD shall ensure that the design of all aboveground structures associated with the Proposed Project shall be consistent with the general building style of the existing site and surroundings to ensure compatibility with visual character of the immediate neighborhood.

- Include mitigation measure in design specifications
- Retain a copy of design specifications in project file

Responsibility: EMWD; Design Contractor

Monitoring Schedule: Before Construction
<table>
<thead>
<tr>
<th>Project Mitigation Measures</th>
<th>Implementation, Monitoring, and Reporting Actions</th>
<th>Responsibility</th>
<th>Monitoring Schedule</th>
<th>Completion of Implementation (Action/Date Completed/Signed off by)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES-MM 2: Nighttime Construction</td>
<td>• Include mitigation measure in design specifications and construction contractor specifications &lt;br&gt;• Retain a copy of design specifications and construction monitoring report in project file</td>
<td>EMWD; Design Contractor; Construction Contractor</td>
<td>Before and During Construction</td>
<td></td>
</tr>
<tr>
<td>Project Mitigation Measures</td>
<td>Implementation, Monitoring, and Reporting Actions</td>
<td>Responsibility</td>
<td>Monitoring Schedule</td>
<td>Completion of Implementation (Action/Date Completed/Signed off by)</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------</td>
<td>----------------</td>
<td>---------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Air Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AQ-MM-1: Tier 4 Rated Engines</strong></td>
<td>EMWD shall require that the construction contractor ensures that all off-road equipment be required to have EPA certified Tier 4 final engines or engines that are certified to meet or exceed the emission ratings for EPA Tier 4 final engines. Any emissions control device used by the contractor shall achieve emissions reductions that are no less than what could be achieved by a Level 4 diesel emissions control strategy for a similarly sized engine, as defined by CARB regulations. During construction, the construction contractor shall maintain a list of all operating equipment in use on the project site for verification. The construction equipment list shall state the makes, models, and numbers of construction equipment on-site. Equipment shall be properly serviced and maintained in accordance with the manufacturer’s recommendations. Construction contractors shall also ensure that all nonessential idling of construction equipment is restricted to five minutes or less in compliance with California Air Resources Board’s Rule 2449.</td>
<td>• Include mitigation measure in construction contracting specification</td>
<td>EMWD; Construction Contractor</td>
<td>During Construction</td>
</tr>
<tr>
<td><strong>AQ-MM-2: On-Road Haul Trucks</strong></td>
<td>EMWD and the construction contractor shall ensure that the contracted haul fleet for import and export of materials and soil operate vehicles that have 2012 or newer engines. Should a fleet that comprises all 2012 or newer vehicles not be available, then preference shall be given to the contractor with the newest haul fleet that will be dedicated to the Proposed Program.</td>
<td>• Include mitigation measure in construction contracting specification</td>
<td>EMWD; Construction Contractor</td>
<td>During Construction</td>
</tr>
<tr>
<td></td>
<td>• Conduct periodic monitoring of mitigation commitments during construction.</td>
<td>• Retain construction monitoring report in project file.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Retain construction monitoring report in project file.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

San Jacinto Valley Water Banking ERRP Wells 201, 202, and 203

ES-5

June 2018
Biological Resources

BIO-MM-1: Focused Burrowing Owl Surveys. Focused protocol surveys for burrowing owl shall be conducted prior to initiation of the Proposed Project in areas that contain suitable habitat for the species. The focused protocol surveys shall be conducted by a knowledgeable biologist following protocol outlined in the CDFW Staff Report on Burrowing Owl Mitigation (CDFW, 2012). If burrowing owl is observed during the focused surveys and found to be potentially impacted by the Proposed Project, additional avoidance and mitigation measures will be required. Avoidance measures include constructing Proposed Project facilities outside the breeding season, establishing a suitable buffer around an active burrow, restricting activities around certain times of year, and excluding and relocating owls. A Burrow Exclusion Plan approved by CDFW will be required to implement exclusion and relocation. Permanent impacts to land that previously contained burrowing owls may also require conservation of mitigation lands to offset the impact to burrowing owl and its habitat. The conservation of mitigation lands will be determined through consultation with CDFW.

<table>
<thead>
<tr>
<th>Biological Resources</th>
<th>Implementation, Monitoring, and Reporting Actions</th>
<th>Responsibility</th>
<th>Monitoring Schedule</th>
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</thead>
<tbody>
<tr>
<td>BIO-MM-1: Focused Burrowing Owl Surveys</td>
<td>Retain a qualified biologist to conduct survey</td>
<td>EMWD</td>
<td>Before Construction</td>
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<td></td>
<td>Retain copies of all surveys and reports in project file</td>
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<td>Consult with CDFW as applicable</td>
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<td></td>
<td>Implement mitigation measures as applicable</td>
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<td>Document compliance with mitigation measures as applicable</td>
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### BIO-MM-2: Preconstruction Surveys

EMWD shall conduct pre-construction surveys for coastal whiptail, coast horned lizard, California horned lark, and San Diego black-tailed jackrabbit to determine if these species are present within the Proposed Project impact areas for extraction and conveyance facilities. If any of these species are present, construction BMPs and WEAP training shall be implemented during construction activities to avoid and minimize potential impacts to these species. Example BMPs to be implemented during construction include limiting vehicle speed onsite to 15 miles per hour, covering trenches and open pits, if trenches are left open adding wooden ramps in the trench to allow small mammals to escape, temporarily fencing work areas using silt fencing, and cleaning up all trash and debris daily. Additional avoidance measures may include establishing a buffer around the species an onsite monitoring should a population of a special-status species be found. Additionally, the WEAP training will be conducted by a knowledgeable biologist to identify species that could be impacted and summarize the construction BMPs to be implemented. Construction personnel will be instructed to not directly harm any special-status species onsite by halting activities until the species can move to offsite areas or contact a qualified biologist to move the species out of harm’s way.

<table>
<thead>
<tr>
<th>Project Mitigation Measures</th>
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</table>
| **BIO-MM-2: Preconstruction Surveys** | - Retain a qualified biologist to conduct survey  
   - If identified species are present, conduct construction Best Management Practices (BMPs) and Worker Environmental Awareness Program (WEAP) training conducted by a knowledgeable biologist  
   - Retain copies of all surveys and reports in project file | EMWD | Before and During Construction |

Before and During Construction
### Project Mitigation Measures

|--------------------------|---------------------------------------------------|----------------|---------------------|
| Construction of the Proposed Project shall avoid the general avian nesting season of February through August. If construction of Proposed Project facilities that contain or are immediately adjacent to suitable nesting habitat must occur during the general avian nesting season, a pre-construction clearance survey should be conducted within 10 days prior to the start of construction activities to determine if any active nests or nesting activity is occurring on or within 500 feet of the Proposed Project. If no sign of nesting activity is observed, construction may proceed without potential impacts to nesting birds. If an active nest is observed during the pre-construction clearance survey, an adequate buffer should be established around the active nest depending on sensitivity of the species and proximity to Proposed Project impact areas. Typical buffer distances include up to 300-feet for passerines and up to 500-feet for raptors, but can be reduced as deemed appropriate by a monitoring biologist. On site construction monitoring may also be required to ensure that no direct or indirect impacts occur to the active nest. Proposed Project activities may encroach into the buffer only at the discretion of the monitoring biologist. The buffer should remain in place until the nest is no longer active as determined by the monitoring biologist. | - Include mitigation measure in construction contracting specification  
- Retain a qualified biologist to conduct survey if necessary, and to establish buffer if necessary  
- Retain copies of all surveys and reports in project file  
- Conduct periodic monitoring of mitigation commitments during construction.  
- Retain construction monitoring report in project file. | EMWD | Before Construction |

### Cultural Resources

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<tr>
<th>CUL-MM 1: Archaeological Sensitivity Training.</th>
<th>Implementation, Monitoring, and Reporting Actions</th>
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<tr>
<td>Prior to the start of any ground-disturbing activity, a Qualified Archaeologist shall conduct cultural resources sensitivity training for all construction personnel. Construction personnel shall be informed of the types of archaeological resources that may be encountered, and of the proper procedures to be enacted in the event of an inadvertent discovery of archaeological resources or human remains.</td>
<td>- Retain a qualified archaeologist to conduct pre-construction worker sensitivity training</td>
<td>EMWD</td>
<td>Before Construction</td>
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### CUL-MM-2: Cultural Resources Mitigation and Monitoring Program

**Program.** Prior to the start of any ground-disturbing activity, the Qualified Archaeologist shall prepare a Cultural Resources Mitigation and Monitoring Program (CRMMP) based on Proposed Project design plans. The CRMMP shall include provisions for archaeological monitoring of all ground disturbance related to construction of the Proposed Project, procedures to be followed in the event of discovery of archaeological resources, and protocols for Native American coordination and input, including review of documents. The CRMMP shall outline the role and responsibilities of Native American Tribal representatives. It shall include communication protocols, an opportunity and timelines for review of cultural resources documents related to discoveries that are Native American in origin, and provisions for future Native American monitoring in the event that resources of Native American origin are discovered. The CRMMP shall include provisions for Native American monitoring during testing or data recovery efforts for resources that are Native American in origin. The Native American monitor shall be selected from a tribe that is culturally and traditionally affiliated with the project area as indicated by the Native American Heritage Commission (NAHC).

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| **CUL-MM-2: Cultural Resources Mitigation and Monitoring Program.** | • Retain a qualified archaeologist to prepare a CRMMP  
• Retain copies of all surveys and reports in project file  
• Implement monitoring procedures as required by the CRMMP  
• Retain construction monitoring report in project file. | EMWD | Before Construction |

### CUL-MM-3: Archaeological Monitoring

All Project-related ground disturbance shall be monitored by archaeological monitor(s) familiar with the types of resources that could be encountered and shall work under the direct supervision of the Qualified Archaeologist. Archaeological monitor(s) shall be empowered to halt and re-direct ground disturbing activities in the event of a discovery until it has been assessed for significance and treatment implemented, if necessary, based on the recommendations of the Qualified Archaeologist in coordination with EMWD, and Native American representatives in the event the resource is Native American in origin. The

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| **CUL-MM-3: Archaeological Monitoring.** | • Include mitigation measure in construction contracting specification  
• Retain a qualified archaeologist to monitor ground disturbance | EMWD; Construction Contractor | During Construction |
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<td>Qualified Archaeologist may reduce the amount of monitoring that is required in certain areas if it is determined that the potential to encounter archaeological resources in that area is low based on observations of soil stratigraphy and other factors.</td>
<td>Retain construction monitoring report in project file.</td>
<td>EMWD</td>
<td>During Construction</td>
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**CUL-MM 4: Archaeological Discovery.** In the event archaeological resources are encountered during construction, activity in the vicinity of the find shall cease, and the protocols and procedures for discoveries outlined in the CRMMP shall be implemented. The discovery shall be evaluated for potential significance by the Qualified Archaeologist. If the Qualified Archaeologist determines that the resource may be significant, the archaeologist shall develop an appropriate treatment plan for the resource in accordance with the CRMMP. The Qualified Archaeologist shall also determine the level of archaeological monitoring that is warranted during future ground disturbance in the area, and whether work may proceed in other parts of the Proposed Project area while treatment for archaeological resources is being carried out.

- Retain a qualified archaeologist to implement CRMMP discovery procedures as necessary
- Include mitigation measure in construction contracting specification
- If found, document and retain records regarding discovery of archaeological resources.
- Retain construction monitoring report in project file.
### Project Mitigation Measures

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| **CUL-MM-5: Paleontological Monitoring.** Prior to the start of earth moving activities, EMWD shall retain a Qualified Paleontologist to attend any pre-grade construction meetings to determine when and where excavations will occur below a depth of 3 feet below the existing ground surface. Working with EMWD and the construction crew, the Qualified Paleontologist shall determine a paleontological monitoring schedule. The Qualified Paleontologist, or a paleontological monitor working under the direct supervision of the Qualified Paleontologist, shall monitor all ground-disturbing activity below a depth of 3 feet below the existing ground surface. The location, duration, and timing of monitoring shall be determined by the Qualified Paleontologist designated for the Proposed Project in consultation with the EMWD and shall be based on a review of geologic maps and grading plans. During the course of monitoring, if the Qualified Paleontologist can demonstrate based on observations of subsurface conditions that the level of monitoring should be reduced, increased, or discontinued, the paleontologist, in consultation with EMWD may adjust the level of monitoring, as warranted. | - Include mitigation measure in construction contracting specification  
- Retain a qualified paleontologist to conduct monitoring  
- Retain copy of monitoring schedule in project file  
- Prepare and retain construction monitoring reports in project file | EMWD; Construction Contractor | Before and During Construction |
<p>| <strong>CUL-MM-6: Paleontological Sensitivity Training.</strong> Prior to start of earth moving activities, the Qualified Paleontologist shall conduct pre-construction worker paleontological resources sensitivity training. This training shall include information on what types of paleontological resources could be encountered during excavations, what to do in case an unanticipated discovery is made by a worker, and laws protecting paleontological resources. All construction personnel shall be informed of the possibility of encountering fossils and instructed to immediately inform the construction foreman or supervisor if any bones or other potential fossils are unexpectedly unearthed in an area where a paleontological monitor is not present. | - Retain a qualified paleontologist to conduct pre-construction worker sensitivity training | EMWD | Before Construction |</p>
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| CUL-MM-7: Unanticipated Paleontological Discovery. In the event of unanticipated discovery of paleontological resources when a paleontological monitor is not present, the contractor shall cease ground-disturbing activities within 50 feet of the find until it can be assessed by the Qualified Paleontologist. The Qualified Paleontologist shall assess the find, implement recovery and reporting measures, if necessary, and determine if paleontological monitoring is warranted once work resumes. | • Include mitigation measure in construction contracting specification  
• Retain construction monitoring report in project file | EMWD; Construction Contractor | During Construction |
| CUL-MM-8: Human Remains. If human skeletal remains are uncovered during Proposed Project implementation, EMWD shall immediately halt work, contact the Riverside County coroner to determine whether the remains are human, and follow the procedures and protocols outlined in the CRMMP (see Mitigation Measure CUL-MM-2). If the County Coroner determines that the remains are Native American, they shall contact the NAHC as required by law. The NAHC shall then identify the person(s) thought to be the MLD of the deceased Native American, who will then help determine what course of action should be taken in dealing with the remains. EMWD shall ensure that the immediate vicinity where the Native American human remains are located is not damaged or disturbed by further development activity until the landowner has discussed and conferred with the MLD regarding their recommendations. | • Include mitigation measure in construction contracting specification  
• If found, document and retain records regarding discovery of skeletal remains in project file | EMWD; Construction Contractor | During Construction |
Geology, Soils, and Seismicity

**GEO-MM 1: Soils Reports and Geotechnical Investigation.** A soils report and geotechnical investigation report shall be prepared by a California licensed geotechnical engineer for all Project facilities with potential to encounter shallow groundwater or expansive soils. These reports shall evaluate various geotechnical characteristics including existing liquefaction risk, expansive soils, and soil stability, and whether the operation of Project facilities would exacerbate an existing risk of liquefaction or soil instability or create a new risk. The reports and evaluation shall provide recommendations for facility design per these findings; these recommendations shall be incorporated into facility design.

- Include mitigation measure in design specifications
- Retain a copy of Geotechnical Investigation report, recommendations, and design specifications in project file

**Responsibility:** EMWD; Design Contractor  
**Monitoring Schedule:** Before Construction

**GEO-MM 2: Groundwater Monitoring.** EMWD shall monitor groundwater levels to identify if and when levels reach below historical low levels. If monitoring data show that groundwater levels have reached historically low levels, EMWD shall reduce recovery operations to prevent subsidence from occurring.

- Monitor groundwater levels and retain records of monitoring data
- Maintain records of recovery operations
- Document changes in recovery operation as applicable

**Responsibility:** EMWD; Project Operator  
**Monitoring Schedule:** Before Construction
<table>
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<tr>
<th>Project Mitigation Measures</th>
<th>Implementation, Monitoring, and Reporting Actions</th>
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<th>Monitoring Schedule</th>
<th>Completion of Implementation (Action/Date Completed/Signed off by)</th>
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<td>Hazards and Hazardous Materials</td>
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| **HAZ-MM 1: Implement Fire Hazard Reduction Measures.** | During construction of facilities located in areas designated as moderate, high, or very high fire hazard severity zone by CAL FIRE, EMWD shall require that all staging areas, welding areas, or areas slated for development using spark-producing equipment shall be cleared of dried vegetation or other material that could ignite. Any construction equipment that includes a spark arrester shall be equipped with a spark arrester in good working order. During the construction of the Proposed Project facilities, contractors shall require all vehicles and crews to have access to functional fire extinguishers at all times. In addition, construction crews shall have a spotter during welding activities to look out for potentially dangerous situations, including accidental sparks. | • Include mitigation measure in construction contracting specification
• Conduct periodic monitoring of mitigation commitments during construction.
• Retain construction monitoring report in project file. | EMWD; Construction Contractor | Before and During Construction |
| Noise                                           |                                                  |                                  |                                  |                                                 |
| **NOI-MM 1: Operational Noise Standards.** EMWD shall ensure that new aboveground Project facilities are designed such that operational noise complies with applicable noise standards at the property boundary. | • Include mitigation measure in design specifications
• Retain a copy of design specifications in project file | EMWD; Design Contractor | Before Construction |
### Project Mitigation Measures

**NOI-MM 2: Construction-Related Noise Measures.** To reduce temporary construction-related noise impacts, EMWD shall require the construction contractor to implement BMPs that ensure the following:

a. Place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest to the Proposed Program site.
b. Locate equipment staging areas at the greatest possible distance between construction-related noise sources and noise-sensitive receptors nearest the Proposed Program site.
c. Ensure appropriate maintenance and working order of equipment and vehicles, and that all construction equipment is equipped with manufacturers approved mufflers and baffles.
d. Install sound-control devices in all construction equipment, no less effective than those provided on the original equipment.

<table>
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<th>Implementation, Monitoring, and Reporting Actions</th>
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<tr>
<td>· Include mitigation measure in construction contracting specification</td>
<td>EMWD; Construction Contractor</td>
<td>During Construction</td>
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<tr>
<td>· Conduct periodic monitoring of mitigation commitments during construction.</td>
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<tr>
<td>· Retain construction monitoring report in project file.</td>
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**Transportation and Traffic**

**TRAF-MM 1: Traffic Control Plan.** Prior to the start of construction of the conveyance facilities, EMWD shall require the construction contractor to prepare a Traffic Control Plan. The Traffic Control Plan shall show all signage, striping, delineated detours, flagging operations and any other devices that will be used during construction to guide motorists, bicyclists, and pedestrians safely through the construction area and allow for adequate access and circulation to the satisfaction of the City of San Jacinto. The Traffic Control Plan shall be prepared in accordance with the City of San Jacinto’s traffic control guidelines and will be prepared to ensure that access will be maintained to individual properties, and that emergency access will not be restricted. Additionally, the Traffic Control Plan will ensure that congestion and traffic delay are not substantially increased as a result of the construction activities. Further, the Traffic Control Plan will include detours or alternative routes for bicyclists using on-street bicycle lanes as well as for pedestrians using adjacent sidewalks. In addition, EMWD shall provide written notice at least two weeks prior to the start of construction to owners/occupants along streets to be affected during construction.

During construction, EMWD will maintain continuous vehicular and pedestrian access to any affected residential driveways from the public street to the private property line, except where necessary construction precludes such continuous access for reasonable periods of time. Access will be reestablished at the end of the workday. If a driveway needs to be closed or interfered with as described above, EMWD shall notify the owner or occupant of the closure of the driveway at least five working days prior to the closure. The Traffic Control Plan shall include provisions to ensure that the construction of the conveyance pipelines do not interfere unnecessarily with the work of other agencies such as mail delivery, school buses, and municipal waste services.

EMWD shall also notify local emergency responders of any planned partial or full lane closures or blocked access to roadways or driveways required for Proposed Program facility construction. Emergency responders include fire departments, police departments, and ambulances that have jurisdiction within the Proposed Program area. Written notification and disclosure of lane closure location must be provided at least 30 days prior to the planned closure to allow for emergency response providers adequate time to prepare for lane closures.

<table>
<thead>
<tr>
<th>Include mitigation measure in construction contracting specification</th>
<th>Retain copy of Traffic Control Plan in project file</th>
<th>Conduct periodic monitoring of Traffic Control Plan requirements during construction.</th>
<th>Retain construction monitoring report in project file</th>
</tr>
</thead>
</table>

**EMWD; Construction Contractor**

**Before and During Construction**
APPENDIX D

Sample Aluminum Sign
Your order includes one basic setup/proof and one minor revision of that proof. Basic setup includes placement of your logo, graphic or photo and up to three lines of text.

- Minimum charge of $25 each for additional minor revisions
- New designs or major revisions may be more.
- Work done under design agreements may include more than one revision.

Please Note: Please review design, colors, size, spelling and grammar, information accuracy (telephone numbers, URLs, addresses, prices, etc), and order quantity.

Once your graphics are printed or fabricated changes cannot be made.

This is a low-resolution PDF proof. This proof is intended for concept, content and layout review only. The colors in this document are not a true representation of the printed product.

Due to the variances of the monitor on which it is viewed, colors of the printed product may vary from the digital PDF proof.

Typographical errors cannot be changed after the product is produced. Please carefully check proof for accuracy of content and spelling. Thank you for your understanding.
APPENDIX E

SCE Service Plans
APPENDIX F
Maxim Security System Pre-Negotiated Proposal
ORDER TO CONNECT, PRESSURE TEST, DISINFECT, AND FLUSH THE PROPOSED PIPELINES.

CONTRACTOR TO PROVIDE DETAILED SHUTDOWN AND CONNECTION COORDINATION SCHEDULE TO DISTRICT FOR REVIEW AND APPROVAL PRIOR TO START OF ANY WORK.

THE CONTRACTOR SHALL MAINTAIN SERVICE IN THE EXISTING STORM DRAIN. THE CONTRACTOR SHALL COORDINATE WITH THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT.

THE PHASE 1B PIPELINE WORK WILL BE GOING ON CONCURRENTLY WITH THIS PROJECT. THE CONTRACTOR SHALL COORDINATE WITH EMWD AND THE PHASE 1B PIPELINE CONTRACTOR IN ORDER TO COMPLETE ALL WORK IN A TIMELY MANNER.

COLOR SCHEDULE NOTES:
1. MANUFACTURER’ SPEC./COLOUR CODE SHEETS ARE AVAILABLE FROM OTHER MANUFACTURER. CONTRACTOR TO PROVIDE SAME OR EQUIVALENT COLORS. IF AN ALTERNATE MANUFACTURER IS SUBMITTED, CONTRACTOR SHALL PROVIDE MANUFACTURER SPECIFICATIONS AND COLOUR SHEET.
2. PROVIDE APPLICABLE ITEMS FROM OTHER MANUFACTURER, CONTRACTOR TO PROVIDE SAME OR EQUIVALENT COLOUR. IF MANUFACTURER SPECIFICATIONS ARE NOT SUBMITTED, CONTRACTOR SHALL PROVIDE MANUFACTURER SPECIFICATIONS.
3. CONTRACTOR TO PROVIDE DETAILED SHUTDOWN AND CONNECTION COORDINATION SCHEDULE TO DISTRICT FOR REVIEW AND APPROVAL PRIOR TO START OF ANY WORK.
4. THE CONTRACTOR SHALL MAINTAIN SERVICE IN THE EXISTING STORM DRAIN. THE CONTRACTOR SHALL COORDINATE WITH THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT FOR THE TB'S TO THE STORM DRAIN AND COMPLY WITH ALL REQUIREMENTS.

COLOR SCHEDULE:
- SAFETY BLACK (SW-4090)
- WHITE
- YELLOW
- SWISS COFFEE (DEW341)
- BAGEL (SW-6114)
- ORCO TAN
- OTAY BROWN
- DUNN-EDWARDS AIROLITE CO
- PAINTED STEEL
- FLAT WALL CAP (TEXTURE TO MATCH PILASTER CAP)
- CMU BLOCK-SPLIT FACE (EXTERIOR SIDE)
- BAM DG
- INTERIOR LIGHTING

MANUFACTURER:
- SHERWIN-WILLIAMS
- SHERWIN-WILLIAMS
- SHERWIN-WILLIAMS
- AIROLITE CO
- FENCE CORP
- ALUMAX INC.
- GEORGIA PACIFIC
- GREENHECK
- BLACK
- SAFETY BLACK (SW-4090)
- WHITE
- YELLOW
- SWISS COFFEE (DEW341)
- BAGEL (SW-6114)
- ORCO TAN
- OTAY BROWN
- DUNN-EDWARDS AIROLITE CO
- PAINTED STEEL
- FLAT WALL CAP (TEXTURE TO MATCH PILASTER CAP)
- CMU BLOCK-SPLIT FACE (EXTERIOR SIDE)
- BAM DG
- INTERIOR LIGHTING
COORDINATE WITH SO CAL GAS COMPANY TO PURGE THE CAPPING OF EXIST GAS LINE SHALL BE COORDINATED WITH SO CAL GAS COMPANY.

AND ELECTRICAL WIRING SHALL BE COORDINATED WITH SCE.

REMOVE INTERFERING PORTIONS OF EXIST 16" IRRIGATION LINE PER DTL 3 ON SHT C-505.

EXIST SCE ELECTRICAL TRANSFORMER, REMOVE AND DISPOSE OF WELL, ANCILLARY PIPING AND EQUIPMENT. WELL, PIP, CONDUIT SUPPORTS.

EXIST ELECTRICAL, WATER, AND PIPELINE.

COORDINATE WITH SO CAL GAS COMPANY TO PURGE THE CAPPING OF EXIST GAS LINE AND ELECTRICAL WIRING.

EXIST SCE CONDUITS.

EXIST 12" WATER LINE (CML & C STL) PER E.M.W.D. DTL 3 ON SHT C-505.

EXIST 15' EASTERN MUNICIPAL WATER DISTRICT (UNK).

EXIST BARBED WIRE.

EXIST BALL.

EXIST TANK.

EXIST WATER LINE.

EXIST MONITORING WELL.

EXIST SCE VAULT.

EXIST SCE CONDUITS.

EXIST 16'' IRRIGATION LINE.

EXIST PORTA POTTY.

EXIST STORAGE CONTAINER.

EXIST IN PLACE STRUCTURE.

EXIST IN PLACE WATER MAIN.

EXIST IN PLACE WATER METER.

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CONSTRUCTION NOTES

1. CONSTRUCT WHITE WALL PER DTL 10% WHT C WHI
2. CONSTRUCT MASONRY PER DL 7 ON 3/4 WM AGR
3. CONSTRUCT BLOCK WALL, ACCENT STRIPES AND CAP PER COLOR SCHEMATIC ON WM A GR
4. CONSTRUCT BLOCK WALL, PANEL VICTORIAN FINISH RED WHT
5. CONSTRUCT BLOCK WALL, PANEL VICTORIAN FINISH RED WHT
6. CONSTRUCT BLOCK WALL, PANEL VICTORIAN FINISH RED WHT

MATCHLINE 1 - SEE BELOW LEFT

EAST WALL PROFILE (LOOKING EAST)

SCALE: 1" = 5'-0"

EAST WALL PROFILE (LOOKING EAST)

SCALE: 1" = 5'-0"

SCE INNER WALL PROFILE (LOOKING EAST)

SCALE: 1" = 5'-0"

APPROVED BY:

DIRECTOR OF ENGINEERING

www.tetratech.com
CONSTRUCTION NOTES

- CONSTRUCT TYPE 1 WALL PROFILES PER DTL 1 ON SHEET C-504
- CONSTRUCT PILASTER PER DTL 2 ON SHEET C-504
- CONSTRUCT BLOCK WALL, ACCENT STRIPE AND CAP PER COLOR
  SCHEDULE ON SHEET C-504
- CONSTRUCT TYPE 1 WALL PROFILES 1 ON SHEET C-504
- CONSTRUCT PILASTER PER DTL 2 ON SHEET C-504
- CONSTRUCT BLOCK WALL, ACCENT STRIPE AND CAP PER COLOR
  SCHEDULE ON SHEET C-504
ROLLING GATE DETAIL

1. POST MOUNTED ROLLERS

2. ACCESS ROAD WIDTH AS SHOWN ON SITE PLANS

3. ACCESS GATE LOOP DETECTOR DETAIL

4. GATE LOCK DETAIL

5. CARD READER PEDESTAL

6. SECTION THROUGH GATE/TRACK

NOTES:

1. A ROLLER GUIDE (SEE NOTE 1)

2. PAGE 1 OF 100

3. PAGE 36 X 24

4. PAGE 90% SUBMITTAL

5. SCALE: NTS

6. DRAWN: __-________ D  60376

7. DESIGNED: 41473 (6) (7) (8)

8. CHECKED: 40A-19

9. SUBMITTED: 40A-19

10. DATE

11. INITIALS

12. APP'D/DATE

13. DESCRIPTION

14. REFERENCES

15. DRAWER MEASURES 1 INCH

16. AS NOTED

17. AS BUILT

18. AS NOTED PER PROJECT MANAGER

19. AS NOTED PER CONTRACTOR

20. AS NOTED PER CARD READER MANUFACTURER

21. AS NOTED PER ACCESS ROAD WIDTH

22. AS NOTED PER CENTRALIZED TREATMENT FACILITY

23. AS NOTED PER RIVERSIDE COUNTY, CALIFORNIA

24. AS NOTED PER EASTERN MUNICIPAL WATER DISTRICT

25. AS NOTED PER WELLS 201, 202, 203, AND 205

26. AS NOTED PER AMBER KOWALSKY, P.E.

27. AS NOTED PER DIRECTOR OF ENGINEERING

28. AS NOTED PER EASTERN MUNICIPAL WATER DISTRICT
1. **DOUBLE SWING GATE DETAIL**
   - **SCALE:** NTS
   - **ELEVATION**

2. **RIBBON GUTTER**
   - **SCALE:** NTS
   - **ELEVATION**

3. **SURFACE SOIL PREPARATION**
   - **SCALE:** NTS
   - **ELEVATION**

4. **PEDESTRIAN GATE DETAIL**
   - **SCALE:** NTS
   - **ELEVATION**

5. **REDWOOD HEADER**
6. **EARTH SWALE**
**Concrete Mow Curb**

- 3/4" radius exposed edges
- Medium broom finish
- Install grade level

**Finish Grade**

- #4 rebar continuous
- 6'-0" wide

**Precast Concrete Box**

- 5' x 5' x 8' deep
- Hot dip galvanized H2O traffic rated grating
- 4'-0" min

**Drain**

- 24" onsite
- See sheet C-103 for continuation

**Grate Top**

- EL 1575.18

**Pipe Support**

- Per detail 1 on sheet D-501

**Concrete Mat**

- 30" thick
- Foundation per sheet S-104

**Class II Aggregate Base**

- 3" thick

**Existing Grade**

- Top of slab EL 1576.70

**Filter Facility Pad**

- 50'-0"
- Final grade varies

**Subgrade Preparation**

- Per detail 6 on sheet S-503

**Grading Plan**

- FG 1576.10

**1' Bench (Typ)**

- (2% - 20%) slope

**Motor Operated Butterfly Valve**

- Pipe support

**Concrete**

- Schedule 40 steel
- Hot dip galvanized entire assembly after fabrication
- Color schedule shown on sheet G-004

**Concrete Sign**

- 3" x 3" x 6" deep pre-cast
- Concrete sign for pedestrian control
- Padlock capable

**3" DIA Schedule 40 PVC Pipe**

- Sleeve embedded in concrete

**4" Dia Schedule 40 Steel Post**

- Welded or threaded cap with 1/2" rod handle

**Wells 201, 202, 203, and 205**

- Centralized Treatment Facility

**Backwash Waste Tank Pad**

- Section A

**Pipe Support**

- Per detail 1 on sheet D-501

**Concrete Mat**

- 30" thick
- Foundation per sheet S-104

**Class II Aggregate Base**

- 3" thick

**Existing Grade**

- Top of slab EL 1577.60

**Filter Tank Pad**

- Section B

**NOTES:**
1. Provide deep score joints at 8' OC and 3/8" rubber expansion joints at 24' OC.
2. Concrete shall be 560-C-3250.

**REFERENCES**

- AS NOTED
- EASTERN MUNICIPAL WATER DISTRICT
- PROJECT MANAGER
- DATE: 06/2021
- DIRECTOR OF ENGINEERING
- DATE: 06/2021
- DESIGN: 17885 Von Karman Ave, Suite 500
  Irvine, California 92614
  Tel: (949) 809-5000  Fax: (949) 809-5010

**APPROVED BY:**

- Shaun Stone, P.E.
- Greg Kowalski, P.E.

**06/2021**

**90% SUBMITAL**

- DIGALERT
- TETRA TECH
- D-WELL 201, 202, 203, AND 205 CENTRALIZED TREATMENT FACILITY
**1. TYPE 1 REINFORCED CONCRETE BLOCK WALL**

- **TEN BLEV PER WALL PROFILE**
- **6'-0"**
- **8" (NOMINAL)**
- **1'-0"**
- **10'-8" MAX.**
- **8" (NOMINAL)**
- **PARTIALLY GROUTED CMU WALL**
- **1'-6"**
- **5'-0" MAX. RETAINING**
- **6" MIN.**
- **FINISH GRADE**
- **BACKFILL OVER FOOTING TOE 2" CLR.**
- **BACKFILL OVER FOOTING HEEL 3" CLR.**
- **MAX. SLOPE 2:1**
- **#5 VERTICAL BAR @ 16", EACH FACE**
- **#4 HORIZONTAL BAR @ 24"**
- **#5 CONTINUOUS HORIZONTAL BAR AT TOP OF WALL**
- **4'-8" LAP**
- **3'-0" MAX. RETAINING**

**NOTES:**

1. SEE NOTE 4 ON SHEET G-002 REGARDING ANTI-GRAFFITI AND WATERPROOFING.
2. ALL COURSES BELOW GRADE AND ADJACENT TO PAVING SHALL HAVE A SMOOTH PRECISION FACE FINISH. PAVING AGAINST AN IRREGULAR SURFACE WILL NOT BE ALLOWED. CONTRACTOR SHALL MINIMIZE THE AMOUNT OF PRECISION BLOCK ABOVE THE PAVEMENT INTERFACE.

**2. PILASTER ELEVATION**

- **MASONRY CAP - 60 X 10"**
- **SEE COLOR SCHEDULE ON G-002 FOR BLOCK TYPE AND COLOR**
- **TYPE 1 REINFORCED CONCRETE BLOCK WALL**
- **BACKFILL OVER FOOTING TOE 2" CLR.**
- **TYPICAL CORNER PILASTER**
- **CENTER PILASTERS ON WALL**
- **EXTENDING HORIZONTAL REINFORCING INTO PILASTER AND PROVIDE 90° BEND**

**3. TYPICAL CORNER PILASTER**

- **MASONRY CAP - 60 X 10"**
- **SEE COLOR SCHEDULE ON G-002 FOR BLOCK TYPE AND COLOR**
- **FINISHED SURFACE, ELEVATION VARIES.**

**4. STEPPED FOOTING**

- **MASONRY CAP**
- **CONCRETE BLOCK WALL OR PILASTER**

**5. MASONRY CAP**

- **MASONRY CAP**
- **CONCRETE BLOCK WALL OR PILASTER**
- **NOT FOR CONSTRUCTION**

**REFERENCES**

- **DESIGNED:**
- **DRAWN:**
- **CHECKED:**
- **SUBMITTED:**
- **SCALE:**

**APPENDIX**

- **APPROVED BY:**
- **DIRECTOR OF ENGINEERING:**

**PROJECT MANAGER**

- **APPROVALS**

**REVISED BY:**

- **EASTERN MUNICIPAL WATER DISTRICT**
- **RIVERSIDE COUNTY, CALIFORNIA**

**SPECIFICATIONS**

- **SCALE: NTS**
- **TYPE 1 REINFORCED CONCRETE BLOCK WALL**
- **PILASTER ELEVATION**
- **TYPICAL CORNER PILASTER**
- **STEPPED FOOTING**
- **MASONRY CAP**
3. ALL REINFORCEMENT, ANCHOR BOLTS, AND OTHER ANCHORAGES PLACED IN CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS

2. THE CONTRACTOR ACKNOWLEDGES RESPONSIBILITY FOR JOBSITE INSPECTION IS REQUIRED OF ALL FIELD WELDING IN ACCORDANCE WITH C.B.C. CHAPTER 17.

4. BARS SPECIFIED AS "CONTINUOUS" SHALL EXTEND THE FULL LENGTH OF THE MEMBER CONTAINING THEM AND MAY BE SPLICED (UNLESS NOTED OR OTHERWISE.

9. WELDING EQUIPMENT SHALL BE CHECKED PRIOR TO WELDING AS REQUIRED BY WELDING EQUIPMENT SPECIFICATIONS.

6. ALL WELDING SHALL BE SHIELDED ARC TYPE AND SHALL BE PERFORMED BY QUALIFIED WELDERS AS REQUIRED BY THE CONTRACT DOCUMENTS.

7. VERIFY ALL CONNECTORS ARE TIGHT AFTER WORK IS COMPLETED.

3. CONCRETE MASONRY UNITS (CMU) SHALL BE HOLLOW CELLULAR CONCRETE UNITS SHALL BE EITHER SINGLE OR DOUBLE OPEN END BLOCKS AND SHALL COMPLY WITH THE PROJECT SPECIFICATIONS. CONTRACTOR FOR THESE REASONS SHALL NOT BE CAUGHT EASY.

1. ALL CONCRETE SHALL HAVE A MINIMUM A TRENT COMPRESSION STRENGTH OF 2000 PSI AT 28 DAYS. ACCELERATED CONCRETE SHALL BE CONFORMED TO A.A.C.C. SPECIFICATIONS.

2. CEMENT FOR CONCRETE SHALL BE TYPE I PORTLAND CEMENT CONFORMING TO ASTM C150 OR C150M.

5. ALL MEMBERS AND COMPONENTS SHALL BE GALVANIZED IN CONFORMANCE WITH C.B.C. CHAPTER 17.

4. CONNECTIONS OF FRP MEMBERS SHALL BE WITH STAINLESS STEEL BOLTS OR NUTS.

5. FOR FRP MEMBERS WITHOUT A SIZE INDICATED, CONTRACTOR SHALL PROVIDE A DETAILED VIEWS PROVIDED OF THE DESIGNER. FOR THE DESIGNER'S APPROVAL, PROVIDED THAT IT HAS A CURRENT I.C.C. EVALUATION REPORT DEMONSTRATING EQUAL PROPERTIES.

6. ALL PRECAST SYSTEM COMPONENTS SPECIFIED BY MODEL ARE MANUFACTURED WITH ARCHITECTURAL, ELECTRICAL AND MECHANICAL DRAWINGS.

7. VERIFY ALL CONNECTORS ARE TIGHT AFTER WORK IS COMPLETED.

1. STEEL NOTES

1b. CONCRETE MASONRY UNITS (CMU) SHALL BE HOLLOW CELLULAR CONCRETE UNITS SHALL BE EITHER SINGLE OR DOUBLE OPEN END BLOCKS AND SHALL COMPLY WITH THE PROJECT SPECIFICATIONS. CONTRACTOR FOR THESE REASONS SHALL NOT BE CAUGHT EASY.

2. CHANNEL MEMBERS SHALL BE FABRICATED FROM STRUCTURAL GRADE STEEL WITH ASTM A36, UNLESS NOTED OTHERWISE.

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7. VERIFY ALL CONNECTORS ARE TIGHT AFTER WORK IS COMPLETED.

1. STEEL NOTES
12. VERIFY ANCHOR EMBEDMENT

11. VERIFY CONCRETE THICKNESS

9. VERIFY ANCHOR SPACING

7. VERIFY HOLE DIMENSIONS

6. VERIFY THAT THE FOLLOWING ARE IN COMPLIANCE

5. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT

4. PRIOR TO CONSTRUCTION, VERIFY CERTIFICATES OF COMPLIANCE USED IN

MASONRY CONSTRUCTION (LEVEL C, FOR RISK CATEGORY IV):

C - INSPECT THESE ITEMS ON A

PERIODIC BASIS. OPERATIONS NEED NOT BE DELAYED PENDING

CONSTRUCTION PERSONNEL MAY BE PERMITTED, WITH

THE PROJECT SITE IN ACCORDANCE WITH SPECIFICATION ARTICLE 1.5 B.1.b.3 FOR

PRIOR TO CONSTRUCTION AND FOR EVERY 5,000 SQ. FT (465 SQ. M) DURING

PROJECT ENG.

DATE

1. CONCRETE:

FREQUENCY OF THE PERIODIC ANCHOR INSPECTIONS. THE ENGINEER MAY

ADHESIVE ANCHORS:

- DIMENSIONS (ALIGNMENT, GAPS AT ROOT)

- TACKING (TACK WELD QUALITY AND LOCATION)

- D. WELDER IDENTIFICATION SYSTEM

- G. PROPER STORAGE PROVIDED FOR BOLTS, NUTS, WASHERS AND OTHER FASTENER

- D. STRUCTURAL STEEL (MILL REPORTS AND IDENTIFICATION

- A. PREFABRICATED TRUSSES

- B. PLYWOOD ROOF, FLOOR AND WALL SHEATHING

- STRUCTURAL FRAME

- CENTRALIZED TREATMENT FACILITY

- S.002

- O:\PROJECTS\IRVINE\09565\200-09565-19001\CAD\SHEETFILES\TREATFAC\S-002 SPECIAL INSPECTIONS AND STRUCTURAL OBSERVATIONS.DWG

- JOHNSON, WILLIE

- www.tetratech.com

- D2G0402-011

- 1381W
MASONRY OPENING FOR EXHAUST FAN. SET SILL AT LEVEL CONCRETE PAD AT SOUND TRAP. SET TOP OF LOCATE VERTICAL BARS AT CENTERLINE.

LOCATE VERTICAL BARS

SIZE AND SPACING

ACCESS LADDER. O'KEEFE'S GALVANIZED STEEL TOC 0'-0".

TYPICAL U.N.O.

#6 @ 8"

TYPICAL U.N.O.

LOCATE HORIZONTAL BARS ADJACENT TO 2' - 0"

CONCRETE CONTAINMENT AREA 21' - 4"

2' - 4"

24" THICK CONCRETE MAT FOUNDATION w/ #6 @ 12"

TOC 0'-0"

16' - 8"

MASONRY OPENING ABOVE DOOR FOR INTAKE LATERAL RESTRAINT AT TOP OF SOUND TRAP PER TYPICAL U.N.O.

6' - 0"

LOCATION

8"

14

6' - 0"

LATERAL RESTRAINT FOR SOUND TRAP, FOUR TOTAL LATERAL RESTRAINTS FROM FOUNDATION THROUGH CONCRETE CONTAINMENT WALL, WITH A 2'-0" WIDE CLEAR SPACE IN BETWEEN. PROVIDE COMPLETE CALCULATIONS AND FABRICATION DRAWINGS.

2' - 0"

TOC 0'-0"

FILL CONTAINMENT AREA 16' - 8"

8'

8' - 6"

8' - 8" (x7'-4") M.O.

5

TOC -(0'-2 1/2")

CONCRETE CONTAINMENT WALL BELOW TNK-6100 TOC -(0'-1")

- 8"

DEPRESSED FLOOR AT ANALYZER ROOM TNK-6200 TOC +1'-0"

3' - 0" SQ.

4' - 4"

16' - 0"

TOC 0'-0"

1' - 0"

HORIZONTAL #5 CONT. AT TOP OF WALL CHORD BARS VERTICALLY APART @ 8"

3' - 4"

M.O.

5

TOC 0'-0"

1' - 10"

S-101

1719 PZ SPEC

301 LOUVER. SET SILL AT +1' TG 0'-0" TYP.

- 8"

- 4"

TOC -(0'-3")

10

11

7

21

7

22

S

AS NOTED

APPROVED BY:

Shaun Stone, P.E.

APPROVALS

PROJECT ENG.

RIVERSIDE COUNTY, CALIFORNIA

DERETSI GER

REFERENCES

NO. DATE INITIALS DESCRIPTION

Shaun Stone, P.E. APP'D/DATE

DERETSI GER

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REFERENCES

NO. DATE INITIALS DESCRIPTION

Shaun Stone, P.E. APP'D/DATE
KEYNOTES

1. 1/2" DEEP GALVANIZED STEEL DECK. DIRECT POUR APPREHEND SLOPE. 1/2" SHEET 6'-0".
2. WALL FRAMING HSS8X2X1/8 & HSS8X2X1/8 MPS 1. ATTACHED TO THE WALL PER THE
MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. STEEL BEAM TYPICAL W10X12 W10X12
4. EXTERIOR CONCRETE BLOCK WALL
5. INTERIOR CONCRETE BLOCK PARTITION WALL
6. MASONRY PLASTER WALL
7. PIPE DRAIN AND OVERFLOW ASSEMBLY
8. SUPPORT FOR GENERATOR DIESEL PARTICULATE FILTER
9. CEILING IN RESTROOM: 5/8" THICK TYPE X GYPSUM BOARD WITH NO. 6 DRYWALL SCREWS @ 8" AT EACH SUPPORT. ATTACH GYPSUM BOARD TO 4" DEEP GALVANIZED STEEL COLD FORMED METAL FRAMING HSS8X2X1/8 (CEMCO 400S250 - 54 OR APPROVED EQUAL) @ 16" ON CENTER MAXIMUM. PROVIDE JOIST SECTIONS AS TW +(12'-6") BLOCKING AT ALL UNSUPPORTED DRYWALL PANEL
10. EXHAUST FAN. FRAME AROUND CEILING JOIST AS SPECIFIED IN KEYNOTE 11.
11. ROOF MOUNTED HVAC EQUIPMENT. SEE SHEET MP2.1
12. 2'-0" X 3'-0" ROOF ACCESS HATCH (BILCO TYPE S WITH BIL GUARD 2.0 ROOF HATCH SAFETY RAILING TYPICAL ALONG OR APPROVED EQUAL).
KEYNOTES:

1. 12" THICK CONCRETE SLAB w/ #5 @ 12" EACH WAY TOP AND BOTTOM. PROVIDE LIGHT BROOM FINISH IN NORTH/SOUTH DIRECTION.
2. POLAR CONCRETE CURB - TYPICAL ON NORTH SOUTH AND EAST SIDES.
3. 3" SQUARE, 2 1/2" DEEP H-20 TRAFFIC RATED PRECAST CONCRETE VAULT WITH 2 1/2" DEEP GALVANIZED STEEL BAR GRATING WITH 5/16 BEARING BARS.
4. CONCRETE CURB.
5. CONCRETE SIDEWALK.

CONTAINMENT SLAB

CONTAINMENT SLAB STANDARD CURB

TRUCK CONTAINMENT SLAB
1. 6' - 1" CONCRETE MAT FOUNDATION w/ #8 @ 12" EACH WAY, TOP AND BOTTOM
2. 16' - 0" CONCRETE MAT FOUNDATION w/ #5 @ 10" EACH WAY, TOP AND BOTTOM
3. 45' - 6" DIA. BOLTED STEEL BACKWASH TANK.
4. TANK ANCHORAGE PER DETAIL 2 ON SHEET S-503
5. NOT USED
6. TOP OF SLOPE OCCURS AT THE EDGE OF THE FLOOR PLATE OF THE TANK
7. SLOPE THE TOP OF THE EXPOSED PORTION OF THE FOUNDATION 1% MIN. TOWARDS EDGE
8. CONCRETE LANDING EXTENSION AT LADDER EXTEND TYP. MAT FOUNDATION INTO LANDING
9. PRECAST CONCRETE CATCH BASIN – SEE SHEET D-103 FOR SIZE AND LOCATION
10. 2' - 6" WIDE x 6' - 0" LONG CONCRETE EQUIPMENT PAD FOR BACKWASH PUMPS. PROVIDE A MINIMUM OF 4 - 1" CAST-IN-PLACE ANCHORS EMBED 6" INTO THE FOUNDATION. REFER TO DETAIL 10 ON SHEET S-503 FOR EQUIPMENT PAD DETAIL.

KEYNOTES

DATUM: DATUM (0' - 0") IS AT THE FOUNDATION AT THE EDGE OF THE TANK FLOOR PLATE AND IS AT ELEVATIONS 1576.7
1. **24" CONCRETE MAT FOUNDATION w/ #7 @ 12" EACH WAY, TOP AND BOTTOM**

2. **CONSTRUCTION JOINT - SEE DETAIL 9 ON SHEET**

3. **#5 (x6'-0" LONG) DIAGONAL AT THE TOP MAT OF REINFORCING**

4. **8" TALL CONCRETE PEDESTAL (2 PER FILTER VESSEL, 8 TOTAL) - SEE DETAIL 3 ON SHEET**

5. **FILTER VESSEL - SEE MECHANICAL DRAWINGS**

6. **5 1/2" DIA. ASTM F1554 GR105 CAST-IN-PLACE ANCHOR BOLTS w/ LEVEL NUT EMBED 20". POST INSTALLED ANCHORS MAY NOT BE USED IN PLACE OF CAST-IN-PLACE ANCHOR BOLTS.**

7. **PIPE PENETRATION IN MAT FOUNDATION. SEE DETAIL 6 ON SHEET**

8. **PIPE SUPPORT PER DETAIL 1 ON SHEET**

**DATUM:** DATUM (0' - 0") IS AT THE FOUNDATION AND IS AT ELEVATION 1578.1
KEYNOTES

1. 18" CONCRETE MAT FOUNDATION w/ #5 @ 10" EACH WAY, TOP AND BOTTOM

2. CONSTRUCTION JOINT PER DETAIL 9 ON SHEET S-503

3. #5 (x6'-0" LONG) DIAGONAL AT THE TOP MAT OF REINFORCING

4. PIPE PENETRATION IN THE MAT FOUNDATION PER DETAIL ON SHEET S-501

5. CONCRETE PIPE SADDLE SUPPORT - SEE SHEET D-301

NOTES

- 90% SUBMITTAL
- 06/2021
- 4:13:35 PM
- BIM 360://200-09565-19001 EMWD Central Treatment Facility/09565-19001-S-PumpStation-v2019.rvt

BLENDING STATION FOUNDATION

SCALE: 3/8" = 1' - 0"

1'-0" 2'-0"
5'-0" 7'-0"
10'-0" 12'-0"

TYPICAL FOOTING EXCAVATION

SLEEVE THRU FOOTING AND PIPE TRENCH LOCATION

TYPICAL BAR BEND

REINFORCING LAP SPLICE SCHEDULE

WALL & FOOTING REINF. AT CORNERS & INTERSECTIONS

TYP. REINF. FOR OPENINGS THRU NON-STRUCT FLOOR SLABS SUPPORTED ON-GRADE

GRATING SEAT

NOT USED

NOT USED

NOT USED

NOT USED

NOT USED

NOT USED

TYPICAL SLAB REINFORCEMENTS

REINFORCEMENT

EASTERN MUNICIPAL WATER DISTRICT

DIAL TOLL FREE AT LEAST TWO DAYS BEFORE YOU DIG 811 (TYP.)

FOR TILT-UP CONSTRUCTION

FLOOR SLABS SUPPORTED ON-GRADE

STOP BAR (WELD TO ANGLE)

CONT. 3/8" THICK x GRATING DEPTH

NOTE:

ALL LAPS ARE PER DETAIL 4 ON THIS SHEET AND AS NOTED IN GEN. CLEARANCE AS SHOWN IN DETAIL.

INCREASE LAP LENGTHS BY A FACTOR OF 1.3 FOR HORIZONTAL REINFORCEMENT (NOT PLACED IN THE MEMBERS) WHEN MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER ABOVE THIS REINFORCEMENT.

CONCRETE FILL PIPE TRENCH.

LINES NOT PERMITTED EXCAVATION BELOW THESE LINES.

EXCAVATION SHALL BE CLEAN AND FREE OF DEBRIS.

FACED 1 1/2D CLEAR OR WIRE TIE TOGETHER WALLS DIRECTLY INTO NEAT OR FORMWORK NOT PERMITTED BELOW GRADE UNLESS WALLS ARE STABLE. STABILITY SHALL BE DETERMINED BY THE ENGINEER.

ENGINEER'S APPROVALS

TYPICAL BAR BEND

NOT FOR TILT-UP STRUCT.

TILT-UP CONST.

VERT. REINF.

TYP.

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KEYNOTES
1. 4" THICK EXPANDED POLYSTYRENE RIGID INSULATION
2. FLASH WITH 4' ROOFING DURHAM 5/8" THICK
3. FLASHING COP AT MASONRY WALL
4. MANSARD
5. ROOF DRAINING DRAIN OFF ASSEMBLY
6. CRICKET MADE OF TAPERED EXPANDED POLYSTYRENE SLOPE 1/4" PER FOOT MINIMUM
7. ROOF ACCESS HATCH

WELL NO. 201, 202, 203, AND 205
CENTRALIZED TREATMENT FACILITY

RIVERSIDE COUNTY, CALIFORNIA

EASTERN MUNICIPAL WATER DISTRICT

DESIGNED:
DRAWN:
CHECKED:
SUBMITTED:
SCALE:

ROOF PLAN

1/4" = 1' - 0"

REFERENCES
APPROVED BY:
DIRECTOR OF ENGINEERING DATE

REVISIONS
www.tetratech.com

DIAL TOLL FREE 811
AT LEAST TWO DAYS
BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

SPEC.
1719 PZ SPEC.

EASTERN MUNICIPAL WATER DISTRICT

CENTRALIZED TREATMENT FACILITY

ROOF PLAN

1/4" = 1' - 0"

ROOF PLAN
KEYNOTES

1. SPLIT FACADE BLOCKS WITH SMOOTH Finish AT INTERIOR FACE TYPICAL U.N.O.
2. 2 COURSES OF SMOOTH PRECISION BLOCK
3. HOLLOW METAL DOOR AND FRAME
4. HOLLOW METAL DOUBLE DOOR AND FRAME
5. PAVED DRIVE
6. MATT FOUNDATION
7. PAVING
8. FASCIA
9. MANSARD WITH STANDING SEAM ROOFING
10. ROLL UP DOOR
11. FILL CONTAINMENT AREA

NOT FOR CONSTRUCTION

6/3/2021 4:11:17 PM
KEYNOTES

1. SPLIT-FACE BLOCK WITH SMOOTH FACE AT INTERIOR FACE, TYPICAL U.N.O.
2. 2 COURSES OF SMOOTH PRECISION BLOCK
3. HOLLOW METAL DOOR AND FRAME
4. HOLLOW METAL DOUBLE DOOR AND FRAME
5. FINISHED GRADE
6. MAT FOUNDATION
7. FASCIA
8. MANSARD WITH STANDING SEAM ROOFING
9. ROLL-UP DOOR
### General

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### Piping Continued

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### Controls

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### Valves & Gauges

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<td>NON-SLAM WAFER CHECK VALVE</td>
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<td>PRESSURE AND TEMP. RELIEF VALVE</td>
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<td>SOLENOID CONTROL VALVE</td>
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<td>BALL VALVE</td>
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### Piping

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<td>TRANSFER DUCT (WITH LINER)</td>
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<td>ACOUSTICAL LINING DUCT</td>
<td>MOTORIZED DAMPER INSIDE DUCT</td>
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<tr>
<td>ACOUSTICAL LINING DUCT</td>
<td>DUCTWORK OFFSET (RISE OR DROP)</td>
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<tr>
<td>ACOUSTICAL LINING DUCT</td>
<td>DUCT WORK THROUGH BEAM PENETRATION</td>
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### Miscellaneous

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<td>MISCELLANEOUS</td>
<td>ANALOG OUTPUT</td>
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<td>MISCELLANEOUS</td>
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### Mechanical Legend

- **MECHANICAL LEGEND**: Lists various symbols for equipment and system elements.
- **MECHANICAL DRAWING LIST**
  - **EASTERN MUNICIPAL WATER DISTRICT**: Lists mechanical drawings with details.
  - **MECHANICAL PLAN**: MP-101 MECHANICAL PLAN
  - **MECHANICAL DETAILS**
    - MP-501 PLUMBING DETAILS
    - MP-502 MECHANICAL DETAILS
    - MP-503 MECHANICAL DETAILS
  - **VARIABLE AIR VOLUME TERMINAL UNIT W/ REHEAT**
  - **FAN POWERED TERMINAL UNIT**
  - **VARIABLE AIR VOLUME TERMINAL UNIT W/ REHEAT**
  - **FAN POWERED TERMINAL UNIT**

### Notes

- **NOTES**: Additional notes and symbols for specific equipment or systems.
- **REFERENCES**: Includes references to details and notes.

### Additional Details

- **DATE**: 06/2021
- **DRAWN**: Greg Kowalski, P.E.
- **DIRECTOR OF ENGINEERING DATE**: Eastern Municipal Water District

---

**MECHANICAL LEGEND AND ABBREVIATIONS**

**90% SUBMITTAL**

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**EASTERN MUNICIPAL WATER DISTRICT**

---

**MECHANICAL DRAWING LIST**

---

**EASTERN MUNICIPAL WATER DISTRICT**

---

**MECHANICAL PLAN**

---

**MECHANICAL DETAILS**

---

**REFERENCES**

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**NOTES**

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**90% SUBMITTAL**

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**MECHANICAL LEGEND AND ABBREVIATIONS**

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**EASTERN MUNICIPAL WATER DISTRICT**

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**MECHANICAL DRAWING LIST**

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**MECHANICAL PLAN**

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**MECHANICAL DETAILS**

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**REFERENCES**

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**NOTES**

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**90% SUBMITTAL**

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**MECHANICAL LEGEND AND ABBREVIATIONS**

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**EASTERN MUNICIPAL WATER DISTRICT**

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**MECHANICAL DRAWING LIST**

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**NOTES**

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**90% SUBMITTAL**

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**MECHANICAL LEGEND AND ABBREVIATIONS**

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**MECHANICAL DRAWING LIST**

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**MECHANICAL PLAN**

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**MECHANICAL DETAILS**

---

**REFERENCES**

---

**NOTES**

---

**90% SUBMITTAL**

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**MECHANICAL LEGEND AND ABBREVIATIONS**
31. MOTOR STARTERS, WHERE REQUIRED, SHALL BE PROVIDED AND MOUNTED BY THE MECHANICAL INSTALLER.

16. ALL DUCT HANGERS AND SUPPORTS SHALL COMPLY WITH THE MECHANICAL CODE AND THE "SMACNA HVAC DUCT SYSTEMS" 

15. REFER TO TYPICAL DETAILS FOR DUCTWORK, PIPING, AND EQUIPMENT INSTALLATION.

8. COORDINATE ALL CUTTING AND PATCHING WITH GENERAL CONTRACTOR AND OTHER DISCIPLINES.

1. THESE GENERAL NOTES APPLY TO ALL SHEETS.

7. COORDINATE ALL WORK WITH OTHER TRADES AND AVOID IMPACTING ARCHITECTURAL AND STRUCTURAL DESIGN.

6. EACH UNIT TO BE PROVIDED WITH MATCHING FIXTURES."
1. LOUVER TO HAVE DRAINABLE BLADES / HEADER.

2. PROVIDE ECM (ELECTRONICALLY COMMUTATED MOTOR) WITH FACTORY MOUNTED POTENTIOMETER FOR SPEED ADJUSTMENT.

3. COORDINATE COLOR AND FRAME WITH ARCHITECTURAL DRAWINGS.

4. PROVIDE MINIMUM 1" DEFLECTION SPRING VIBRATION ISOLATION AND SEISMIC RESTRAINT PER SPECIFICATIONS.

5. PROVIDE BACKDRAFT DAMPER.

6. ADJUSTABLE HORIZONTAL / VERTICAL DISCHARGE.

7. FAN TO BE CONNECTED TO WALL TIMER.

NOTES:

2. CAPACITY RATED AT ANSI STANDARD CONDITIONS.

TAG # MANUFACTURER MODEL NUMBER AREA SERVED LOCATION SYSTEM SERVED

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<th>TAG</th>
<th>MANUFACTURER</th>
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FAN COIL SCHEDULE

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COND SCHEDULE

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PLUMBING FIXTURE SCHEDULE

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DOMESTIC WATER HEATER SCHEDULE

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EXHAUST FAN SCHEDULE

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COORDINATE WITH ELECTRICAL FOR POWER AND DISCONNECT AS REQUIRED.

NOTES:

- Cooperate with electrical for power and disconnect as required.
- Capacity rated at ANSI standard conditions.
- Provide minimum 1" deflection spring vibration isolation and seismic restraint per specifications. Cooperate with structural design.
A. EXHAUST TO TERMINATE AT MINIMUM 10' ABOVE GRADE.

B. REFRIGERANT PIPING SIZED PER MANUFACTURER RECOMMENDATION. PROVIDE INSULATION.

C. PROVIDE SOUND TRAP AND REQUIRED TRANSITION. REFER TO CIVIL DRAWINGS.

1. 12'x12' INTAKE LOUVER FOR GENERATOR ROOM.

2. 10'x10' EXHAUST LOUVER FOR GENERATOR

3. EXHAUST OUTLET SHALL BE AT LEAST 3' FROM ANY OPENING INTO THE BUILDING AND 10' AFF.

4. UNIT COMPLETE WITH BDD. FAN TO BE CONTROLLED VIA T-STAT IN THE SPACE. FAN IS COMMAND ON AFTER GENERATOR SHUTS OFF. FAN COMMAND OFF WHEN TEMPERATURE IN THE ROOM IS EQUAL TO AMBIENT TEMP (ADJ.)

5. PROVIDE INDIRECT DRAIN FROM EYESHIFT TO FILL CONTAINMENT AREA OR GRATED SLOTS.
NOTES:

1. REFER TO PLANS FOR SIZES AND CONTINUATION.
2. COORDINATE WATER, WASTE, VENT AND POWER WITH MANUFACTURER REQUIREMENTS.

1. WALL HUNG LAVATORY / SINK
2. ELECTRIC UNDER SINK INSTANTANEOUS WATER HEATER
3. VTR FLAT ROOF-LEAD
4. CONDENSATE CONNECTION TO SINK TAILPIECE

NOTES:

1. REFER TO PLANS FOR SCHEDULE AND LOCATION. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
2. FOR ADA COMPLIANCE INSULATE EXPOSED WATER PIPES, DRAIN PIPE, VALVES AND FITTINGS.

NOTES:

1. REFER ARCHITECTURAL PLANS AND ROOFING SYSTEM FOR ADDITIONAL REQUIREMENTS.
2. VENT SHALL EXTEND THROUGH FLASHING AND TERMINATE VERTICALLY NOT LESS THAN SIX INCHES (152 MM) ABOVE THE ROOF NOR LESS THAN ONE FOOT (305 MM) FROM A VERTICAL SURFACE. WHERE LOCATED IN FREEZING CLIMATES THE VENT SHALL TERMINATE NOT LESS THAN TEN INCHES (254 MM) ABOVE ROOF, OR IN ACCORDANCE WITH LOCAL AHJ.
3. VENT SHALL TERMINATE NOT LESS THAN TEN FEET (3048 MM) FROM, OR NOT LESS THAN THREE FEET (914 MM) ABOVE AN OPERABLE WINDOW, DOOR, OPENING, AIR INTAKE, OR VENT SHAFT, OR NOT LESS THAN THREE FEET (914 MM) IN EVERY DIRECTION FROM A LOT LINE, ALLEY OR STREET. FOR HEALTHCARE FACILITIES EACH VENT SHALL TERMINATE NOT LESS THAN TWENTY-FIVE FEET (7620 MM) FROM ANY AIR INTAKE OR VENT SHAFT.

REFERENCES

APPROVED BY:
DIRECTOR OF ENGINEERING DATE

MP-501

PLUMBING DETAILS
6. Sidewall Propeller Exhaust Fan

4. Exposed Duct Supply Register

5. Condensing Unit-Roof Mounted

3. Inline Fan

2. Return Duct Fittings

1. Supply Duct Fittings

**NOTES:**

1. Provide duct liner and/or external duct insulation as noted on plans or in specifications.
2. Provide header and separations per SMACNA and building code requirements.
3. Provide manual balancing damper immediately downstream of a fixed duct tap.
4. Maintain minimum clearance between duct taps and ducts. (Exception: Use of duct tap offsets and/or mechanical forged vibration isolation devices as noted on plans or in specifications.)
5. Provide duct liner and/or external duct insulation as noted on plans or in specifications.
6. Radiused elbows or turning vanes required on ducts. (Exception: Use of duct tap offsets and/or mechanical foraged vibration isolation devices as noted on plans or in specifications.)

**SPEC.**

1719 PZ 1138199

1159 PZ 06/2021

SHAUN STONE, P.E.

17885 Von Karman Ave, Suite 500

RIVERSIDE COUNTY, CALIFORNIA

EASTERN MUNICIPAL WATER DISTRICT

EASTERN MUNICIPAL WATER DISTRICT

CENTRALIZED TREATMENT FACILITY

MECHANICAL DETAILS
CONSTRUCTION NOTES

1. ALL ABOVE GRADE STEEL PIPE SHALL BE STD WT. CEMENT MORTAR LINED AND PAINTED UNLESS INDICATED OTHERWISE. ALL BELOW GRADE STEEL PIPE SHALL BE STD WT. CEMENT MORTAR LINED AND COATED.
Wells 201, 202, 203, and 205

NOTES:

1. All steel pipe, except noted, shall be ASTM A53, Schedule 40, Type B, with a coating unless noted.

2. All valves and controls shall be painted for UV resistance.

3. All PVC pipe, fittings, and valves shall be coated.

4. Pipe shall be STD WT. CEMENT MORTAR LINED and indicated otherwise.

5. All above-grade steel pipe shall be STD WT. CEMENT MORTAR LINED and painted unless noted.

6. All below-grade steel pipe shall be STD WT. CEMENT MORTAR LINED and painted unless noted.

7. Pipe support stanchion per DTL 1 on SHT-501

8. Pipe rack per DTL 1 on SHT S-509

9. Air relief valve

10. Sample and analyzer panel

11. Dual media pressure filter for iron and manganese removal

12. Surface wash pump

13. D-102, D-1719, and others

SCALE: 1/4" = 1'
**Notes for Diesel Fuel Tank:**

1. Electrical wires and equipment in the dispersing area shall be installed in accordance with the electrical code (7901.4 UFC).
2. Valves, fittings, and related components shall conform to nationally recognized engineering standards listed for the application, code 7901.11 UFC.
3. Provide procedures in accordance with UFC standards to identify the material within (diesel fuel) code 7902.1.3 UFC.
4. Provide placarding in accordance with UFC Standard 79.3, identifying the material within code 7902.1.3 UFC.
5. All tank supports shall be designed to resist damage as a seismic activity in accordance with the building code (7902.19 UFC).
6. Provide venting in accordance with code 7902.1.11.4 UFC. Outlets shall be located such that the vapors are released at a safe point outside of building, at least 24 inches above the adjacent ground level, provide approved flame arresters or pressure vacuum breather valves.

**Generator Room and Fuel Tank Plan**

- Equipment and pipe supports per code 79.01.4 UFC.
- Generator electrical per code 79.01.4 UFC.
- Fuel lines per code 79.01.4 UFC.
- Active diesel particulate filter (side outlet configuration) by Johnson Matthey with blanket insulation.
- 2000 gallon fuel tank.
- Enclosure assembly (future, 33 Hrs @ 121.
- Louvered louvers for fuel tank.
- 507 fuel pipe chase per DTL 503.
- 4' - 6" deep wall louver see SHT MP 003.
- Fuel pipe chase per DTL 505.
- 10' - 0" wall containment pipe (typ).
- 9' - 8" flexible expansion joint and 90° bend with thermal blanket insulation per specifications.
- 12" dia SS SCH 10 long radius 90° bend with type S with safety post and railing system with self-closing gate for fall protection.
- 8" x 12" flexible expansion joint and 90° bend with thermal blanket insulation per specifications.
- Generator ducting per code 79.02.1.11.4 UFC.
- Fuel pipe chase per DTL 505.
- 12" dia SS SCH 10 long radius 90° bend with "TECTUM" acoustical panel per DTL 505.
- Fuel pipe chase per DTL 505.
- 12" dia SS SCH 10 long radius 90° bend with "TECTUM" acoustical panel per DTL 505.
- Generator ducting per code 79.02.1.11.4 UFC.

**References**

- Centralized Treatment Facility
- Generator Room
- Generator Ducting

**Drawings**

- Generator Room
- Fuel Tank Plan

**Approvals**

- Shaun Stone, P.E.
- Greg Kowalski, P.E.

**Submission Details**

- Date: 06/2021
- Spec.: D-105
- Scale: 1/4" = 1'-0"

**Underlying Services**

- 811 Call Toll Free
- Dial TOLL FREE 811 Before You Dig
- www.tetratech.com

**Project Details**

- Project Manager: DC
- Project Engineer: DG
- Operations: DB
- Maintenance: DD
- Centralized Service Area of Southern California
- 36 x 24 ft. I.D. D-105
- 58 references
- Bar Measures 1 inch

**Notation**

- 6/3/2021 3:26:51 PM
- BIM 360://200-09565-19001 EMWD Central Treatment Facility/09565-19001-D-PumpStation-v2019.rvt
- 36 x 24 ft. I.D. D-105
- 58 references
- Bar Measures 1 inch
FROM PHASE 1 WELLS
SEE SHEET C-103 FOR CONTINUATION

30-FLS-CS
2"x1/2"-SHC-DWCP

8

30-FLW-CS

16

ARV-
1001
BFV-
1001
CV-
1001
FE/FIT-
1000
BFV-
1011
BFV-
1030
BFV-
1022

25

TYP

24-FLS-CS
18-FLS-CS
24-FLS-CS

FUTURE 24" INFULUENT FROM PHASE 3 WELLS

FROM CHEMICAL ADDITION
PUMPS SEE SHEET C-103 FOR CONTINUATION

32

3

33

FINISHED GRADE (VARIES, SEE GRADING PLAN)
CONSTRUCTION NOTES

1. NaOCl FRP Tank 1 (5000 GAL)
2. NaOCl FRP Tank 2 (5000 GAL)
3. Fume Scrubber
4. Chemical Metering Pump Skid in accordance with Section 11246
5. 1/2" x 2" Tubing to Piping Transition per DTL 2 on SHT D-503
7. Future Chemical Metering Pump Skid in accordance with Section 11246
8. Chemical Pull Box per DTL 5 on SHT D-503
16. Basket Strainer
21. Calibration Column
25. 1/2" PFA Tubing HCL Discharge in 2" PVC Pipe to Injection Points
26. 1/2" PVC Tubing HCL Discharge in 2" PVC Pipe
27. 4" Vent to Fume Scrubber
29. 2" PVC Pipe (Fill)
30. 2" PVC Pipe (Discharge)
32. 2" Diaphragm Valve (MOV)
33. 1/2" CPVC Ball Valve
43. 1/2" CPVC 90° Elbow
44. 4" PVC Ball Valve
45. 4" Bulk Head Connection
46. 2" Bulk Head Connection
47. 2" PVC Ball Valve
48. 2" PVC Anti-Siphon Check Valve
50. 1/2" CPVC Tee
51. 1/2" Pulsation Dampener
52. Unistrut Pipe Support per DTL 9 on SHT D-501
53. 3" PVC Socket Ball Valve
55. Ultrasonic Level Transmitter per DTL 2 on SHT D-507

X

SCALE: 1/2" = 1'-0"
BOLTED STEEL TANK PANEL
PER TANK MANUFACTURER

APPLY A CONTINUOUS BEAD OF SEALER AROUND THE INDICATED BOLT HOLE PATTERN

NECK WELDMENT

PREFORMED GASKET

DOOR PLATE

DAVIT WELDMENT

EYE BOLT WITH 2-1/2" HEX NUTS

1/2" X 2 1/4" LONG HHCS, NUT, AND SPECIAL HEX WASHER

1/2" X 2" LONG HHCS, 1/2" NUT, AND 1/2" WASHER

DOOR PLATE

PVC BLIND FLANGE

WITH 2" NPT FLEXIBLE CONDUIT WITH 1/2" NPT WATER TIGHT GLAND

TANK DOME

ULTRASONIC LEVEL INSTRUMENT

PVC FLANGE

8" (MIN)

6" (MAX)

4"±

CML & C STEEL PIPE

CEMENT MORTAR COATING

CML & PAINTED STEEL PIPE

3

COATING TRANSITION

SCALE: NTS

1

ACCESS MANWAY

SCALE: NTS

2

TYPICAL ULTRASONIC LEVEL TRANSMITTER DETAIL

SCALE: NTS

3

COATING TRANSITION

SCALE: NTS

4

NOT USED

SCALE: NTS

5

NOT USED

SCALE: NTS

6

NOT USED

SCALE: NTS

7

NOT USED

SCALE: NTS

8
### TANK SCHEDULE

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<td>SODIUM HYPOCHLORITE</td>
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### PUMP SCHEDULE

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### INJECTION QUILL AND STATIC MIXER SCHEDULE

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<td>STATE MIXER</td>
<td>FLUID/</td>
<td>6</td>
<td>HASTELLOY</td>
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### VALVE SCHEDULE

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<td>6</td>
<td>HASTELLOY</td>
<td>15103.1</td>
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**Note:** Do not include values smaller than 2 inches in size.
1. THE CONTRACTOR SHALL VERIFY ALL POWER UTILITY EQUIPMENT, INCLUDED DEVICES FOR FUTURE CONSIDERATION, AND EXISTING REQUIREMENTS WITH APPROVED SERVICE PLANS PRIOR TO INSTALLATION.

2. ALL POWER UTILITY CONDUITS FOR E-101 SHALL INCLUDE 4" PVC COPING WITH PVC COATED RIGID STEEL CONDUITS SWEEPS INCLUDING RISERS.

3. ALL POWER UTILITY CONDUITS FOR E-101 SHOWN ON SHEET E-501 FOR MORE INFORMATION.

NOTES

1. CHECK FOR FUTURE. REFER TO DETAIL 8 ON SHEET E-610 AND E-611 FOR MORE INFORMATION.

2. REFER TO DETAIL 13 ON SHEET E-502 FOR REQUIREMENTS.

3. POSITIONED 3' X 5' CONCRETE PULL BOX. GRADE MOUNTED COMPLETE WITH H-20 RATED STEEL COVER. SEE DETAIL ON SHEET E-502 WITH H-20 RATED STEEL COVER. SEE DETAIL 9 ON SHEET E-502.

4. INSTALLATION.

5. INSTALL AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

6. ELECTRIC SERVICE ENTRANCE BOXES DESIGNED TO C-501. REFER TO INTRUSION ALARM GATE PROXIMITY SENSOR INSTALLATION. REFER TO DETAIL 2 ON SHEET C-501 FOR MORE INFORMATION.

7. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

8. REFER TO DETAIL 13 ON SHEET E-502 FOR REQUIREMENTS.

9. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

10. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

11. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

12. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

13. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

14. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

15. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

16. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

17. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

18. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

19. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

20. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

21. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

22. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

23. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

24. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

25. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

26. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

27. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.

28. INSTALL NEW AREA FIXTURES MOUNTED ON THE 20' LIGHT POLE. REFER TO DETAIL 8 ON SHEET E-501 FOR MORE INFORMATION.
ELECTRICAL ROOM AND CHEMICAL ROOM POWER PLAN

GENERAL NOTES

1. ALL DISCONNECT AND JUNCTION BOXES SHOWN SHALL BE RATED NEMA 4X OR BETTER.
2. ALL CONDUIT LOCATIONS ARE SCHEMATIC/DIAGRAMATIC. CONTRACTOR TO FIELD VERIFY ACTUAL LOCATIONS IN THE FIELD.

NOTES

1. CAP CONDUIT FOR FUTURE.
2. PROVIDE 30A, NEMA 4X DISCONNECT SWITCH

REFER TO E-101 FOR CONDUIT CONTINUATION
1" CONDUIT
(TYP.)

SP205
P111
P110
P210
P209
P226
P221
P235
P228
P303
P301
P312
SP113
SP112
P211
P222
P214
P213
P215
P223
P212
P224
P216
SP210
SP207
SP111
SP208
SP211
SP110
SP212
SP209
SP216

2" CONDUIT
(TYP.4)

#4/0 BC GND

3" TYP

3" TYP

3" TYP

3" TYP

3" TYP

4" CONDUIT
(TYP.)

#4/0 BC GND

NOTES:

1. sections and ducts are shown for information only to depict the available capacity in the existing under slab. contractor shall confirm field layout, cable routing, and under slab layout prior to start of construction. contractor shall verify slab/under slab specification and location of all cables.

2. conduit installed in under slab shall be pvc schedule 40.

3. all under slab shall be poured in red concrete (2 sack slurry).

DUCT BANK SECTION LEGEND

NEW DUCT BANK CONDUIT

NEW CABLE IN NEW DUCT BANK CONDUIT

1. SECTIONS ARE SHOWN FOR INFORMATION ONLY TO DEPICT THE AVAILABLE CAPACITY IN THE EXISTING UNDER SLABS. CONTRACTOR SHALL FIELD VERIFY CABLE LOCATIONS WITHIN UNDER SLABS PRIOR TO START OF CONSTRUCTION AND COORDINATE SOURCE AND DESTINATION OF ALL CABLES.

2. CONDUIT INSTALLED IN UNDER SLABS SHALL BE PVC SCHEDULE 40.

3. ALL UNDER SLABS SHALL BE POURRED IN RED CONCRETE (2 SACK SLURRY).

NOT FOR CONSTRUCTION

E-503
DUCT BANK DETAILS

AS SHOWN
G 4000AF 4000AT LSIG SST PULL SECTION

FROM SCE POC GROUND LOOP UTILITY PAD MOUNTED TRANSFORMER

MAIN SWITCH BOARD "MSB", NEMA 3R, 4000A, 480V, 3Ø, 4W, 100KAIC SYM

PIECE BLDG GND.RING #4/0 BARE COPPER WIRE

EXISTING SWBD WELL NO. 27

1200AF 1000AT 3P LSIG SWBD-1 SEE SHEET E-602

3000AF 2500AT 3P LSIG SWBD-2 (FUTURE) SEE SHEET E-604

AUTOMATIC TRANSFER SWITCH "ATS-1", NEMA 3R, 3000A, 480V, 3Ø, 100KAIC SYM

STAND-BY GENERATOR 650 KW

NOTES

1. CONSULT WITH ENGINEER CONCERNING SPECIFICATIONS AND MATERIALS TO BE USED.

2. PROVIDE ARC FLASH REDUCTION BREAKER. THE MAINTENANCE SWITCH AND THE BLUE INDICATING LIGHT LOCATED ON THE AUTOMATIC TRANSFER SWITCH.

3. PROVIDE WITH MODBUS TCP COMMUNICATION CONNECT TO ETHERNET SWITCH.

NOT FOR CONSTRUCTION

MSB - LOAD CALCULATION

<table>
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<tr>
<th>EQUIPMENT</th>
<th>KW/HP</th>
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<td>(E) WELL 27</td>
<td>434.0</td>
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<tr>
<td>SWBD-1</td>
<td>278.0</td>
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<tr>
<td>SWBD-2 (FUTURE)</td>
<td>0.0</td>
<td>1,640.0</td>
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<tr>
<td>TOTAL</td>
<td>712.0</td>
<td>2,503.0</td>
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EASTERN MUNICIPAL WATER DISTRICT

CENTRALIZED TREATMENT FACILITY

17885 Von Karman Ave, Suite 500
Irvine, California 92614
Tel: (949) 809-5000 Fax: (949) 809-5010
NOTES:

1. The maintenance switch and blue indicating light for the SWBD-1 main circuit breaker will be located on the "SWBD-1".

2. The maintenance switch and blue indicating light for the MCC-1 circuit breaker will be located on the "MCC-1".

3. The SWBD-1 main switchboard "SWBD-1" ELEVATION

4. The MCC-1 motor control center "MCC-1" ELEVATION

5. The main switchboard "MSB-1" ELEVATION

6. The switchboard "SWBD-1" ELEVATION

7. The motor control center "MCC-1" ELEVATION

THE MAINTENANCE SWITCH AND BLUE INDICATING LIGHT FOR THE SWBD-1 MAIN CIRCUIT BREAKER WILL BE LOCATED ON THE "SWBD-1".

THE MAINTENANCE SWITCH AND BLUE INDICATING LIGHT FOR THE MCC-1 CIRCUIT BREAKER WILL BE LOCATED ON THE "MCC-1".
NOTES

NOTES

DIGITAL INPUT TO BE SET FOR SWITCH OVER BETWEEN LOCAL CONTROL AND MODBUS CONTROL.

OPTICAL KEYPAD, ETM, PUSH BUTTON, POTENTIOMETER AND INDICATOR SHALL BE DOOR MOUNTED.

DIGITAL OUTPUT FUNCTION TO BE SET FOR DRIVE RUNNING.

VFD SHALL BE PROVIDED WITH MODBUS TCP OPTION FOR COMMUNICATION WITH THE SCADA.

MODBUS COMMUNICATION TO BE USED TO SEND COMMANDS AND SETPOINTS, READ STATUS INFORMATION AND RESET FAULTS.

PROVIDE CONTROL AND SPARE RELAYS TO HAVE A MINIMUM OF 1 N.C. AND N.O. CONTACTS. ALL CONTACTS SHALL BE WIRED TO TERMINALS.

E-STOP LOCATED AT THE PUMPS FOR MOTORS 100HP AND ABOVE, AS INDICATED IN THE ELECTRICAL DRAWINGS.

MOTORS 25HP AND LARGER SHALL BE PROVIDED WITH THREE THERMOSTATS OF THE NORMALLY CLOSED TYPE, ONE PER MOTOR PHASE.

VARIABLE FREQUENCY DRIVE (VFD)

EASTERN MUNICIPAL WATER DISTRICT

REVISIONS

1. CLEAR ALL DPA FORMS

APPROVALS

1. PUMP CONTROL SCHEMATIC (VARIABLE FREQUENCY DRIVE) (TYPICAL FOR THE BACKWASH RETURN PUMPS)
TYPICAL PUMP CONTROL SCHEMATIC (FVNR STARTER)

NOTES:
1. PROVIDE CONTROL AND SPARE RELAYS TO HAVE 1 N.C. AND 1 N.O. CONTACTS. ALL CONTACTS SHALL BE WIRED TO TERMINABLE.
2. ALL PUSHBUTTONS, SELECTOR SWITCHES, ETM, HMI AND INDICATORS SHALL BE DOOR MOUNTED.

LEGEND:
- Field Mounted Device (Preferably Switched) (Showing):
- Input/Output to PLC
  * = Push to Test

PROVIDE CONTROL AND SPARE RELAYS TO HAVE 1 N.C. AND 1 N.O. CONTACTS. ALL CONTACTS SHALL BE WIRED TO TERMINABLE. ALL PUSHBUTTONS, SELECTOR SWITCHES, ETM, HMI AND INDICATORS SHALL BE DOOR MOUNTED.
PHOTOCELL LOCATED ON ROOF (SEE NOTE 2)

1. All switches shown shall be located on the door of the lighting control panel.

2. Provide 1" exposed PVC coated RGS conduit from the exterior control panel to the roof mounted photoelectric photocell. Contractor shall field verify the final location of the photocell.

* = Remote mounted device
# = Door mounted device

EXTERIOR LIGHTING CONTROL PANEL CONTROL DIAGRAM

NOTE:
1. All switches shown shall be located on the door of the lighting control panel.
2. Provide 1" exposed PVC coated RGS conduit from the exterior control panel to the roof mounted photoelectric photocell. Contractor shall field verify the final location of the photocell.

* = Remote mounted device
# = Door mounted device
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<td>FIT-1100</td>
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<td>TANK LEVEL CONTROL</td>
<td>FIT-3300</td>
<td>830</td>
<td>SUBTOTAL</td>
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**Electrical Room LTG**

- **UPSTAIRS LTG**
  - PMP-6500
  - 120/208 V

- **ENTRY GATE POLE REC**
  - CONTROL PANEL RTU-1
  - RTU-1 PANEL HEATER

- **ELECTRICAL RM LTG**
  - MOV-3240
  - MOV-3160
  - MOV-3110
  - 42800 V

- **OUTDOOR LIGHTING**
  - ENTRY GATE POLE
  - CHEMICAL RM LTG
  - LIGHT & SITE LTG

- **MAINTENANCE OPERATIONS**
  - ENTRY GATE POLE AREA
  - LIGHT & SITE LTG

- **WIRE**
  - VOLTS: 248
  - VOLTS: 4473

- **MAINTENANCE OPERATIONS**
  - ENTRY GATE POLE AREA
  - LIGHT & SITE LTG

- **WIRE**
  - VOLTS: 248
  - VOLTS: 4473

**ELECTRICAL RM LTG**

- **MOV-3240**
- **MOV-3160**
- **MOV-3110**
- **42800 V**

**OUTDOOR LIGHTING**

- **ENTRY GATE POLE**
- **CHEMICAL RM LTG**
- **LIGHT & SITE LTG**

**MAINTENANCE OPERATIONS**

- **ENTRY GATE POLE AREA**
- **LIGHT & SITE LTG**

**WIRE**

- **VOLTS: 248**
- **VOLTS: 4473**

*Bar Measures 1 inch*

12,104 x 19

36 X 24
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<tr>
<th>FIXTURE</th>
<th>DRIVER</th>
<th>TYPE</th>
<th>MANUFACTURER</th>
<th>MANUFACTURER PART NO.</th>
<th>DESCRIPTION AND VARIATIONS</th>
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<td>FEM L48-4000LM-MD-MVOLT</td>
<td>5000K COLOR, PRE-INSULATED W/(1,000) HOURS LIFETIME, (50,000) HOUR LIFETIME, CONTROLLED BY EXTERIOR LIGHTING CONTROL PANEL, 90 MINUTES NICKEL CADMIUM BATTERY. UL LISTED FOR WET LOCATION. VANDAL RESISTANT LED LUMINAIRE.</td>
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<td>LITHONIA</td>
<td>TWH LED-20C-40K-T3M-MVOLT</td>
<td>5000K COLOR, PRE-INSULATED W/(2,000) HOURS LIFETIME, (50,000) HOUR LIFETIME, CONTROLLED BY EXTERIOR LIGHTING CONTROL PANEL, 90 MINUTES NICKEL CADMIUM BATTERY. UL LISTED FOR WET LOCATION. VANDAL RESISTANT LED LUMINAIRE.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LITHONIA</td>
<td>LV-S-W-1-R-120/277 OR EQUAL</td>
<td>5000K COLOR, PRE-INSULATED W/(1,000) HOURS LIFETIME, (50,000) HOUR LIFETIME, CONTROLLED BY EXTERIOR LIGHTING CONTROL PANEL, 90 MINUTES NICKEL CADMIUM BATTERY. UL LISTED FOR WET LOCATION. VANDAL RESISTANT LED LUMINAIRE.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LITHONIA</td>
<td>KAD LED-40C-1000-50K-R2-MVOLT</td>
<td>5000K COLOR, PRE-INSULATED W/(2,000) HOURS LIFETIME, (50,000) HOUR LIFETIME, CONTROLLED BY EXTERIOR LIGHTING CONTROL PANEL, 90 MINUTES NICKEL CADMIUM BATTERY. UL LISTED FOR WET LOCATION. VANDAL RESISTANT LED LUMINAIRE.</td>
</tr>
<tr>
<td></td>
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<td>LITHONIA</td>
<td>KAD LED-40C-1000-50K-R2-MVOLT</td>
<td>5000K COLOR, PRE-INSULATED W/(2,000) HOURS LIFETIME, (50,000) HOUR LIFETIME, CONTROLLED BY EXTERIOR LIGHTING CONTROL PANEL, 90 MINUTES NICKEL CADMIUM BATTERY. UL LISTED FOR WET LOCATION. VANDAL RESISTANT LED LUMINAIRE.</td>
</tr>
</tbody>
</table>

Colors of lighting fixtures shall be per the color scale on Sheet G-002.
1. TOTAL CHLORINE ANALYZER SHALL BE PROVIDED IN THE FUTURE IF CHLORAMINES ARE CREATED ON SITE.
### NEW EQUIPMENT LIST

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>MANUFACTURER</th>
<th>MODEL</th>
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<tbody>
<tr>
<td>1</td>
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<td>NEMA 12 ENCLOSURE, FREE STANDING, 90&quot;H X 36&quot;W X 24&quot;D</td>
<td>PER SPEC 16950</td>
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<tr>
<td>1</td>
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<td>BACK PANEL</td>
<td>FBO</td>
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<td>DUPLEX RECEPTACLE</td>
<td>LEVITON</td>
<td>6599-1</td>
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<td>1</td>
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<td>LED LIGHT</td>
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<tr>
<td>1</td>
<td></td>
<td>POWER GROUND BAR</td>
<td>LEVITON</td>
<td>BINA</td>
</tr>
<tr>
<td>1</td>
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<td>INSTRUMENT GROUND BAR</td>
<td>LEVITON</td>
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</tr>
<tr>
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<td>24 VDC POWER SUPPLY</td>
<td>POWER ONE</td>
<td>HE24-7.2-AG</td>
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<td>DIN RAIL MOUNTED TERMINAL STRIP</td>
<td>ENTRELEC</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>CIRCUIT BREAKERS</td>
<td></td>
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<tr>
<td>1</td>
<td></td>
<td>FUSES</td>
<td></td>
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<tr>
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<td></td>
<td>3&quot; X 3&quot; WIRE DUCT</td>
<td>PANDUIT</td>
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<td>1</td>
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<td>INDUSTRIAL ETHERNET SWITCH</td>
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<td></td>
<td>EXHAUST FAN</td>
<td>HOFFMAN</td>
<td>A4AXFN</td>
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<td>FILTERED INLET LOUVER</td>
<td>HOFFMAN</td>
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<tr>
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<td>HOFFMAN</td>
<td>ATEMNO</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>SURGE ARRESTOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>12 VDC BATTERY MOUNTING BRACKET</td>
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</tr>
</tbody>
</table>

---

**NOTES:**

1. THESE SPECIFICATIONS SHALL BE IT IS DEEMED DESIRABLE DOING TO ESTABLISH SPECIFICATION REQUIREMENTS. CONTRACTOR SHALL SUBMIT UNDERGROUND CALCULATIONS IN ACCORDANCE WITH SPECIFICATION REQUIREMENTS.
2. PROVIDE A MINIMUM OF 30"X 24" SPACE FOR DISTRICT SUPPLIED RTU. THE RTU SHALL BE INSTALLED AND TERMINATED BY THE CONTRACTOR.
3. THE DISTRICT SUPPLIED OIT SHALL BE INSTALLED AND TERMINATED BY THE CONTRACTOR.
4. ENCLOSURE (EATON B-LINE SERIES NUMBER WITH LOCKING HANDLE OR APPROVED EQUAL).
5. COORDINATE THE SIZE OF THE BATTERY MOUNTING BRACKETS WITH THE OWNER.

---

**TREATMENT PLANT RTU COMMUNICATION CONTROL PANEL (CP-1) ELEVATION**

**SCHEDULE**

<table>
<thead>
<tr>
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<th>INSRIPTION</th>
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<tbody>
<tr>
<td>COMMUNICATION PANEL RTU</td>
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</table>

**REFERENCES**

- EASTERN MUNICIPAL WATER DISTRICT
  - PROJECT MANAGER
  - DATE: 06/2021
  - INITIALS: G.K.
  - APPROVED BY: DIRECTOR OF ENGINEERING
  - DATE: 06/2021
  - INITIALS: S.S.
- INSPECTION
  - DATE: 06/2021
  - INITIALS: D.
- OPERATIONS
  - DATE: 06/2021
  - INITIALS: D.
- MAINTENANCE
  - DATE: 06/2021
  - INITIALS: D.

**DESIGNED:**

<table>
<thead>
<tr>
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<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNICATION PANEL RTU</td>
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</tr>
</tbody>
</table>

**DRAWN:**

**CHECKED:**

**SUBMITTED:**

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