CONTRACT DOCUMENTS FOR
RIO LINDA/ELVERTA
COMMUNITY WATER DISTRICT

WELL NO. 16 PUMP STATION PROJECT

ISSUED FOR BID

NOVEMBER 2019

Domenichelli & Associates
5180 Golden Foothill Parkway, Ste. 220
El Dorado Hills, California 95762
(916) 933-1997

Contract Specifications for
Well No. 16 Pump Station Project
Rio Linda/Elverta Community Water District

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RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
WELL 16 PUMP STATION PROJECT

NOTICE TO CONTACTORS

Notice is hereby given that the Board of Directors of the Rio Linda / Elverta Community Water District (District), Sacramento County, California will receive sealed bids as follows:

BID DATE & TIME:	Friday, January 3, 2020, 2 PM Local Time
SUBMIT SEALED BIDS TO:	Rio Linda / Elverta Community Water District Mike Vasquez, PE, PLS, District Engineer 730 L Street Rio Linda, CA 95673
FOR:	**WELL 16 PUMP STATION PROJECT**
ESTIMATED CONSTRUCTION COST:	$2,800,000
CONTRACTOR LICENSE REQUIRED:	Class A - General Engineering Contractor

PROJECT DESCRIPTION

The work to be performed under this contract includes the furnishing of all labor, materials, tools, and equipment necessary for the completion of the Well 16 Pump Station Project. The work generally consists of the performance, construction, and installation of the following:

- General Requirements
- Site Work
- Fences and Gates
- Onsite Piping and Valves
- CMU Control Building and Appurtenances
- Well Pump, Motor, and Pump Base
- Painting and Coatings
- Offsite Piping
- Chlorine Feed System
- Electrical
- Flushing, Pressure Testing, and Disinfection
- Performance Testing and Facility Startup

QUESTIONS REGARDING WORK

Any questions regarding the type of work to be done may be addressed to Mike Vasquez, PE, PLS, District Engineer, at (650) 292-9112 or mvasquez@ekiconsult.com. ***Responses will be provided to questions submitted up until December 13, 2019 at 12:00 PM.***

A **mandatory pre-bid conference** will be held for the purpose of reviewing and answering questions regarding this Project at the District Office on December 10, 2019 at 10:00 am. It is suggested that each prospective bidder review the bid documents and Project location prior to the pre-bid conference. Bids from any bidder not attending this conference will be rejected as nonresponsive.

Pursuant to Public Contract Code section 2204, bids that equal or exceed $1,000,000 must be accompanied by an Iran Contracting Act certification.

Claims for $375,000 or less shall be in accordance with Section 20104 of the Public Contract Code.

Pursuant to Public Contract Code section 9204, all contracts entered into after January 1, 2017 must abide by the contract claims process described in this section and resolved in accordance to this section as summarized below:

- District Review of Claim. Within 45 days after receiving a complete Contract Claim, District shall review the claim and provide the Contractor a written statement identifying what portion of the claim is disputed and what portion is undisputed. District will pay any undisputed portion of the claim within 60 days from the date of the written statement. If District fails to timely issue a written statement, the claim shall be deemed rejected in its entirety.

- Meet and Confer Conference. If the Contractor disputes the District's written statement or if the Contract Claim is deemed rejected, the Contractor may demand and the parties will conduct an informal conference to meet and confer regarding settlement in accordance with section 9204, subsection (d)(2). Within 10 business days following the conclusion of the meet and confer conference, District shall provide Contractor a written statement identifying the portion (if any) of the claim remaining in dispute and any undisputed portion will be paid by District within 60 days after this written statement.

- Non-Binding Mediation. Any remaining disputed portion of the claim shall be submitted to nonbinding mediation in accordance with section 9204, subsection (d)(2).

- Interest. Any amount not paid in a timely manner as required by this subsection shall bear interest at a rate of 7 percent per annum until paid.

- The foregoing is a summary of section 9204. In the event of any conflict between the summary and section 9204, the statute will govern.

CALIFORNIA CONTRACTORS LICENSE

Award of this contract requires a valid California Contractor's Class A – General Engineering license.

CONTRACTOR'S EXPERIENCE

The Contractor must demonstrate previous successful experience in the installation of groundwater well equipping, site, and pipeline improvements. The required experience includes the following:

A. The Contractor, foreman, or installer(s) must have successfully completed a minimum of two potable groundwater well equipping projects including site work for a municipal potable groundwater well pumping more than 1,000 gallons per minute within the last five years.

B. The Contractor, foreman, or installer(s) must have successfully installed a minimum of 25,000 lineal feet of pipelines between 8-inch diameter and 12-inch diameter in public paved roadways within the last five years.

CONTRACT DOCUMENTS

Contract Documents for the Well 16 Pump Station Project may be viewed at the District Office. Alternatively, plans and specifications can be obtained from the following building exchanges and/or plan rooms:

- Century Graphics, repro@csdsinc.com, (916) 344-0232
- McGraw Hill Construction Dodge, diana.boyles@mhfi.com, (530) 674-2805
- Sacramento Regional Builders Exchange, yelenam@sacregionbx.com, (916) 442-8991
- Shasta Builders Exchange, planroom@shastabe.com, (530) 221-5556
- Placer County Contractors Assoc., planroom@placerbx.com, (530) 889-3953
- Nevada County Contractors Assoc., ncrecep@pacbell.net, (530) 274-1919
- El Dorado Builder's Exchange, director@goodbuilders.org, (530) 672-2955
- Contra Costa Builders Exchange, aprilh@ccbx.com, (925) 685-8630

The latest County of Sacramento Standard Construction Specifications, which are incorporated by reference in the Contract Documents, are available in electronic

format at www.saccountyspecs.net. Exceptions to the County of Sacramento Standard Construction Specifications are as follows:

- Standard Contract Agreement. The District's Agreement for Construction Services will be used and can be obtained at the above listed building exchanges and/or plan rooms.

Bids submitted must use the project specifications and contract drawings dated November 2019 unless otherwise updated by addenda.

BONDS

Each bid must be submitted on the bid forms provided in the Contract Documents. Each bid must also be accompanied by security in the form of a bid bond issued by a corporate surety, a certified check or cashier's check payable to the Rio Linda / Elverta Community Water District , or cash for an amount no less than ten percent (10%) of the aggregate sum of the bid.
The successful bidder shall be required to execute a Material and Labor Payment Bond and Performance Bond, issued by a corporate surety, acceptable to the Rio Linda / Elverta Community Water District , each for not less than one hundred percent (100%) of the contract price.

Pursuant to the California Contract Code Section 22300, the contractor may, at its own expense, substitute securities for any money being withheld by the Rio Linda / Elverta Community Water District to ensure performance under this contract.

LABOR COMPLIANCE PROGRAM

To be qualified to bid on this Project, bidders must be registered and qualified to perform public work with the Department of Industrial Relations pursuant section 1725.5 of the California Labor Code. All subcontractors listed in a qualified bidder's bid as performing any portion of the work also must be registered and qualified with the Department of Industrial Relations. This is a construction project in accordance with Section 1771.5 of the California Labor Code.

The District has an active Labor Compliance Program (LCP) approved by Department of Industrial Relations (LCP ID: 2011.00995) that is administered by Kurey & Associates Labor Compliance Management. The contractor and all subcontractors will be required to comply with this program. The LCP can be accessed by contacting Kate Kurey at (209) 946-9601.

The District affirmatively identifies this Project as a "public works project" as that term is defined by Labor Code Section 1720. Therefore, the Project is subject to prevailing wage requirements under Labor Code Section 1771. Contractor and its subcontractors shall fully comply with all the provisions of the California Labor Code governing the performance of public works contracts including, but not limited to, payment of prevailing wages, limitations on time worked, compliance with apprentice requirements,

maintenance of payroll records, posting of wages at the job site, and prohibitions against discrimination. The prevailing wage rates may be obtained on the internet at: https://www.dir.ca.gov/OPRL/dprewagedetermination.htm. The prevailing wage rates obtained from the internet link are hereby incorporated in this Contract and made a part hereof.

The contractor and all subcontractors will be required to submit certified payrolls and labor compliance documentation at the discretion of, and in the manner specified, by the District. Certified payroll records may entail data entry of weekly payroll information including: employee identification labor classification, total hours worked on this Project, wage and benefit rates paid, etc. This requirement will also be required of every lower-tier subcontractor and vendor obligated to provide labor compliance documentation.

No contractor or subcontractor may be listed on a bid proposal 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)]. No contractor or subcontractor may be awarded a contract for public work on a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

RESERVATION OF RIGHTS: The Board reserves the right to reject any or all bids, to waive any formality in any bid, and to determine which bid, in the judgment of the Board, is the lowest responsive bid of a responsible bidder.

By order of the Board of Directors of the Rio Linda / Elverta Community Water District, Sacramento County, California dated November 19, 2019.

Timothy R. Shaw
General Manager
Rio Linda / Elverta Community Water District

SECTION 00 41 43
BID SCHEDULE

TO: Rio Linda/Elverta Community Water District
730 L Street
Rio Linda, CA 95673

The undersigned states and declares as follows:

That the Bidder has carefully examined the location of the proposed work; that the Bidder has examined the Contract Documents entitled: Well 16 Pumping Plant; that the Bidder has read the accompanying Instructions to Bidders; that the Bidder hereby proposes to begin work and complete the project in accordance with the schedule and deadlines in the Contract Documents; that the Bidder hereby proposes to furnish all labor, materials, tools, and equipment, and to perform all the work required, complete in place, in accordance with the Contract Documents; and that the Bidder will take in full payment for such work the prices set forth in the accompanying Bid Form.

The Bidder acknowledges that the following quantities are approximate only, being given as a basis for the comparison of Bids, that the District does not expressly or by implication agree that the actual amount of work will correspond therewith, and that the District reserves the right to increase or decrease the amount of any class or portion of the work, as may be deemed necessary or advisable by the Engineer.

Where lump sum prices are in the bidding schedule, they shall include all labor, materials, and equipment necessary to produce a complete and finished job. When no specific item is listed in the bidding schedule for work required, the cost of such work shall be included in the price bid for the item which most appropriately covers the work. When items of work in the Bid Form are preceded by the letter (S), such items shall be deemed designated "Specialty Items" as outlined in Section 00 43 36 Designation of Subcontractors, Subsection 1.02.

The following surety or sureties have agreed to furnish payment and performance bonds to the Bidder if it is awarded the contract:

Performance Bond: _____

Payment Bond: _____

The undersigned hereby acknowledges the receipt and review of Addenda Nos.:

_____

Contractor's License No.: _____

Expiration Date: _____

Type of License: _____

Name under which license is held: _____

Status of License: _____

Executed on [DATE] _____

The Bidder's authorized officer identified below hereby declares that the representations in this Bid are true and correct and of my own personal knowledge, and that these representations are made under penalty of perjury under the laws of the State of California.

Bidder

_____ (Company/Firm Name)

_____ (Company Type, e.g. corporation {include state of incorporation}, sole proprietor, partnership)

_____ (Authorized Signature)

_____ (Printed Name)

_____ (Title)

Address: _____

_____

_____

Phone No.: _____

E-mail: _____

Bid Form

ITEM NO.	ITEM	Qnty.	Unit	Unit Cost	Item Cost
1	General Requirements	1	LS		
2	Site Work	1	LS		
3	Fences & Gates	1	LS		
4	Onsite Piping and Valves	1	LS		
5	CMU Control building and Appurtenances	1	LS		
6	Well pump, motor, and pump base	1	LS		
7	Painting and Coatings	1	LS		
8	Piping	1	LS		
9	Chlorine feed system	1	LS		

ITEM NO.	ITEM	Qnty.	Unit	Unit Cost	Item Cost
10	Electrical	1	LS		
11	Flush, Pressure Test and Disinfection	1	LS		
12	Performance Testing and Facility Startup	1	LS		

TOTAL BID PRICE = _____

(NUMBERS)

TOTAL BID PRICE = _____

(WORDS)

Notes:

1. Detailed descriptions for each bid item are included in Section 01 22 00 Measurement and Payment.
2. In the event that the product of a unit price and an estimated quantity does not equal the extended amount stated, the unit price will govern and the correct product of the unit price and the estimated quantity shall be deemed to be the bid amount.
3. The maximum allowed for Mobilization and Demobilization is 10 percent of the total project cost.

L.S. = Lump Sum

U.C. = Unit Cost

N.A. = Not Applicable

**** END OF SECTION ****

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RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
PROJECT:
PROJECT NO.

AGREEMENT FOR CONSTRUCTION SERVICES

THIS CONSTRUCTION SERVICES AGREEMENT ("Agreement") is made and entered into this ___ day of _____, 20__, by and between Rio Linda/Elverta Community Water District, a California county water district ("District") and _____, a _____, ("Contractor") (each individually a "Party" and collectively the "Parties"). There are no other parties to this Agreement.

RECITALS

A. The District's Board of Directors (the "Board") caused plans and specifications ("Plans") for the construction work herein described ("Project") and did approve and adopt said Plans, which are attached hereto as **Exhibit A**.

B. The District did publish a notice and invitation to submit sealed bids for the performance of the Project ("Notice to Contractors"), which is attached hereto as **Exhibit A**, on November 19, 2019, at the time and in the manner required by law and District policy.

C. The District also provided instructions for submitting bids on the Project ("Instructions for Bidders") which are attached hereto as **Exhibit A**.

D. The Contractor, in response to such Notice to Contractors, submitted to the District within the time specified in the Notice to Contractors and in the manner provided therein, a sealed bid to perform the Project as specified in said Plans, which the Board publicly opened and canvassed in the manner provided by law with other bids submitted for the Project.

E. Contractor's bid included a bid schedule ("Bid Schedule"), which is attached hereto as **Exhibit A**, and which sets forth details about Contractor's completion of the Project, including extended costs for Project materials.

F. Contractor provided the required bid guarantee and executed bid guarantee form, which is attached hereto as **Exhibit A**, at the same time the Contractor submitted its bid.

G. Contractor's bid included a list of subcontractors designated to perform specified portions of the Project ("Designation of Subcontractors"), which is attached hereto as **Exhibit A**.

H. Within five (5) business days of the last day to submit bids for the Project, Contractor submitted certifications of qualification for Contractor and its Designation of Subcontractors on the Project, which are collectively attached hereto as **Exhibit A**.

I. Contractor was the lowest responsible bidder for the performance of the Project, and the Board, as a result of the canvass of said bids, determined and declared the Contractor as the lowest responsible bidder for the Project and awarded a contract therefore.

J. Contractor represents to District that it is a duly qualified firm experienced in the construction of water facilities.

K. In the judgment of the Board, it is necessary and desirable to employ the services of Contractor to perform construction work on the Project.

L. Pursuant to Contractor's bid, Contractor will complete the Project in accordance with the District's plans and all other Contract Documents (defined below).

M. Contractor's timeframe for completing the Project is set forth in the Time Allowed for Completion and Liquidated Damages, which is attached hereto as **Exhibit A** ("Completion Schedule").

N. As a condition of awarding the Project to Contractor, Contractor must furnish payment and performance bonds ("Bond" or "Bonds").

O. District desires to retain Contractor to perform the Project in accordance with the District's general conditions ("General Conditions"), attached hereto as **Exhibit A**.

P. Unless otherwise provided in this Agreement, abbreviations and capitalized terms shall have the meanings ascribed to them in **Exhibit A**.

Q. Collectively, the Agreement along with Exhibit A comprise the contract documents ("Contract Documents").

NOW, THEREFORE, in consideration of the promises and covenants set forth below, the Parties agree as follows:

AGREEMENT

Section 1. Recitals. The recitals set forth above ("Recitals") are true and correct and are hereby incorporated into and made part of this Agreement by this reference. In the event of any

inconsistency between the Recitals and Sections 1 through 23 of this Agreement, Sections 1 through 23 shall prevail.

Section 2. Term. This Agreement shall commence on the Effective Date and terminate one (1) year after District files a Notice of Completion with the County Recorder acknowledging completion of the Project ("Term"), unless the Parties mutually agree in writing to terminate the Agreement earlier or extend the Term pursuant to this Agreement.

Section 3. Effective Date. This Agreement shall only become effective once all of the Parties have executed the Agreement (the "Effective Date"). Contractor, however, shall not commence the performance of the services until it has been given notice by District ("Notice to Proceed").

Section 4. Work.

(a) *Services*. Subject to the terms and conditions set forth in this Agreement and the Contract Documents, Contractor shall perform the services necessary to complete the Project ("Services") within the required timeframe and in accordance with the standards and specifications established in the Contract Documents. Contractor shall not receive additional compensation for the performance of any work unless it is included in the Contract Documents, or the Parties agree otherwise in writing.

(b) *Modification of Services.* Only the District's General Manager may authorize extra or changed work. Failure of Contractor to secure such a written authorization for extra or changed work shall constitute a waiver of any and all right to adjustment in the Agreement price or Agreement time due to such unauthorized work, and thereafter, Contractor shall be entitled to no compensation whatsoever for the performance of such work. Contractor further waives any and all right or remedy by way of restitution or quantum meruit for any and all extra work performed without such express and prior written authorization of the General Manager.

Section 5. Time of Performance. Contractor warrants that it will commence performance of the Services on the date specified in the Notice to Proceed and shall conform to the Completion Schedule. The time of performance is a material term of this Agreement relied on by District in entering into this Agreement. It is agreed by the Parties that time is of the essence and that if the Project is not completed as set forth in Exhibit A, Completion Schedule, damage will be sustained by the District, and it may be impracticable to determine the actual amount of damage resulting from the delay. It is, therefore, agreed that Contractor shall pay to District as damages, the amount stated in **Exhibit A** for each and every day the Project is delayed prior to Substantial Completion. It is agreed that Contractor shall pay to District as damages, the amount stated in **Exhibit A** for each and every day the Project is delayed following Substantial Completion prior to final payment.

The Parties expressly agree that this liquidated damage clause is reasonable under the circumstances existing at the time the agreement is made. The District shall have the right to deduct the amount of liquidated damages owed pursuant to this section from any money due or to become due to Contractor.

Notwithstanding the above, the Parties expressly agree that the liquidated damages specified above do not include the District's legal, engineering, inspection, superintendence and other similar expenses. Accordingly, the District shall have the right to charge Contractor and to deduct from the amount due or to become due to Contract, the actual cost to the District for legal, engineering, inspection, superintendence, loss of revenue due to water delivery interruptions, and other expenses, which are directly chargeable to this Agreement and which accrue during a period of delay, except that the cost of final inspection and preparation of the final estimate shall not be included in the charges.

Section 6. Payment. District shall pay Contractor for all Services which are to be performed by Contractor, and Contractor agrees to accept the compensation provided in Exhibit A, Bid Schedule, which is summarized as follows:

Total compensation for completion of Project: $ _____ total.

Section 7. Representations of Contractor. District relies upon the following representations by Contractor in entering into this Agreement:

(a) *Standard of Care*. District has relied upon the professional ability and training of Contractor as a material inducement to enter into this Agreement. Contractor hereby warrants that it is qualified to perform the Services provided in the Contract Documents and that all of its work will be performed in accordance with the performance standards provided in Contract Documents, using generally accepted construction practices and standards, in compliance with all applicable federal, state and local laws.

(b) *Independent Contractor*. In performing the Services hereinafter specified, Contractor shall act as an independent contractor and shall have control of the work and the manner in which it is performed. Contractor is not to be considered an agent or employee of District and is not entitled to participate in any pension plan, insurance, bonus, or similar benefits District provides its employees. In the event District exercises its right to terminate this Agreement, Contractor expressly agrees that it shall have no recourse or right of appeal under rules, regulations, ordinances, or laws applicable to employees. Nothing contained herein shall be construed as creating an employment, agency or partnership relationship between District and Contractor.

(c) *Taxes*. Contractor agrees to file federal and state tax returns and pay all applicable taxes on amounts paid pursuant to this Agreement and shall be solely liable and responsible to pay such taxes and other obligations, including, but not limited to, state and federal income and FICA taxes. Contractor agrees to indemnify and hold District harmless from any liability which it may incur to the United States or to the State of California as a consequence of Contractor's failure to pay, when due, all such taxes and obligations. In case District is audited for compliance regarding any withholding or other applicable taxes, Contractor agrees to furnish District with proof of payment of taxes on these earnings.

(d) *Authority*. Contractor represents that it possesses the necessary licenses, permits, or approvals required to perform the Services or will obtain such licenses, permits, or approvals prior to the time such licenses, permits, or approvals are required. Contractor shall also ensure that all subcontractors are similarly licensed and qualified. Contractor represents and warrants to District that Contractor shall, at Contractor's sole cost and expense, keep in effect or obtain at all times during the Term of this Agreement, any licenses, permits, and approvals which are legally required for Contractor to practice Contractor's profession at the time the Services are rendered.

(e) *Warranty*. Contractor warrants that the work performed shall be free of defects for a period of one (1) year from Project completion. If any installation fails as the result of the workmanship of Contractor, Contractor shall repair or replace the defective installation at no cost to District. Warranty work shall be performed promptly following notice by District that such work is required.

(f) *Records Maintenance.* Contractor shall keep and maintain full and complete documentation and accounting records concerning all Services performed that are compensable under this Agreement and shall make such documents and records available to District for inspection at any reasonable time. Contractor shall maintain such records for a period of not less than five (5) years following completion of work hereunder.

(g) *No Conflict of Interest*. Contractor represents that no conflict of interest will be created under state or federal law by entering into or in carrying out this Agreement. Contractor further promises that in the performance of this Agreement, no person having such interest will be knowingly employed. If requested to do so by District, Contractor shall complete and file, and shall cause any person doing work under this Agreement to complete and file, a "Statement of Economic Interest" with the Sacramento County Clerk disclosing their financial interests.

(h) *Nondiscrimination*. Contractor shall not discriminate against any employee, applicant for employment, or volunteer because of race, color, creed, religion, national origin, sex, age, or physical or mental handicap. Contractor shall take affirmative action to insure the

applicants are employed and that employees are treated during employment without regard to their race, color, creed, religion, sex, age, or physical or mental handicap. Such protections shall include, but not be limited to, the following: employment; promotion; demotion or transfer; recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; or selection for training, including apprenticeship. Contractor agrees to post, in conspicuous places, available to employees and applicants for employment, notices that Contractor shall provide an atmosphere free of sexual harassment for employees, clients, volunteers and the general public.

Contractor shall comply with all applicable federal, state, and local laws, rules, and regulations in regard to nondiscrimination in employment because of race, creed, color, sex, age, marital status, physical or mental disability or national origin. In addition, all agreements with sub-contractors will include language as required by the Office of Federal Contract Compliance Programs that requires sub-contractors to maintain equal employment opportunity policies, and, as necessary, affirmative action policies.

Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, creed, religion, sex, national origin, ancestry, age, or physical or mental handicap.

Section 8. Assurance of Performance. If, at any time, District believes Contractor may not be adequately performing its obligations under this Agreement or may fail to complete the Services as required by this Agreement, District may submit a written request to Contractor for written assurances of performance and a plan to correct observed deficiencies in Contractor's performance. Failure to provide written assurances subsequent to such written request, constitutes grounds to declare a breach under this Agreement.

Section 9. Excusable Delays. Contractor shall not be in breach of this Agreement in the event that performance of Services is temporarily interrupted or discontinued due to a "Force Majeure" event which is defined as: riots; wars; sabotage; civil disturbances; insurrections; explosions; natural disasters such as floods, earthquakes, landslides, and fires; strikes; lockouts and other labor disturbances, or other catastrophic events which are beyond the reasonable control of Contractor. Force Majeure does not include: (a) Contractor's financial inability to perform; (b) Contractor's failure to obtain any necessary permits or licenses from other governmental agencies; or (c) Contractor's failure to obtain the right to use the facilities of any public utility where such failure is due solely to the acts or omissions of the Contractor.

Section 10. Assignment Prohibited. No Party to this Agreement may assign any right or obligation pursuant to this Agreement. Any attempt or purported assignment of any right or obligation pursuant to this Agreement shall be void and of no effect. Contractor hereunder offers and agrees to assign to District and agrees to require its subcontractors to offer and agree to assign the District, all rights, title, and interest in and to all causes of actions it may have under Section 4 of the Clayton Act (15 U.S.C., § 15) or under the Cartwright Act (Bus. and Prof. Code, § 16700 et seq.), arising from purchases of goods, services or materials pursuant to this contract or any subcontracts entered into hereunder. This assignment shall be made and become effective at the time District tenders final payment to Contractor, without further acknowledgement of the Parties.

Section 12. Ownership and Disclosure of Work Product. District shall be the owner of and shall be entitled to immediate possession of accurate reproducible copies of any design computations, plans, specifications, copies of correspondence, maps, or other pertinent data and information gathered or computed by Contractor ("Work Product") in the performance of and prior to termination of this Agreement by District or upon completion of the work pursuant to this Agreement. Contractor may retain copies of the above-described documents but agrees not to disclose or discuss any information gathered, discovered, or generated in any way through this Agreement without the express written permission of District, during the Term of this Agreement and for a period of one hundred eighty (180) days following expiration of the Term of the Agreement.

When this Agreement is terminated, Contractor agrees to return to District all Work Product, however produced, that it received from District, its contractors or agents, in connection with the performance of its Services under this Agreement. All materials shall be returned in the same condition as received.

Section 13. District's Termination without Cause. At any time, District may terminate the Agreement with or without cause by providing Contractor with seven (7) business days' written notice of such termination.

Section 14. District's Termination in the Event of Contractor's Default. If a Contractor should fail to perform any of its obligations hereunder, within the time and in the manner herein provided, or otherwise violate any of the terms of this Agreement or the Contract Documents, the District may give notice to the Contractor and allow Contractor seven (7) business days to commence correcting such deficiency and cures the default within thirty (30) days. The District, in its sole and absolute discretion, may grant Contractor additional time to cure the deficiency. If the Contractor does not correct such deficiency within the allotted time, the District may immediately terminate this Agreement by giving written notice of such termination, stating the reason for such termination.

(a) Contractor shall deliver copies of all Work Product prepared by it pursuant to this Agreement.

(b) If District terminates this Agreement before District issues the Notice to Proceed to Contractor or before Contractor commences any Services hereunder, whichever last occurs, District shall not be obligated to make any payment to Contractor. If District terminates this Agreement after District has issued the Notice to Proceed to Contractor and after Contractor has commenced performance under this Agreement, District shall pay Contractor the reasonable value of the Services rendered by Contractor pursuant to this Agreement prior to termination of this Agreement. District shall not in any manner be liable for Contractor's actual or projected lost profits had Contractor completed the Services. Contractor shall furnish to District such financial information, as in the judgment of the District Manager, is necessary to determine the reasonable value of the Services rendered by Contractor prior to termination.

(c) Except as provided in this Agreement, in no event shall District be liable for costs incurred by or on behalf of Contractor after the date of the notice of termination.

Section 15. Liability for Breach. Neither Party waives the right to recover damages against the other for breach of this Agreement including any amount necessary to compensate District for all detriment proximately caused by Contractor's failure to perform its obligations hereunder or which in the ordinary course of things would be likely to result therefrom. District reserves the right to offset such damages against any payments owed to Contractor. District shall not in any manner be liable for Contractor's actual or projected lost profits had Contractor completed the Services required by this Agreement. In the event of termination by either Party, copies of all finished or unfinished Work Product shall become the property of District. Notwithstanding the above, in no event shall District be liable, regardless of whether any claim is based on contract or tort, for any special, consequential, indirect or incidental damages, including, but not limited to, lost profits or revenue, arising out of or in connection with this Agreement or the Services performed in connection with this Agreement.

Section 16. Workers' Compensation Certification. Contractor is aware of the provisions of Labor Code section 3700 requiring every employee to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of the Labor Code. Contractor will comply with such provisions before commencing the performance of the work of this Agreement.

Section 17. Performance and Payment Bonds. Contractor shall, before commencing Services under this Agreement, file Bonds (pursuant to Civil Code, Division 3, Part 4, Title 15,

Chapter 7) with the District, each payable to the District. These Bonds shall be issued by a surety company authorized to do business in the State of California and shall be maintained during the entire Term of this Agreement at the sole and absolute expense of Contractor. Each Bond shall be for the amount of one hundred percent (100%) of the total compensation under this Agreement. Any alterations made to the Contract Documents or the specifications to the Project shall not operate to release any surety from liability on any Bond required herein and surety hereby consents such alterations in any surety on said Bonds hereby waives the provisions of California Civil Code sections 2819 and 2845.

Section 18. Insurance Coverage. During the Term, the Contractor shall maintain in full force and effect policies of insurance set forth herein, which shall be placed with insurers with a current A M Best's rating of no less than A VII and will provide the District with written proof of said insurance. Contractor shall maintain coverage as follows and will provide the District with written proof of said insurance. Contractor shall maintain coverage as follows:

(a) *General Liability*. Contractor shall carry commercial general liability insurance in an amount no less than Two Million Dollars ($2,000,000.00) combined single limit for each occurrence, covering bodily injury and property damage. If commercial general liability insurance or another form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this Project or the general aggregate shall be Two Million Dollars ($2,000,000.00). Said commercial general liability insurance policy shall either be endorsed with the following specific language or contain equivalent language in the policy:

> "The Rio Linda/Elverta Community Water District, its officers and employees are named as additional insured for all liability arising out of the operations by or on behalf of the named insured in the performance of this Agreement."

> "The inclusion of more than one insured shall not operate to impair the rights of one insured against another insured, and the coverage afforded shall apply as though separate policies had been issued to each insured, but the inclusion of more than one insured shall not operate to increase the limits of the company's liability."

> "The insurance provided herein is primary coverage to the Rio Linda/Elverta Community Water District with respect to any insurance or self-insurance programs maintained by District."

"This policy shall not be canceled or materially changed without first giving thirty (30) days prior written notice to the Rio Linda/Elverta Community Water District, Attention: General Manager."

(b) *Worker's Compensation Insurance and Employer's Liability*. Contractor shall carry workers' compensation insurance as required by the State of California under the Labor Code. Employer's Liability coverage shall be in the amount of at least One Million Dollars ($1,000,000.00). Said policy shall be endorsed with the following specific language:

"This policy shall not be canceled or materially changed without first giving thirty (30) days prior written notice to Rio Linda/Elverta Community Water District, Attention: General Manager."

(c) *Documentation*. The following documentation shall be submitted to District:

(i) Properly executed Certificates of Insurance clearly evidencing all coverages, limits and endorsements required above ("Certificates"). Said Certificates shall be submitted prior to the execution of this Agreement.

(ii) Signed copies of the specified endorsements for each policy. Said endorsement copies shall be submitted prior to the execution of this Agreement.

(iii) Upon District's written request, certified copies of insurance policies. Said policy copies shall be submitted within thirty (30) days of District's request.

(iv) Coverages shall contain no special limitations on the scope of protection afforded to the District and shall contain standard separation of insured provisions.

(d) *Policy Obligations*. Contractor's indemnity and other obligations shall not be limited by the foregoing insurance requirements.

(e) *Material Breach.* If Contractor, for any reason, fails to maintain insurance coverage that is required pursuant to this Agreement, such failure shall be deemed a material breach of this Agreement. District, at its sole option, may terminate this Agreement and obtain damages from Contractor resulting from said breach. Alternatively, District may purchase such required insurance coverage, and without further notice to Contractor, District may deduct from sums due to Contractor any premium costs advanced by District for such insurance. These remedies shall be in addition to any other remedies available to District.

Section 19. Indemnification. To the fullest extent permitted by law (including, without limitation, California Civil Code sections 2782 and 2782.8), Contractor shall defend, indemnify hold harmless and release District, and District's elected and appointed councils, commissions, directors, officers, employees, agents, and representatives ("District's Agents") from and against any and all actions, claims, loss, cost, damage, injury (including, without limitation, disability, injury or death of an employee of Contractor or its subcontractors), expense and liability of every kind, nature and description that arise out of, pertain to or relate to acts or omissions of Contractor, or any direct or indirect subcontractor, employee, contractor, representative or agent of Contractor, or anyone that Contractor controls (collectively "Liabilities"). Such obligations to defend, hold harmless and indemnify District and District's Agents shall not apply to the extent that such Liabilities are caused in whole by the sole negligence, active negligence, or willful misconduct of District or District's Agents, but shall apply to all other Liabilities. With respect to third party claims against the Contractor, the Contractor waives any and all rights of any type of express or implied indemnity against District and District's Agents. This indemnification obligation is not limited in any way by any limitation on the amount or type of damages or compensation payable to or for Contractor or its agents under workers' compensation acts, disability benefits acts or other employee benefit acts.

District may withhold from its payments to Contractor such amount as, in the District's opinion, are necessary and sufficient to provide security against the loss, damage, expense, penalty, fine, cost, claim, demand, suit, cause of action, judgment, or liability covered by the foregoing indemnity provision. District's withholding of payments under this provision will in no way relieve Contractor from performing all obligations under this Agreement.

Neither termination of this Agreement nor completion of the acts to be performed under this Agreement shall release Contractor from its obligations to indemnify the District and District's Agents.

Submission of insurance Certificates or other proof of compliance with the insurance requirements in this Agreement does not relieve Contractor from liability under this indemnification clause. The obligations of this indemnity shall apply whether or not such insurance policies shall have been determined to be applicable to any of such damages or claims for damages.

Section 20. Notices. Any notice or communication required hereunder between District and Contractor must be in writing, and may be given either personally, by registered or certified mail (return receipt requested), or by Federal Express, UPS or other similar couriers providing overnight delivery. If personally delivered, a notice or communication shall be deemed to have been given

when delivered to the Party to whom it is addressed. If given by registered or certified mail, such notice or communication shall be deemed to have been given and received on the first to occur of (a) actual receipt by any of the addressees designated below as the Party to whom notices are to be sent, or (b) five (5) days after a registered or certified letter containing such notice, properly addressed, with postage prepaid, is deposited in the United States mail. If given by Federal Express or similar courier, a notice or communication shall be deemed to have been given and received on the date delivered as shown on a receipt issued by the courier. Any Party hereto may at any time, by giving ten (10) days written notice to the other Party hereto, designate any other address in substitution of the address to which such notice or communication shall be given. Such notices or communications shall be given to the Parties at their addresses set forth below:

If to District: Rio Linda/Elverta Community Water District
730 L Street
Rio Linda, CA 95673
Attention: General Manager
Tel: (916) 991-1000

With courtesy copy to: Churchwell White LLP
1414 K Street, Third Floor
Sacramento, California, 95814
Attention: Barbara A. Brenner, Esq.
Tel: (916) 468-0950

If to Contractor: _____
_____
_____
_____

Section 21. Exhibits. All "Exhibits" referred to below or attached to herein are by this reference incorporated into this Agreement, with the same force and effect as if the same were set forth at length herein and the Parties will be and are bound by any and all of said Exhibits:

Exhibit Designation	Exhibit Title
Exhibit A:	Bid Documents

Section 22. Contract Documents. The Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all. The intent of the Contract Documents is to include all work necessary for the completion of the Agreement. The Contractor shall perform

all Services in conformance with the Contract Documents, unless otherwise directed in writing by the District pursuant to section 4(b).

Section 23. General Provisions.

(a) *Modification.* No alteration, amendment, modification, or termination of this Agreement shall be valid unless made in writing and executed by all of the Parties to this Agreement.

(b) *Waiver.* No covenant, term, or condition or the breach thereof shall be deemed waived, except by written consent of the Party against whom the waiver is claimed, and any waiver of the breach of any covenant, term, or condition shall not be deemed to be a waiver of any preceding or succeeding breach of the same or any other covenant, term, or condition.

(c) *Authority*. All Parties to this Agreement warrant and represent that they have the power and authority to enter into this Agreement and the names, titles, and capacities herein stated on behalf of any entities, persons, states, or firms represented or purported to be represented by such entities, persons, states or firms and that all former requirements necessary or required by the state or federal law in order to enter into the Agreement have been fully complied with.

(d) *Drafting and Ambiguities*. Each Party acknowledges that it has reviewed this Agreement with its own legal counsel, and based upon the advice of that counsel, freely entered into this Agreement. Each Party has participated fully in the review and revision of this Agreement. Any rule of construction that ambiguities are to be resolved against the drafting party does not apply in interpreting this Agreement.

(e) *Governing Law*. This Agreement shall be governed by and construed in accordance with the laws of the state of California.

(f) *Venue*. Venue for all legal proceedings shall be in the Superior Court for the State of California, in and for the County of Sacramento.

(g) *Severability*. If this Agreement in its entirety is determined by a court to be invalid or unenforceable, this Agreement shall automatically terminate as of the date of final entry of judgment. If any provision of this Agreement shall be determined by a court to be invalid and unenforceable, or if any provision of this Agreement is rendered invalid or unenforceable according to the terms of any federal or state statute, which becomes effective after the Effective Date of this Agreement, the remaining provisions shall continue in full force and effect and shall be construed to give effect to the intent of this Agreement.

(h) *Counterparts*. This Agreement may be executed simultaneously, and in several counterparts, each of which shall be deemed an original, but which together shall constitute one and the same instrument.

(i) *Audit*. District shall have access at all reasonable times to all reports, contract records, contract documents, contract files, and personnel necessary to audit and verify Contractor's charges to District under this Agreement.

(j) *Entire Agreement*. This Agreement, together with its specific references, attachments and exhibits, constitutes the entire agreement of the Parties with respect to the subject matters hereof, and supersedes any and all prior negotiations, understanding and agreements with respect hereto, whether oral or written.

(k) *Supersedes Prior Agreement*. It is the intention of the Parties hereto that this Agreement shall supersede any prior agreements, discussions, commitments, or representations whether, written, electronic or oral, between the Parties with respect to the subject matter of this Agreement.

(l) *Mandatory and Permissive*. "Shall" and "will" and "agrees" are mandatory. "May" and "can" are permissive.

(m) *Headings*. Headings used in this Agreement are for reference purposes only and shall not be considered in construing this Agreement.

(n) *Attorney's Fees and Costs*. If any action at law or in equity, including action for declaratory relief, is brought to enforce or interpret provisions of this Agreement, the prevailing Party shall be entitled to reasonable attorney's fees and costs, which may be set by the court in the same action or in a separate action brought for that purpose, in addition to any other relief to which such Party may be entitled.

(o) *Necessary Acts and Further Assurances*. The Parties shall at their own cost and expense execute and deliver such further documents and instruments and shall take such other actions as may be reasonably required or appropriate to evidence or carry out the intent and purposes of this Agreement.

(p) *Time is of the Essence*. Time is of the essence in this Agreement for each covenant and term of a condition herein.

IN WITNESS WHEREOF, this Agreement has been entered into by and between District and Contractor as of the Effective Date.

DISTRICT	**CONTRACTOR**
Rio Linda/Elverta Community Water District, a California county water district	_____, a _____
By:_____ Timothy R. Shaw, General Manager	By:_____ [name, title]
Date:_____	Date:_____

Approved as to Form:

By:_____
Barbara A. Brenner, General Counsel

EXHIBIT A
BID DOCUMENTS

SECTION 00 71 00

ABBREVIATIONS AND DEFINITIONS

PART 1 - GENERAL

1.01 GENERAL

A. Whenever the following terms, titles, or abbreviations are used in these Specifications, or in any document or instrument where these Specifications govern, the intent and meaning shall be as herein defined. Working titles having a masculine gender, such as "workman" and "journeyman" and the pronoun "he", are utilized in the specifications for the sake of brevity, and are intended to refer to persons of either gender.

1.02 ABBREVIATIONS

AA	Aluminum Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
APA	American Plywood Association
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATS	Automatic Transfer Switch
AWG	American Wire Gage
AWS	American Welding Society
AWWA	American Water Works Association
Cal-OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CDPH	California Department of Public Health
CL	Centerline
County	County where work is being performed
CSI	Construction Specifications Institute
CY	Cubic Yards
DDW	Division of Drinking Water
DI	Drain Inlet
DIP	Ductile Iron Pipe
DIR	Department of Industrial Relations
DWR	Department of Water Resources
EA	Each
EP	Edge of Pavement
FIP	Female Iron Pipe
FS	Federal Specifications
Inv	Invert
ISA	International Society of Arboriculture
LB	Pound

LF	Linear Feet
LS	Lump Sum
MIP	Male Iron Pipe
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCC	Portland Cement Concrete
PVC	Polyvinyl Chloride Pipe
SD	Storm Drain
SF	Square Foot/Feet
SS	Sanitary Sewer
STA	Station
Title 8	Title 8 (Construction Safety Orders) of the California Code of Regulations
Title 19	Title 19 (Public Safety) of the California Code of Regulations
Title 24	Title 24 (Building Standards) of the California Code of Regulations
TOC	Top of Curb
Typ.	Typical
UL	Underwriters' Laboratories, Inc.
UBC	Uniform Building Code (latest edition adopted by Owner)
USBR	United States Bureau of Reclamation
UMC	Uniform Mechanical Code (latest edition adopted by Owner)
UPC	Uniform Plumbing Code (latest edition adopted by Owner)
VFD	Variable Frequency Drive
WCLA	West Coast Lumbermen's Association
WIC	Woodwork Institute of California

1.03 DEFINITIONS

A. **Abandonment of Work:** Defined as, but not limited to, becoming unresponsive to time restraints as defined in the project schedule or leaving the site unsecured for more than one day.

B. **Acceptance:** means the formal written acceptance by the Owner of the entire Contract which has been completed in all respects in accordance with the Specifications and any approved modifications.

C. **Agreement:** The written contract (Contract) signed by the Owner and the Contractor covering the work and the furnishing of labor, materials, tools, and equipment in the construction of the work.

D. **As Approved:** shall be understood to be followed by the words “by the Engineer," unless otherwise qualified.

E. **As Shown, Etc.:** Where "as shown", "as latest indicated", "as detailed", or words of similar import are used, the reference is to the Contract unless specifically stated otherwise. Where "as directed", "as permitted", "approved", or words of similar import are used, they shall mean the direction, permission, or approval of the Owner.

F. **Bid:** When submitted on the prescribed bid form, properly signed and guaranteed, the Bid constitutes the offer of the Bidder to complete the work at the price shown on the Bidder's bid form.

G. **Bid Guarantee:** Cash, cashier's check, certified check, or bidder's bond accompanying the bid submitted by the bidder, as a guarantee that the bidder will enter into a Contract with the Owner for the performance of work herein described.

H. **Bidder:** Any person, persons, firm, partnership, joint venture, corporation, or combination thereof, submitting a Bid for the work, acting directly or through a duly authorized representative.

I. **Bid Documents:** The sum of the documents that comprise the Bid by a Bidder to perform the work.

J. **Board of Directors:** The Rio Linda/Elverta Community Water District Directors. Also referred to as "Board".

K. **Bid Opening:** The event conducted by the Owner during which the sealed Proposals submitted by Bidders to perform the work are opened and publicly read.

L. **Board Of Supervisors:** The Board of Supervisors of the County of Sacramento, a political subdivision of the State of California. Also referred to as "Board".

M. **Calendar Day:** Every day shown on the calendar. When the Contract Time is stated in Calendar Days, every day will be charged toward the Contract Time. See Section 7-17 for the sole exception.

N. **Change Order:** A Contract amendment approved by the Owner that includes, but is not limited to, alterations, deviations, additions to, or deletions from, the Contract which are required for the proper completion of the work.

O. **Contract:** See Agreement.

P. **Contract Documents:** Any or all of the documents listed in the Agreement.

Q. **Contractor:** The person or persons, firm, partnership, joint venture, corporation, or combination thereof, private or municipal, who (that, has, have) entered into a Contract, as defined in these Specifications, with the Owner.

R. **Contract Time:** The time stated in the Contract for completion of the work. The Contract Time may be a single allotment of time, a group of times specific to portions of the work, or a combination of the two, or a specified completion date.

S. **County:** The County of Sacramento, a political subdivision of the State of California.

T. **District:** The Rio Linda/Elverta Community Water District (RLECWD), acting as Owner through its authorized representatives.

U. **Date of the Contract:** The date on which the Contract is signed by the Owner's authorized representative.

V. **Days:** Calendar days unless otherwise designated.

W. **Engineer:** Engineer retained by or designated by the Owner as its engineering representative during the course of construction.

X. **Estimated Quantities:** The list of items of work and the estimated quantities associated with the work. The Estimated Quantities provide the basis for the Bid.

Y. **General Manager:** The General Manager of the agency who has full authority over the project.

Z. **He:** Includes "she" and "it" and his shall include "her" and "its."

AA. **Inspector:** The person or persons authorized to act as agent(s) for the Owner in the inspection of the work.

BB. **Legal Holidays:** The following days are recognized as “legal holidays” by the Owner:

New Year’s Day	January First
Martin Luther King, Jr. Day	Third Monday in January
Lincoln’s Birthday	February Twelfth
Washington’s Birthday	Third Monday in February
Memorial Day	First Monday in May
Independence Day	July Fourth
Labor Day	First Monday in September
Columbus Day	Second Monday in October
Veteran’s Day	November Eleventh
Thanksgiving Day	Fourth Thursday in November
Thanksgiving Friday	Friday after Thanksgiving
Christmas	December Twenty-fifth

CC. **Notice To Contractors:** The written notice whereby interested parties are informed of the date, location, and time of the Bid Opening of a proposed Owner Project and the terms and conditions of submitting Bids to perform the work.

DD. **Notice To Proceed:** The written authorization by the Owner to the Contractor specifying the date the work may begin and any conditions regarding the beginning of the work.

EE. **Or Equal:** The term "or equal" shall be understood to indicate that the "equal" product be the same or better than the product named in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the Engineer.

FF. **Owner:** Rio Linda/Elverta Community Water District

GG. **Plans or Drawings:** The plans, drawings, profiles, cross sections, Working Drawings, and Supplemental Drawings, or reproductions thereof, approved by the Owner, which show the locations, character, dimensions, and details of the work.

HH. **Project:** Shall mean the work.

II. **Proposal:** Shall mean “Bid”.

JJ. **Record Drawings:** Drawings prepared by the Contractor that document changes to, additions to, or deductions from the Plans, and which represent the work as constructed.

KK. **RLECWD:** means the Rio Linda/Elverta Community Water District and is also referred to as the Owner.

LL. **Schedule of Values:** A statement furnished by the Contractor to the Owner reflecting the portions of the Total Contract Price allotted for the various parts of the work for each work activity contained on the project schedule. Unless otherwise indicated in the Specifications, the total of the Schedule of Values shall equal the full cost of the work, including all labor, material, equipment, overhead, and profit. For lump sum contracts, the

Schedule of Values is the basis for reviewing the Contractor's application for progress payments.

MM. **Special Provisions:** The Special Provisions are specific clauses setting forth conditions or requirements peculiar to the work and supplementary to the Standard Construction Specifications.

NN. **Specifications:** The directions, provisions, and requirements contained herein.

OO. **Reference Standards:** Where reference standards, such as those of "ASTM", "AASHO", etc. have been referred to, the applicable portions of such standard specifications shall become a part of these Contract Documents.

PP. **Standard Drawings:** The Standard Drawings of the Owner, which are incorporated into the Standard Construction Specifications, and made a part of the Plans by reference to one or more specific Standard Drawings.

QQ. **State:** The State of California.

RR. **State Specifications:** The version of the State of California Standard Specifications for Construction of Local Streets and Roads, issued by the California Department of Transportation, in effect at the time of Notice to Contractors.

SS. **State Plans:** The version of the State of California Standard Plans for Construction of Local Streets and Roads, issued by the California Department of Transportation, in effect at the time of Notice to Contractors.

TT. **Subcontractor:** A properly licensed party under contract to and responsible to the Contractor for performing a specified part of the work; or a properly licensed party under contract and responsible to a Subcontractor of the Contractor.

UU. **Supplemental Drawing:** Supplemental drawings define the Plans or Specifications in greater detail by providing additional information that may have not been specifically or clearly shown or called out on the Plans or in the Specifications.

VV. **Technical Provisions:** The provisions of the Standard Construction Specifications that describe the technical aspects of the work.

WW. **Time Limits:** all time limits stated in the Contract Documents are of the essence of the Contract.

XX. **Total Contract Price:** The total price for the work as bid by the Contractor, including any additions or subtractions made via Contract Change Orders.

YY. **Work:** All actions which the Contractor is contractually required to do as specified, indicated, shown, contemplated, or implied in the Contract to construct the work, including all alterations, amendments, or extensions made by Contract Change Order or other written orders or directives of the Owner. Unless specified otherwise in the Contract, the work includes furnishing all materials, supplies, equipment, tools, labor, transportation, supervision, and all incidentals necessary to complete the work.

ZZ. **Working Day:** Any day except: (a) Saturdays, Sundays, and legal holidays; (b) days on which the Contractor is specifically required by the Special Provisions or by law to suspend construction operations; or (c) days on which the Contractor is prevented from proceeding with the current controlling operation or operations of the work for at least five (5) hours per day due to inclement weather, or conditions resulting immediately therefrom.

AAA. **Working Drawing:** Working Drawings detail a particular item of work and the manner in which it is to be accomplished or performed. Working Drawings are prepared by the Contractor as a submittal or a portion of a submittal and may be specifically requested by the Owner or required in the Contract or a Field Instruction or other written directive.

1.04 INTENDED WORDS

A. Whenever in the Contract Documents or upon the Drawings the words DIRECTED, REQUIRED, PERMITTED, ORDERED, DESIGNATED, PRESCRIBED, or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation or prescription of the Engineer is intended, and similarly the words APPROVED, ACCEPTABLE, SATISFACTORY, or words of like import, shall mean approved or acceptable to, or satisfactory to the Engineer, unless otherwise expressly stated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

TECHNICAL SPECIFICATIONS

SECTION 01 00 00

TIME ALLOWED FOR COMPLETION AND LIQUIDATED DAMAGES

PART 1 – GENERAL

1.01 TIME ALLOWED FOR COMPLETION

Substantial completion and final completion shall be completed by the dates specified herein.

Contractual Completion Event	Date of Completion (Calendar Days)
Substantial Completion – Pipelines are completed pressure tested, disinfected and online.	**October 1, 2020 (234 days from NTP)**
Final Acceptance	**November 1, 2020 (265 days from NTP)**

The Notice to Proceed (NTP) shall be issued by the District once the contract is fully executed. The completion dates above are based on a Notice to Proceed date of **February 10th, 2020.**

The time allowed for Substantial Completion or Final Acceptance shall not be extended for delays that do not impact a critical path item of work.

Substantial Completion shall include all construction with the exception of final clean up and submittal of record drawings.

The time allowed for Substantial Completion and Final Acceptance shall include 30 weather delay days. Weather delay days in excess of 30 days may be added to the Contractor's date of completion for Substantial Completion and Final Acceptance.

1.02 LIQUIDATED DAMAGES

Contractor shall pay to the District liquated damages in the amount of two thousand five hundred ($2,500.00) per day for each calendar day after the date of Substantial Completion for which the contract is not substantially complete.

In addition to Paragraph A above, Contractor shall pay to the District liquated damages in the amount of two thousand five hundred ($2,500.00) per day for each calendar day after the date of Final Acceptance for which the contractor has not received Final Acceptance.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

**** END OF SECTION ****

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SECTION 01 11 00

SUMMARY OF WORK

Part 1 - GENERAL

1.01 PROJECT LOCATION

A. The work covered under this contract will be performed at the District's property located on U Street, approximately 1000 feet east of Dry Creek Road in Rio Linda, California.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The work consists of a new pump pedestal and discharge piping, control building, hypochlorite disinfection, outdoor propane generator, CMU sound wall, security iron fencing, automatic sliding gate, pump to waste and drainage improvements, asphalt paving and driveway, frontage landscaping, and new pipeline in County Right of Way to connect to existing water system.

B. The following is a list of the facilities that are planned to be constructed. This list describes the overall project and is not intended to describe the complete extent of the Contract requirements identified by the contract documents (Plans and Specifications).

C. The Contractor shall make an independent determination of all project requirements and include all associated costs in their bid. The facility to be constructed under this contract will include, but not be limited to, the following components:

1. Well Pump
    a. Pump pedestal
    b. Vertical turbine pump and motor (200 HP)
2. Onsite Piping and Appurtenances
    a. Above grade piping (6" and 12")
    b. Below grade piping (6" and 12")
    c. (1) 12" check valve
    d. (1) 12" ultra mag flow meter
    e. Landscaping and irrigation stub out for site frontage
3. Control Building
    a. 12' H CMU block control building
        1) Chemical room
        2) Electrical room
        3) Storage room
4. Chemical Room
    a. Pre-engineered skid-mounted chemical pump system
    b. 400-gallon double contained polyethylene chemical storage tank
    c. Precast concrete catch basin for chemical containment
5. Offsite Piping and Appurtenances
    a. 8" and 6" ductile iron pipe
    b. (4) Fire hydrants
    c. (1) 4" Blow off
    d. (2) Tie ins on U Street and 14th Street
6. Electrical
    a. Electrical service

b. Meter main
c. Instrumentation
d. Low level site lighting
e. Associated conduits and wire
f. SMUD Service
g. Emergency Propane Generator and Tank

7. Facility Controls
   a. Programmable Logic Controller (PLC)
   b. Supervisory Control and Data Acquisition (SCADA) for remote monitoring and control
8. Paving and Grading: Site grading for drainage and paving throughout the improved area of the project site
9. Drainage Improvements
   a. Concrete V-Gutter
   b. Rock-lined detention basin on western side of site
   c. Rock-lined frontage ditch
   d. Box culvert
   e. 12” Driveway Culvert
10. Security Fencing and Gates
    a. 8-ft high security iron fencing on the west end of the site and the frontage. One (1) 16’ wide security iron gate and (1) 3’ wide pedestrian swing gate will be located on the facilities frontage. An 8-ft high CMU block wall will be constructed on the north and east sides of the site.
11. Landscaping
    a. Landscaping (xeriscape) and irrigation stub outs in the facility setback area from U Street.
12. U Street surface repairs as required
13. All permits required by Sacramento County

1.03 WORKING HOURS

A. Time restrictions for performing all work at the well site is 7:00 a.m. to 6:00 p.m. Monday through Friday excluding holidays. Special approval will be required by the Engineer if a modification of the time schedule is required.

B. District recognized holidays

1.	New Year’s Day	January 1st
2.	Martin Luther King, Jr. Day	Third Monday in January
3.	Washington’s Birthday	Third Monday in February
4.	Memorial Day	First Monday in May
5.	Independence Day	July 4th
6.	Labor Day	First Monday in September
7.	Veteran’s Day	November 11th
8.	Thanksgiving Day	Fourth Thursday in November
9.	Thanksgiving Friday	Day after Thanksgiving Day
10.	Christmas	December 25th

1.04 SITE SECURITY

A. The Contractor shall be responsible for maintaining any temporary fencing required to secure the project area. The Contractor will be responsible for providing 24-hour security to the project site. This can be accomplished by either providing security with a security guard or surveillance system when the contractor is not on site. The

surveillance system must be approved by the Owner prior to moving material or equipment on site. Bay Alarm or an approved equivalent would be considered acceptable by the Owner. The Contractor shall be responsible for removing the temporary fencing at the completion of the project. This includes removing the fence posts and concrete.

1.05 WORK SEQUENCE

A. The sequence of work shall provide for the following requirements:

1. Obtain Notice to Proceed from Owner
2. Begin providing submittals for Engineer's review
3. Start site rough grading
4. Order the materials and construct the facilities per the plans, specifications, and approved submittals
5. Disinfect, Startup and Test facilities as required
6. Compile into binders and submit the operational and maintenance manuals for all equipment provided
7. Provide record drawings for the facilities constructed

1.06 STAGING AREA

A. The Contractor may use the existing property as a staging area and delivery site during construction. If the Contractor uses an offsite delivery or staging area not owned by the Owner, an agreement to use this property will be between only that property owner and the Contractor. The Contractor understands that the Owner will assume no liability for the use of any onsite or offsite property by the Contractor.

1.07 STORING OF SITE CUT AND FILL

A. The Contractor may use the Owner's property to store cut and fill that is related to this project. No non-project related cut and fill can be stored on the Owner's property. Prior to the completion of the project, the Contractor must remove any unused earth and spoil from the project site.

1.08 DOCUMENT EXISTING CONDITIONS

A. Prior to commencing the Work, the Contractor shall examine the site with the Engineer. The Contractor shall examine and document photographically and in writing the condition of existing buildings, structures, pavement, equipment, improvements, trees, and landscaping on or adjacent to the project site which are not to be disturbed as part of the project. This record shall serve as a basis for determination of subsequent damage due to the Contractor's operations and shall be signed by all parties making the examination. The Contractor shall record existing conditions on a flash drive by making a color digital photographs. Any damage to existing facilities which cannot be shown from the initial examination records as pre-existing shall be the responsibility of the Contractor to repair or replace to the satisfaction of the Engineer.

1.09 SHUTDOWN OF EXISTING UTILITIES, SERVICES, OR OPERATIONS

A. Obtain the Owner's approval at least seven (7) days prior to the shutdown of any utility, service or operation of any existing facility. Give required notice and make appropriate arrangements with utility owners and other affected parties prior to shutdown of any utility service. The Contractor's Bid shall include the cost of

premium time to perform work requiring utility shutdowns on weekends or outside of normal working hours

B. Schedule utility service or operations shutdowns for periods of minimum use and at the Owner's convenience. Have all required material, equipment, and workers on site prior to beginning any work involving a possible shutdown. Perform work as required to reduce shutdown time to the minimum. In some cases, this may require increased numbers of workers and/or premium time for night or weekend work

C. The Contract price shall include the cost of additional workers and premium time work required to minimize the impact of utility service or operations shutdowns

Part 2 - PRODUCTS (NOT USED)

Part 3 - EXECUTION

3.01 PROJECT COORDINATION

A. The Contractor will be required to coordinate his work, to phase the construction operations, and to provide, install, and maintain any temporary connections necessary to prevent interference to operation of Owner's facilities. Any construction work requiring the shutdown of facilities must be scheduled and performed per Paragraph 1.09

B. In addition to the above, the Contractor shall:

1. Coordinate scheduling, submittals, and work of the various sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements with provisions for accommodating items installed later
2. Verify that the utility requirement characteristics of operating equipment are compatible with utilities planned to be provided. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing such equipment in service
3. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings\
4. Follow routing shown for pipes and conduit as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs
5. In finished areas, except as otherwise indicated, conceal pipes and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements
6. Coordinate completion and cleanup of work of separate sections in preparation for Substantial Completion and for portions of work designated for the Owner's partial occupancy
7. After the Owner's occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents to minimize disruption of the Owner's activities

3.02 RUN OFF AND EROSION CONTROL

A. Given the extent of proposed disturbance is over one (1) acre, the project will require preparation of a Storm Water Pollution Prevention Plan (SWPPP) for the project site.

**** END OF SECTION ****

SECTION 01 14 16
COORDINATION AND MEETINGS

PART 1 - GENERAL

1.01 GENERAL

A. The Contractor shall be familiar with all items of the Project requiring coordination as well as plan the Work to ensure orderly progress and completion within the Contract Time. The Contractor shall coordinate the work of all subcontractors.

1.02 EXISTING UTILITIES

A. Only District Personnel shall operate existing water valves unless otherwise directed by the Engineer.

B. The Contractor shall coordinate their construction activities closely with the utility service companies. The Contractor shall give at least 72 hours (three business days) notice to the utility service companies prior to the time when field location of existing services will be required.

C. Obtain best available current information on location, identification and marking of existing utilities, piping, and conduits and other underground facilities before beginning any excavation. Call 811/800-227-2600 for information at least 48 hours in advance of beginning work. Give the Engineer 24-hour notice before beginning work.

D. The location of existing utilities and underground facilities known to the Engineer are shown in their approximate location based on information available at the time of preparing the Drawings. The actual location, size, type, and number of utilities and underground facilities may differ from that shown and utilities or underground facilities may be present that are not shown.

E. Use extreme care when excavating or working in areas that may contain existing utilities, process piping, conduits, or other underground facilities. Use careful potholing, hand digging, and probing to determine the exact location of underground installation(s). Some locations contain multiple pipes or conduits. Prior to performing any subsurface work, investigate, determine, and prepare a plan to turn off or disconnect each utility believed to be within 100 feet of the subsurface work in the event of an accidental breach of a utility conduit.

F. Where connections to existing utilities or other underground facilities are required or where new piping or conduits may cross or interfere with existing utilities or underground facilities, carefully excavate and uncover existing installations to a point 1 foot below the piping or conduit to determine the actual elevation and alignment. Call the Engineer’s attention to differing existing conditions that may require a clarification or change.

G. Shutdown of existing utilities, services, or operations shall be done in accordance with Section 01 11 00 Summary of Work, Subsection 1.09.

H. The Contractor shall not install valves, fire hydrants, tie-ins, or services until the location and configuration has been reviewed and approved by the Engineer.

1.03 PRECONSTRUCTION MEETING

A. Prior to beginning of Work, the Contractor and their key personnel and Subcontractors including the Contractor’s Superintendent shall attend a meeting with the District and the Engineer to discuss the following:

1. Name, Authority, and Responsibility of Parties Involved
2. Project Procedures:
    a. Progress meetings
    b. Correspondence
    c. Notification
    d. Submittal of Product Data, Shop Drawing Samples, and Proposed Equivalents
    e. Requests for Information
    f. Response to Requests for Information
    g. Requests for Quotation
    h. Work Directive Change
    i. Change Orders
    j. Engineer's "Items of Concern List"
3. Temporary Schedule and Contractor's Construction Schedule
4. Pay Requests
5. Temporary Facilities and Control
6. Testing During Construction
7. Contractors Coordination
8. Mechanical/Electrical Coordination
9. Maintenance of Record Drawings
10. Owner Provided Items or Work and Owner Furnished Contractor Installed Items
11. Early Beneficial or Partial Occupancy
12. Final Testing, Startup, and Balancing
13. Owner Training
14. Punch Lists and Project Closeout Procedures
15. Final Deliverables including Record Drawings, Operation and Maintenance Manuals, and Special Guarantees.

1.04 NOISE IMPACT

A. To minimize construction noise impacts on the local residents, no construction activities will be allowed between the hours of 6:00 p.m. and 7:00 a.m. or per County Encroachment permit requirements and during weekends and holidays unless explicitly allowed by the Engineer. Special arrangements may be made for special connections that may be required after hours. Contractor must obtain approval from County to perform work during those hours within County right of way.

1.05 WORKING HOURS

A. The time provided for construction completion of this project assumes the Contractor working 5 days a week, 8 hours per day. Should the Contractor or his subcontractors desire to work more than 5 days per week or 8 hours per day, or on designated off days, approval must be requested from the District. The designated off days shall be all weekends and holidays.

B. Night work is not anticipated for this project unless deemed necessary by County Transportation Department or District. If required by the County, Contractor shall advise the District two weeks prior to all night work requirements. Emergency work may be done without prior permission in accordance with the General Conditions. Work shifts of the prime contractor and subcontractors shall coincide with each other to prevent extending the total hours of work in a single day.

1.06 SCHEDULING REQUIREMENTS

A. The sequence of Work will be submitted and updated by the Contractor as required and approved by the Engineer.

1.07 SURFACE RESTORATION

A. All road surfaces disturbed by excavation are to be maintained according to Section 32 01 18 Pavement Repair and Restoration and the conditions of the Encroachment Permit, whichever one is most stringent.

1.08 LOCAL PHONES

A. The Contractor shall maintain a local cell phone and fax number with 24 hour and seven day a week access.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

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SECTION 01 14 19
FIELD ENGINEERING

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall provide field surveying to make elevations and grades as well as locate the new facilities being constructed.

1.02 FIELD SURVEYING

A. Utilizing the District's reference points, the Contractor shall establish the initial control base line and all control bench marks to be utilized throughout the project. The base line shall be set in accordance with all lines, dimensions, reference points, and elevations given in the Contract Documents.

B. Should the Contractor detect a discrepancy between the information as presented in the Contract Documents and any existing survey grid work, benchmarks, structures, etc., the Contractor shall notify the Engineer immediately. New construction shall not commence until accurate control base lines and benchmarks have been established.

C. The Contractor shall, throughout the course of the project, set all additional stakes which are needed for offset stakes, reference points, slope stakes, pavement and grade stakes, stakes for structures, storm drains, utilities, fence, culverts, or other structures, supplementary bench marks, and any other horizontal or vertical controls necessary to secure a correct layout and construction of the work. Stakes for line and grade for storm drains, etc., shall be set at twenty-five (25) foot maximum intervals. Base lines shall be staked in such manner as to clearly define them for the project.

D. It shall be the Contractor's responsibility that the finished work conform to the lines, grades, elevations and dimensions called for in the Contract Documents. The Work shall be subject to checking by the Engineer, but any inspection or checking of Contractor's layout by the Engineer and the acceptance of all or part of it shall not relieve the Contractor of his responsibility to secure the proper dimensions, grades, elevations and locations on the several parts of the Work. The Contractor shall exercise care in the preservation of stakes, monuments and benchmarks and shall have them reset at his expense when they are lost or displaced.

E. Prior to the commencement of any Work activity, the Contractor shall survey and layout the Work to be performed, and advise the Engineer of any conflicts, obstructions, concerns, etc. which will prevent completion of such work in accordance with the requirements of the Contract Documents. If the Contractor fails to conduct such survey and layout or if the survey and layout fails to identify a conflict, obstruction, etc., which it reasonably should have, and a conflict, obstruction, concern, etc., is discovered, the Contractor shall bear the cost of any standby time for labor and/or equipment which occurs pending the Engineer's direction and the cost of rework of any Work installed which is affected by the conflict, obstruction, etc.

F. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

1.03 PRESERVATION OF REFERENCE POINTS AND PROPERTY CORNERS

A. The Contractor shall carefully preserve benchmarks, reference points, lot corners, section corners and other stakes, and in case of destruction shall be charged for the resetting of such points and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance. Price for resetting such points will be deducted from Contractor's monthly pay request. Resetting of property or section corners shall be by a surveyor licensed to practice in California.

1.04 SURVEY NOTES

A. Contractor shall maintain survey notes in a neat and legible format. Contractor shall provide a duplicate set of survey notes for all staking operations to the Engineer for record purposes no later than twenty-four hours after the stakes are set. The Engineer reserves the right to monitor the work of survey crews as judged necessary to show conformance with this specification. However, such monitoring shall in no way relieve the Contractor of the responsibility for survey accuracy and adequacy to obtain a finished product fully conforming to the Contract Documents. Failure to provide adequate notes in the time specified shall be justification for immediate suspension of all work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01 21 19
PRESSURE AND LEAK TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall test all piping, valves, and appurtenances installed under these Contract Documents. Testing shall be performed concurrent with installation. Unless otherwise approved by the Engineer each pipe run and no more than 500 feet of continuous pipe shall be installed without being tested.

1.02 SUBMITTALS

A. The Contractor shall prepare and submit to the Engineer schedules and procedures for testing of all parts of the water main installed in accordance with Section 01 33 13 Submittals. The schedule shall be submitted seven days prior to any testing.

1.03 REFERENCES:

A. AWWA C600 – Installation of Ductile-Iron Water Mains

B. AWWA C605 – Underground Installation of PVC Pipe and Fittings

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. The pump, pipe connections, and all necessary apparatus for the pressure and leakage tests, shall be furnished by the Contractor. The Contractor shall make all excavations and backfills, and shall furnish all necessary assistance for conducting the tests.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall follow the hydrostatic testing method in accordance with ANSI AWWA C600, Section 5.2 Hydrostatic Testing, and these specifications. Air shall be vented from all high points in the line. If required, the Contractor shall provide a corporation stop in a saddle at these points to provide venting. All valves controlling the section to be tested shall be closed. A test pressure of 150 psi minimum, or 1-1/2 times the normal working pressure, whichever is greater, shall be applied and held for a period of 2 hours. The Contractor shall provide the necessary pump and a calibrated container for measurement of make-up water required to replace leakage during this 2-hour period.

B. Allowable leakage in the section during this test shall be NONE.

C. All defective items discovered during the pressure test shall be repaired or replaced by the Contractor at no additional cost to the District. The test shall be repeated after any repair until the system meets the above leakage requirement. The test will be witnessed by the Engineer.

3.02 FILLING AND TESTING

A. Each segregated section of pipeline will be slowly filled with water ensuring that all air is expelled. Extreme care must be taken to ensure all air is expelled from the pipeline during the filling of pipe with water. The line shall stand full of water for twenty-four hours prior to testing to allow all air to escape. If necessary, tap the main at points of highest elevation so that air

can be expelled as the pipe is filled with water. After successful completion of filling and air expulsion, but prior to testing, the corporation stops shall be removed and the taps tightly plugged.

**** END OF SECTION ****

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SCOPE

A. Measurement and payment criteria applicable to the Work performed under a unit price payment method as well as those items paid by lump sum.

B. Defect assessment and non-payment for rejected work.

1.02 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Schedule are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the District determine payment unless otherwise indicated in these specifications.

B. Quantities of materials wasted or disposed of in a manner not called for under the contract; or rejected loads of material, including material rejected after placement by reason of the Contractor's failure to conform to the provisions of the Contract; or materials not used: materials placed outside the limits established on the plans or approved by the Engineer; will not be paid for and such quantities will be deducted from the total quantities. No payment will be allowed for hauling and disposing of rejected material.

C. If the actual Work requires more or less quantities than those indicated on the Bid Schedule, provide the required quantities at the unit sum/prices contracted unless otherwise indicated in these specifications.

1.03 MEASUREMENT OF QUANTITIES

A. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

1.04 LUMP SUM MEASUREMENT

A. Lump sum items will be measured and paid on a percent complete basis, as determined by the Engineer.

B. The Contractor may provide a schedule of values for the lump sum items to accommodate partial pay requests. The schedule of values shall be submitted to the Engineer within 10 days after the notice to proceed for review and approval.

1.05 PAYMENT

A. Payment includes: Full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Engineer multiplied by the unit price for Work which is incorporated in or made necessary by the Work.

1.06 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. The authority of the Engineer to assess the defect and identity payment adjustment, is the final.

1.07 NON-PAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.
7. Products or planting incorrectly handled, installed, or planted.

1.08 SCHEDULE OF MEASUREMENT AND PAYMENT

A. See technical specifications for a complete description of work.

Bid Item 1 – Mobilization and Demobilization

A. Measurement and Payment by Full Compensation

B. All costs connected with mobilization for Contractor's operations will be paid for at the Contract price as follows:

1. The maximum allowed for Mobilization and Demobilization is 10 percent of the total bid cost.
   a. 50 percent of the Contract item price for mobilization or 5 percent of the original contract amount, whichever is less, will be paid to the Contractor when the monthly partial payment estimate of the amount earned for the other items of work is 5 percent or more of the original Contract Price.
   b. 75 percent of the Contract item price for mobilization or 7.5 percent of the original contract amount, whichever is less, will be paid to the Contractor when the monthly partial payment estimate of the amount earned for the other items of work is 10 percent or more of the original Contract Price.
   c. The remaining 25 percent will be included in the final payment after completion of all Contract work and removal from the site of all plant and equipment and final cleanup of the site.
2. In the event the Engineer considers the price for mobilization does not bear a reasonable relation to the costs of the Contract Work, the Engineer may require the Contractor to produce cost data to justify the Bid Price for mobilization. Failure to justify such price to the Engineer's satisfaction will result in payment of actual mobilization costs, as determined by the Engineer, at the completion of the final payment under this contract. The determination of mobilization costs by the Engineer is not subject to appeal.
3. Costs for the project identification signs as required by the County and the encroachment permit and shall be paid as part of mobilization.
4. Construction staking shall be paid as part of Mobilization.
5. Costs associated with obtaining permits (including the sewer access permit), access to private property and staging areas will be paid for as part of Mobilization.
6. Costs associated with erosion and sediment control per County Standards.
7. Marking the proposed water main alignment and proposed fire hydrant locations will be paid as part of mobilization.

C. As-built plan preparation will be paid as part of mobilization and demobilization. As-builts are due 14 days after substantial completion notification. Final compensation will be delayed until As-builts are submitted and approved.

D. All costs associated with project records, submittals, schedules, and meetings.

E. Includes all tools, equipment, materials and labor necessary to provide and implement a traffic control plan in compliance with the Sacramento County Standards and approved by Sacramento County DOT. This includes all signage, flaggers, signal control, barricades, cones, K-rail concrete barriers, etc. used in the implementation of the Traffic Control Plan.

F. The contractor is responsible for development, approval and implementation of a traffic control plan.

G. This also includes all costs for project identification signs required by and all costs for coordination with Sacramento County DOT and construction site signs required by the District.

H. Includes all tools, equipment, materials and labor necessary to implement, maintain and repair the construction BMPs included in the plans and specifications and as required by the District.

I. The Contractor is required to have a registered QSP on staff or under contract for the duration of the project. The QSP shall be named and certification provided prior to the start of construction. Named QSP must be approved by the District.

Bid Item 2 – Site Work

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes demolition, clearing, and off-haul of existing temporary rock driveway, culvert, and chain gate.

C. Contractor shall remove all USA markings prior to substantial completion.

D. Includes excavation and fill operations required to meet (rough and fine) finish grade (or sub-grade) as denoted on the Contract plans and specifications.

E. Includes import, export, placement of materials, compaction, moisture conditioning, testing, certification, slope stabilization, construction of surface drainage swales, and hydroseeding for soil surfaces not overlain with finish materials (such as: base, crushed rock, paving, concrete, etc.).

F. This item also includes any surveying and construction staking required to implement Earthwork and Grading according to the Construction Drawings.

G. Site Drainage Improvements

1. Concrete V-Gutter
2. Drainage Swale/Detention Basin
3. Frontage Ditch
4. Box Culvert
5. 12” Driveway Culvert

H. Concrete (not including building foundation/slab)

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

2. This item includes providing and placing all concrete pads and borders within the well pump site for the electrical transformer, well pump discharge pad, generator pad, propane tank pad, and fire hydrant pad.
3. This item includes all form work, reinforcement, special inspections, testing, certification, and other incidental work required to complete Concrete Pads according to the Contract Documents.
4. This item also includes any surveying and construction staking required to construct concrete pads according to the lines and grades depicted in the Construction Drawings.

I. Asphalt Paving

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. Includes providing and installing all asphalt concrete paving required at the well pump site, according to the Construction Drawings. This item includes, but is not limited to, providing and installing header boards and borders, tack seals, compaction, testing, certification, and other incidental work required to complete Well Site AC Paving according to the Contract Documents.
3. Also includes any surveying and construction staking required to place Well Site AC Paving according to the lines and grades depicted in the Construction Drawings. Also, includes all testing required to show that compaction specifications were met.
4. This item does not include payment for asphalt concrete pavement resurfacing outside the limits of the well site.

J. 4” Pavement Restoration T-Trench

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. Included in the bid item are all costs for freighting, labor, tools, equipment and materials necessary to complete permanent pavement restoration.
3. This item assumes 4-inches of pavement restoration on U Street and 14th Street. All costs associated with raising or lowering iron following final surface restoration shall be paid under this bid item.
4. All pavement restoration shall be installed per Sacramento County Standards and the standard Encroachment Permit in Appendix C. All work shall also be coordinated with Sacramento County Inspection.
5. Payment will be made per the actual square footage of pavement restoration completed.

K. Type 2 Slurry Seal Half Road

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. For Type 2 Slurry Seal placed per Sacramento County Standards. Included in the bid item are all costs for freighting, labor, tools, equipment, and materials necessary to complete the Type 2 Slurry Seal for the Half Width U Street and 14th Street. Included in this item are all permanent traffic striping. Coordination with Sacramento County for approval of Materials is also included in this item.
3. An additional 10% was added to the quantity. Payment will be made per the actual square footage of slurry seal installed.

L. Frontage Landscaping

1. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. This includes, but is not limited to river rock, cobbles, bark, trees, shrubs, plants and irrigation piping, valves, & outlets.

Bid Item 3 – Fences & Gates

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes:

1. Wrought Iron Fencing
   a. By Unit Price per Linear Foot. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
   b. Includes providing and installing 8’ tall wrought security iron fencing, posts, and associated appurtenances as shown on the Contract drawing and denoted in these specifications.
   c. Also includes furnishing all labor, materials, tools, equipment and incidentals and doing all work necessary to install the completed fencing including, but not limited to clearing required for fence installation, placing concrete footings, curbs, posts, operators and hardware.
2. Gates (Automatic and Swing Gate)
   a. Measurement and Payment by Full Compensation
   b. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
   c. Includes providing and installing 8’ tall by 3’ wide pedestrian swing gate, 8’ tall x 16’ wide automatic sliding gate, posts, hardware, gates, operators, key switch, locking mechanisms and associated appurtenances as shown on the Contract drawing and denoted in these specifications.
   d. Also includes furnishing all labor, materials, tools, equipment and incidentals and doing all work necessary to install the completed gates including, but not limited to, placing concrete footings and deadmen/anchors, providing and installing gates, including new posts, hardware and operator.
3. CMU Sound Wall
   a. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
   b. Includes footing excavation, compaction, forming, concrete, reinforcing, masonry units, and caps.

Bid Item 4 – Onsite Piping and Valves

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

C. Includes fabrication, freighting, fittings and mechanical joint caps, placement, excavation, bedding, backfilling, compacting of backfill, dewatering, thrust blocking, flushing and testing, disinfecting, striping, landscaping, and all incidental work in the installation of the complete onsite piping system, with the exception of other items

listed separately on the Bid Schedule. This bid item also includes all fittings (horizontal and vertical) and valves as indicated on the Plans.

D. This item also includes, but is not limited to, excavation and backfill, thrust blocks, pipeline appurtenances, and connection to the new 12" DIP pipeline on U Street.

E. This item includes above and below ground 12" DIP, 6" DIP, copper service water service, 2" irrigation service line, 1/2" sample line, and 2" reduced pressure backflow prevention devices, and appurtenances according to the Contract Plans and Specifications.

F. Disinfection and pressure testing of water main is paid under Bid Item 35.

G. This item also includes any surveying and construction staking required to construct onsite piping according to the lines and limits depicted in the Plans.

H. This item includes, but is not limited to, 12" check valve, 12" ultra mag flow meter (Ultra Mag UM06), onsite 12" and 8" gate valves, and air/vacuum release valves.

Bid Item 5 – CMU Control Building and Appurtenances

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

C. Includes, but is not limited to, delivery, setup, labor, excavation, backfilling, and installation of the building, including concrete foundation/slab, framing, walls, roof, vents, intake fan, solar tubes, ceiling, HVAC system, acoustical louvers, doors and frames, locks, keys, utility trenches, trench drains, floor drains, grating, precast concrete chemical containment sump, masonry units, mortar, grout, and supports according to the Contract Documents. Also includes sloping the floor of the building as necessary to drain to the floor drains as shown on the plans.

D. This item includes preparation of subgrade, dewatering, placement and preparation of structural section, placement of concrete, form work, reinforcement, culvert pipes, rock aprons, special inspections, testing, certification, and other incidental work required to complete CMU Building according to the Contract Documents.

E. This item also includes any surveying and construction staking required to construct Masonry Building according to the lines and grades depicted in the Construction Drawings.

F. This item does not include electrical systems, lighting, or coatings inside the well pump building. Building electrical, lights, and coatings are described and included in other bid items.

Bid Item 6 – Well Pump, Motor, and Pump Base

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item.

C. Includes supplying and installing the vertical turbine pump, pump base plates, and forming and installing the concrete pedestal, and other appurtenances such as but not limited to the vents and sounding tube, according to the Contract Documents.

D. Also includes all testing and startup operations associated with the well pump and system appurtenances.

E. This item does not include well drilling or construction of well casing, well screen, or well completion report. Well drilling and casing have already been completed. The Well Summary Report and as-built drawing is provided in Appendix B.

F. Payment for equipment shall not be made until it is installed in its final location.

Bid Item 7 – Painting and Coatings

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

C. This item shall include but not be limited to abrasive blasting, masking, cleaning, preparation, prime coats, intermediate coats, finish coats, overspray removal, cleanup and disposal.

Bid Item 8 – Piping

A. Measurement and Payment by Full Compensation

B. Potholing

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with locating and marking existing utilities. Contractor shall provide cost for eight (8) potholes in their bid.

C. Offsite 8-inch Ductile Iron Pipe

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. Includes furnish and installation of 8” ductile iron pipe per RLECWD and Sacramento County Standards including but not limited to, location wire, fabrication, freighting, ductile iron fittings, service saddles and corporation stops, 8 mil plastic sheeting, placement, excavation, bedding, backfilling, compacting of backfill, dewatering, thrust blocking, temporary surface pavement repair (hot mix) and striping, landscaping, restoration of all roadside drainage, and all incidental work in the installation of the pipeline complete, with the exception of other items listed separately on the Bid Schedule.

D. Offsite 12-inch Ductile Iron Pipe

1. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. Includes furnish and installation of 12” ductile iron pipe per RLECWD and Sacramento County Standards including but not limited to, location wire, fabrication, freighting, service saddles and corporation stops, 8 mil plastic sleeves/sheeting, ductile iron tees and crosses, placement, excavation, bedding, backfilling, compacting of backfill, dewatering, thrust blocking, temporary surface pavement repair (hot mix) and striping, landscaping, restoration of all roadside drainage, and all incidental work in the installation of the pipeline complete, with the exception of other items listed separately on the Bid Schedule.

E. Offsite Valves and Appurtenances

1. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
2. This item includes, but is not limited to, 8” gate valves, 12” gate valves, 4-inch blow off, and combination air valves.

F. Fire Hydrants

1. Measurement and Payment by Full Compensation
2. By Unit Price Per Each. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
3. Includes furnishing and installing a complete fire hydrant installation per RLECWD Standard Detail No. 6A including the mainline tees, 6- or 8-inch gate valves, valve boxes and covers, fire hydrants, knock off assembly, and installation of extension piping from the hydrant to the main line. It also includes the blue reflector to be placed at the centerline of the roadway adjacent to the fire hydrant per Sacramento County Standards. Includes all costs for property restoration including any fence repair, stump removal, etc. Contractor is responsible for reviewing each fire hydrant location during bidding.
4. Full compensation for labor, tools, equipment and materials necessary to complete installation of fire hydrant assemblies including preparation, excavation, backfill, fittings, valve, valve box and cover, hydrant, pipe, thrust blocks, concrete sidewalk repair, and temporary surface pavement repair and striping for extension piping are considered in this item. This item also includes any costs for raising iron following final surface restoration.

G. 8-inch Tie Ins

1. Measurement and Payment by Full Compensation
2. By Unit Price Per Each. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.
3. Bid item sizes are based on the size of the proposed and existing mainline. No additional compensation will be provided for tie-ins installed outside of normal working hours or out of scope without District approval. Includes furnishing and installing fittings required to make the connection between the new mainline piping and the existing water system. Includes installing ductile iron pipe, flex coupling, mechanical joint sleeves, and/or blind flanges. Includes any temporary materials and work required for the tie-in. Quantities are estimated based on the drawings.
4. Contractor is responsible for exposing the tie-in location and verifying materials and sizes prior to purchase of materials.
5. Included in this bid item are all costs for labor, tools, equipment and materials necessary to complete the tie-in of the new system to the existing system per District Standard drawings or as indicated on the plans including coordination with the District, preparation, excavation, backfill, temporary paving and striping, fittings, valves, nut, bolt, gasket, valve operating extension, and valve riser and box, thrust blocking, polyethylene sheeting, and temporary closure of the existing water system where required. This item also includes any costs for raising iron following final surface restoration.
6. Includes all costs for property restoration including all fencing, surface restoration, landscaping, etc. The Contractor is responsible for visiting the site

prior to bidding to ensure that all property restoration costs are included in the bid.

Bid Item 9 – Chlorine Feed System

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

C. Includes furnishing and installing pre-engineered skid package systems for chemical metering pumps and appurtenances, 400-gallon chemical storage tank, all system piping, valving, fittings, tubing, couplings, fill/drain caps, vents, supports and fasteners and other appurtenances.

D. This item also includes, but is not limited to, injection tubing, tubing sleeves, injection quill, and related appurtenances from the chemical dosing pumps to well discharge piping.

E. Includes piping to the water discharge pipe, sampling pipe from the discharge pipe and water main to the chlorine analyzer system, coatings, pipe saddle, corporation stop, wall penetrations and penetration seals.

F. Item includes controls for chemical dosing/metering system and residual chlorine analyzer system.

G. This item also includes necessary signage and markings for chemical storage, sampling, fill piping, and dosing systems in accordance with Contract Documents and applicable standards.

Bid Item 10 – Electrical

A. Measurement and Payment by Full Compensation

B. See technical specifications for a complete description of work.

C. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

D. Meter/Main, ATS, Distribution, Switchboard

1. NEMA 3R Utility Metering with Main Disconnect and Generator Disconnect.
2. Includes but is not limited to new NEMA 3R weather-wrapped free-standing pad-mounted Switchboard that includes the Utility Metering equipment, Main Breaker and Generator Breaker, fabrication, shipping, startup, testing, and training.

E. Switchboard including Automatic Transfer Switch (ATS), Power Distribution section and low voltage transformer and panelboard.

1. Includes but is not limited to new NEMA 1 free-standing pad-mounted Switchboard that includes the ATS, Power Distribution Panel and distribution feeder breakers for individual loads, low voltage transformer, panelboard, fabrication, shipping, shipping, startup, testing, and training.

F. Stand-alone Ultra Low Harmonic Variable Frequency Drive (VFD)

1. Includes but is not limited to new NEMA 1 free-standing pad-mounted VFD, motor disconnect breaker, motor controls, fabrication, shipping, shipping, startup, testing, and training.

G. PLC Control Panel and Applications Programming

1. Includes but is not limited to new NEMA 1 free-standing pad-mounted PLC Control Panel enclosure, L3000 PLC, Large Operator Interface, software, Radio, Power supplies and applications programming required for integration of the new well site in to the existing SCADA system, fabrication, shipping, shipping, startup, testing, and training.
2. The programming efforts and all software required for the PLC, Operator Interface and integration of the new Well into the existing SCADA system, testing and training.

H. Instrumentation

1. Includes but is not limited to new 10-inch propeller flowmeter, gauge pressure transmitter, high pressure switch, pressure gauge, submersible level transmitter, ultrasonic level transmitter, chlorine analyzer, level float switch, room temperature transmitter, intrusion switch, smoke detector, shipping, configuration, calibration, startup, testing and training

I. Site Electrical Work

1. Includes but is not limited to the labor and materials for all electrical equipment installation which includes conduits, cables, junction/pullboxes, concrete pads, HVAC, pedestals/stanchions, struts, mounting hardware, wireway, grounding system, antenna mast, lighting, lighting mast, utility transformer pad, bollards, trenching and shipping

J. Propane Generator and remote propane fuel Tank

1. Includes but is not limited to Propane Generator, weatherproof enclosure, remote fuel tank, piping, fittings, concrete pads, shipping, startup, testing and training.

Bid Item 11 – Flush, Pressure Test, and Disinfection

A. Measurement and Payment by Full Compensation

B. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

C. Water shall be supplied by the District.

D. All other required materials and supplies shall be supplied by the Contractor. These include, but are not limited to disinfecting chemicals, pumps, temporary power, temporary piping, and valves.

Bid Item 12 – Performance Testing and Facility Startup

A. Measurement and Payment by Full Compensation

1. By lump sum based upon percent complete of the bid item. Includes all tools, equipment, materials, and labor necessary to provide the work associated with this bid item.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01640
PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes:

1. The procedure for requesting substitution approval for a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
   a. Name of manufacturer
   b. Name of vendor
   c. Trade name
   d. Catalog number
2. This Section does not address substitutions for major equipment. See "Instructions to Bidders."

B. Requests for Substitution - General:

1. Base all bids on materials, equipment, and procedures specified
2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are capable of accomplishing the same tasks as the products specifically indicated
3. Other types of equipment and kinds of material may be acceptable

1.02 QUALITY ASSURANCE

A. In making request for substitution or in using an approved product, Contractor represents:
   1. He has investigated proposed product and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended
   2. He will provide same guarantee for substitute item as for product specified.
   3. He will coordinate installation of accepted substitution into work, to include building modifications if necessary, making such changes as may be required for work to be complete in all respects
   4. He waives all claims for additional costs related to substitution which subsequently arise

1.03 DEFINITIONS

A. Product: Manufactured material or equipment.

1.04 PROCEDURE FOR REQUESTING SUBSTITUTION

A. Considered after award of Contract

B. Written requests through Contractor only

C. Transmittal Mechanics:

1. Follow the transmittal mechanics prescribed for shop drawings in Section 01 34 00. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading "DESCRIPTION." Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in paragraph D below.

D. Transmittal Contents:

1. Product identification:
   a. Manufacturer's name
   b. Telephone number and representative contact name
   c. Specification section or drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents
2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
   a. Size
   b. Composition or materials of construction
   c. Weight
   d. Electrical or mechanical requirements
4. Product experience:
   a. Location of past projects utilizing product
   b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product
   c. Available field data and reports associated with proposed product
5. Data relating to changes in construction schedule
6. Data relating to changes in cost
7. Samples:
   a. At request of Construction Manager
   b. Full size if requested by Construction Manager
   c. Held until substantial completion
   d. Construction Manager not responsible for loss or damage to samples

1.05 APPROVAL OR REJECTION

A. Written approval or rejection of substitution given by the Construction Manager.

B. Construction Manager reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent

C. In event substitution results in a change of Contract price or time, provisions in General Conditions will be applied for adjustment

D. Substitutions will be rejected if:

1. Submittal is not through the Contractor with his stamp of approval
2. Requests are not made in accordance with this Section
3. In the Construction Manager's opinion, acceptance will require substantial revision of the original design
4. In the Construction Manager's opinion, substitution is not equal to original product specified or will not perform adequately the function for which it was intended

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

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SECTION 01 39 19
MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide submittals as required in the specifications. All items shall be submitted to the Engineer. Any submittals not conforming to the requirements of this section shall be returned, without a review, for correction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 MOBILIZATION PLAN

A. Within five (5) working days of award of contract, the Contractor shall submit a detailed plan of his mobilization activities together with a cost itemization of his mobilization bid price per Section 01 33 13 Submittals.

B. Mobilization shall include the furnishing of all labor, materials, tools, equipment, and incidentals for mobilization.

C. The Contractor will be required to locate and negotiate the use of land to store their equipment, materials or temporary office buildings near the project site. The District will not be providing any staging area property related to this project.

D. The Mobilization Plan and any staging areas proposed by the Contractor are subject to the review and approval of the District.

**** END OF SECTION ****

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SECTION 01 33 13
SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide submittals as required in the specifications. All items shall be submitted to the Engineer. Any submittals not conforming to the requirements of this section shall be returned, without a review, for correction.

1.02 SUBMITTAL PROCEDURES

A. Accompany each submittal with a letter of transmittal, containing the following information:

1. The name and phone number of the Contractor who prepared the submittal
2. The project name and identifying submittal number
3. Description of the submittal and reference to the Contract requirement or technical specification section being addressed
4. Certification that submittal complies with Contract Documents with all exceptions, or request for substitutions, clearly identified and noted
5. Submittals shall be sequentially numbered; re-submittals shall have the same number with a sequential letter suffix.

B. Reserve space at the bottom of the letter of transmittal for check boxes for the submittal status, 4-6 lines for the Engineer's comments and a line for the Engineer's signature and date. Provide a sample letter of transmittal to the Engineer prior to the first submittal.

1.03 SHOP DRAWINGS SUBMITTED FOR REVIEW

A. This paragraph covers submittal of Shop Drawings required for the Engineer's review as required in the Contract Documents. The Term "Shop Drawings" shall be understood to include shop drawings, detail design calculations, lists, catalog cut sheets, data sheets, operating instructions, installation instructions, fabrication details, and similar information as may be necessary to show that the materials and equipment meet the requirements of the Contract Documents.

B. Number and Type of Submittals:

1. Hard Copies:
   a. Shop Drawings: Submit Two (2) clear, sharp, high-contrast copies
   b. Product Data: Submit Two (2) clear copies
2. Electronic:
   a. All submittals shall be provided in an Adobe PDF Format

C. Submittal Schedule – The Contractor shall make all submittals early enough to allow adequate time for the Engineer's review, manufacture, and delivery at the construction site without causing delay to the Work. Submittals shall be made early enough to allow for unforeseen delays such as:

1. Re-submittals because of inadequate or incomplete submittal information or because the item submitted does not meet the requirements of the Contract Documents
2. Delays in manufacture

3. Delays in delivery – The Contractor shall allow 2 weeks for the Engineer's review of each submittal and one (1) week for each re-submittal. One (1) additional week may be required if the submittal contains requests for substitutions. If the Contractor requires more than one (1) re-submittal, the Contractor shall reimburse the Owner for the cost of the Engineer's additional review effort.

D. Content of Submittals:

1. Each submittal shall include all of the items and material required for a complete assembly, system, or Specification Section.
2. Submittals shall contain all of the physical, technical, and performance data required by the specifications or necessary to demonstrate conclusively that the items comply with the requirements of the Contract Documents.
3. Provide verification that the physical characteristics of items submitted, including size, configuration, clearances, mounting points, utility connection points, and service access points, are suitable for the space provided and are compatible with other interrelated items that are existing or have or will be submitted.
4. Label each Product Data Submittal and Shop Drawing with the information required in paragraph 1.03 B of this Section. Highlight or mark every page of every copy of all Product Data submittals to show the specific items being submitted and all options included or choices offered.

E. Submittal Verification:

1. Similar items, equipment, devices, or products furnished under a single specification section shall all be made by the same maker and have interchangeable parts.
2. All similar materials or products that are interrelated or used together in an assembly shall be compatible with each other.

F. Contractor Approval – The Contractor shall review, date, and sign submittals before sending them to the Engineer. By making such a submittal, the Contractor shall acknowledge the following:

1. Items submitted meet the requirements of the Project Manual, or else any deviations are identified and described in a separate letter accompanying the submittal.
2. Items submitted have been coordinated with and meet the requirements of other submittals and the Work as a whole and quantities and dimensions are correct.

G. Requests for substitution:

1. Cite the specific Contract requirement including the Specification Section and paragraph number for which approval of a substitution is sought.
2. Describe the proposed alternate material, item, or construction and explain its advantages and/or disadvantages to the Owner.
3. State the reduction, if any, in Contract Price that is offered to the Owner.

H. Engineer’s Review Procedure and Meaning:

1. The Engineer will list comments and sign the letter of transmittal for each submittal prior to returning it to the Contractor.
2. A submittal review is not intended to apply to materials not included in the submittal even if omitted materials are related to the subject of the submittal.
3. The Engineer will assign a submittal status to each submittal. The statuses and their meanings are as follows:

a. NO EXCEPTIONS TAKEN (NET): No re-submittal required
b. MAKE CORRECTIONS NOTED (MCN):
    1) No re-submittal required: the Contractor shall make corrections noted prior to manufacture
    2) Partial re-submittals required: the Contractor shall submit related accessory or optional items as noted which are required but were not included with the submittal and/or shall resubmit unsatisfactory portions or attributes of items as noted. The Contractor may proceed to manufacture those portions of the submittal that will be unaffected by required re-submittals
c. AMEND AND RESUBMIT (AAR): The Contractor shall amend and resubmit the submittal as noted or required to comply with the Contract Documents
d. REJECTED – RESUBMIT (RR): The item submitted does not comply with the Contract Documents in a major way. Resubmit items that comply with the requirements of the Contract Documents

4. The letter of transmittal accompanying the returned Product Review submittal may contain numbered notes and/or comments that are attached. Marking a corresponding number on a Shop Drawing submittal shall have the same effect as applying the entire note to the submittal.

I. Re-submittals that contain changes that were not requested by the Engineer on the previous submittal shall be accompanied by a letter explaining the change.

J. Required submittal status prior to proceeding:

1. Do not proceed with manufacture, fabrication, or delivery of items prior to obtaining a submittal status of NET or MCN.

K. Intent and Limitation of Engineer's Review:

1. The Contractor has primary responsibility for submitting and providing work that complies with the requirements of the Project Manual. Neither the Engineer’s submittal review nor failure to notice or comment on deficiencies in the Contractor's submittals shall relieve the Contractor from the duty to provide work, which complies with the requirements of the Contract Documents.

1.04 CONSTRUCTION SCHEDULE

A. Construction schedule giving the starting and completion dates of the various stages of work shall be submitted within 10 days of the date of the Notice to Proceed. The schedule shall conform to the length of time and all specific schedule constraints established in the Contract Documents. The Contractor shall revise and resubmit the Construction Schedule whenever it changes by 7 days or more.

1.05 SUBSTITUTIONS OF NAMED EQUIPMENT/SUPPLIER

A. No substitutions are allowed where an Equipment/Supplier is named as “no equal”.

1.06 MANUFACTURER’S CERTIFICATES

A. Where required in the specifications, submit three (3) hard copies.

B. Submit manufacturers' certificate to Engineer for review. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate. Certificates may be recent or previous test results on material or Product, but must be acceptable to the Engineer.

1.07 RECORD DRAWINGS

A. The Contractor shall keep and maintain, at the job site, one record set of Drawings. On these, the Contractor shall mark all project conditions, locations, configurations, and any changes or deviations which may vary from the details represented on the original Contract Drawings including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed. These master record drawings of the Contractor's representation of as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date at least weekly during the progress of the Work.

   1. Contractor shall note the dimensions of aboveground water features (valves, fire hydrants, etc.) and below ground water features (bends, reducers, etc.). Two dimensions will be required. One North/South and one East/West from a District approved landmark, (Centerline of street, lot line of a property, lip of gutter, back of walk).

B. The Contractor shall submit to the Engineer a final, complete and accurate set of Record Drawings prior to or simultaneously with the Contractor's request for final payment.

1.08 SHEETING, SHORING, BRACING, OR SLOPING OF TRENCHES PLAN

A. Prior to commencement of any excavations, 5 feet or greater in depth, the Contractor shall submit to the District a detailed plan showing the design of sheeting, shoring, bracing, sloping, or equivalent method and shall be in receipt of the District's acceptance of same as specified in Title 8 of the California Code or Regulations.

PART 1 – PRODUCTS (NOT USED)

PART 2 – EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01 34 00
SHOP DRAWINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:

1. Section Addresses:
   a. Mechanics and administration of the submittal process for shop drawings, operation and maintenance manuals, and miscellaneous submittal items.

1.02 DEFINITIONS

A. Shop Drawings:

1. See General Conditions.
2. Product data and samples are Shop Drawing information.

B. Miscellaneous Submittals:

1. Submittals other than Shop Drawings.
2. Representative types of miscellaneous submittal items include but are not limited to:
   a. Construction schedules
   b. Concrete, soil compaction, and pressure test reports
   c. Manufacturer's installation certification letters
   d. Warranties
   e. Construction photographs
   f. Survey data

1.03 TRANSMITTALS

A. Shop Drawings and Operation and Maintenance Manuals:

1. Transmit all submittals to the Engineer
2. Utilize two copies of an approved submittal form to transmit all shop drawings, product data and samples
3. Utilize two copies of an approved submittal form to transmit all Operation and Maintenance Manuals.
4. All transmittals must be from the Contractor and bear his approval stamp. Transmittals will not be received from or returned to subcontractors.
   a. Shop drawing transmittal stamp shall read “***Suppliers Name***” has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval.”
   b. Operation and Maintenance Manual transmittal stamp may be Contractor's standard approval stamp
5. Provide submittal information defining specific equipment or materials utilized on the project. Generalized product information not clearly defining specific equipment or materials to be provided will be rejected.
6. Calculations required in individual specification sections will be received for information purposes only and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
7. Submittal schedule:

a. Schedule of shop drawings:
    1) Submitted and approved within 20 days of receipt of Notice to Proceed.
    2) Account for multiple transmittals under any specification section where partial submittals will be transmitted.
b. Shop drawings:
    1) Submittal and approval prior to 50-percent completion.
c. Operation and Maintenance Manuals and Equipment Record Sheets:
    1) Initial submittal within 60 days after date shop drawings are approved.

1.04 PREPARATION OF SUBMITTALS

A. Shop Drawings:

1. Scope of any letter of transmittal:
    a. Limited to one Specification Section.
    b. Do not submit under any Specification Section entitled (in part) "Basic Requirements."
2. Numbering letter of transmittal:
    a. Include as prefix the specification section number followed by "-xx" beginning with "01."
    b. If more than one submittal under any specification section, number transmittals consecutively.
3. Describing transmittal contents:
    a. Provide listing of each component or item in submittal capable of receiving an independent review action.
    b. Identify for each item:
        1) Manufacturer and Manufacturer's drawing or data number.
        2) Contract Document tag number(s).
4. Resubmittals:
    a. Number with original root number and a suffix letter starting with "A" on a (new) duplicate transmittal form.
    b. Do not increase the scope of any prior transmittal.
    c. Account for all components of prior transmittal.
        1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
        2) Do not include submittal information for items with prior "A" or "B" Action in transmittal.
        3) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
        4) Obtain Engineer's prior approval to exclude items.
5. For 8-1/2 x 11 IN size sheets, provide four copies of each page for Engineer plus the number required by the Contractor. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed 6 copies. If acceptable to the Engineer and Contractor, submittals may be submitted electronically (PDF). This will be determined at the preconstruction conference.
6. For items not covered in paragraph 1.4-A.5 submit one reproducible transparency and one print of each drawing until approval is obtained. Utilize mailing tube; do not fold. The Engineer will mark and return the reproducible to the Contractor for his reproduction and distribution.

7. Contractor shall not use red color for marks on transmittals. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible. Outline Contractor marks on reproducible transparencies with a rectangular box.
8. Transmittal contents:
    a. Coordinate and identify shop drawing contents so that all items can be easily verified by the Engineer.
    b. Identify equipment or material use, tag number, drawing detail reference, weight, and other project specific information.
    c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    d. Submit items like equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11-inch pages. Indicate exact item or model and all options proposed.
    e. Include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data. Arrange data and performance information in format similar to that provided in Contract Documents. Provide, at minimum, the detail provided in the Contract Documents.
    f. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

B. Samples:

1. Identification:
    a. Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, Standard Specification section or drawing detail reference, color, range, texture, finish and other pertinent data.
    b. If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
2. Include application specific brochures, and installation instructions.
3. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
4. Resubmit samples of rejected items.

1.05 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
    a. A - FURNISH AS SUBMITTED.
    b. B - FURNISH AS NOTED (BY ENGINEER).
    c. C - REVISE AND RESUBMIT.
    d. D - REJECTED.
    e. E - ENGINEER'S REVIEW NOT REQUIRED.

2. Transmittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp. Drawings not stamped by the Contractor or stamped with a stamp containing language other than that specified in Paragraph 1.3-A.4.a., will not be reviewed for technical content and will be returned without any action.
3. Transmittals returned with Action "A" or "B" are considered ready for fabrication and installation. If for any reason a transmittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
4. Transmittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
    a. The portion of the transmittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference). One copy or the one transparency of the "C" or "D" drawings will be marked up and returned to the Contractor. Correct and resubmit items so marked.
    b. Items marked "A" or "B" will be fully distributed.
    c. If a portion of the items or system proposed are acceptable, however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action. This is at the sole discretion of the Engineer. In this case, some drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package." Distribution to the District and field will not be made (unless previously agreed to otherwise).
5. Failure to include any specific information specified under the submittal paragraphs of the specifications will result in the transmittal being returned to the Contractor with "C" or "D" Action.
6. In addition to calculations stamped and returned "E. Engineer's Review Not Required," other transmittals such as submittals which the Engineer considers as "Not Required," submittal information which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior transmittal, will be returned with Action "E. Engineer's Review Not Required."
7. Samples may be retained for comparison purposes. Remove samples when directed. Include in bid all costs of furnishing and removing samples.
8. Approved samples submitted or constructed, constitute criteria for judging completed work. Finished work or items not equal to samples will be rejected.

B. Operation and Maintenance Manuals:
    1. Engineer will review and indicate one of the following review actions:
        a. ACCEPTABLE.
        b. FURNISH AS NOTED.
        c. REVISE AND RESUBMIT.
        d. REJECTED.
    2. Acceptable submittals will be retained with the transmittal form returned with a request for five additional copies.
    3. Deficient submittals will be returned along with the transmittal form which will be marked to indicate deficient areas.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

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SECTION 01 43 00
QUALITY CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Quality control requirements and procedures for products and workmanship; sampling and testing of materials; testing of equipment; requirements for testing laboratories; procedures and limitations of inspection; and related matters.

1.02 REFERENCES

A. American Society for Testing and Materials (ATSM):

1. E 329 Standard Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction

1.03 PRODUCTS AND WORKMANSHOP

A. Provide new products of specified quality, and equal to accepted samples when samples were submitted.

B. Perform and complete work in thorough manner.

1. Call the District's attention to apparent errors, conflicts, discrepancies, or omissions in Contract Documents and requires instruction before proceeding with the Work.
2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory test or inspections at point of origin do no preclude retesting or re-inspection at work site.

C. When specified, products will be tested and inspected either at point of origin or at Work site.

1. Notify the District in writing well in advance of when products will be ready for testing and inspection at point of origin.
2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point or origin do not preclude retesting or re-inspection at Work site.

D. Do not ship products which require testing and inspection at point of origin prior to testing and inspection.

1.04 AUTHORITY AND DUTIES OF DISTRICT'S REPRESENTATIVE OR INSPECTOR

A. District's Representative or Inspector employed or retained by District is authorized to inspect the Work.

B. Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.

C. Deficiencies or defects in the Work which have been observed will be called to Contractor's attention.

D. Inspector will not:

1. Alter or waive provisions of Contract Documents.

2. Inspect Contractor's means, methods, techniques, sequences, or procedures for construction.
3. Accept portions of Work, issue instructions contrary to intent of Contract Documents, or act as foreman for Contractor.
4. Supervise, control, or direct Contractor's safety precautions or programs; or inspect for safety conditions on Work site, or of persons thereon, whether Contractor's employees or others.

E. Inspector will:

1. Conduct on-site observations of the work in progress to assist the District in determining when the Work is, in general, proceeding in accordance with Contract Documents.
2. Report to the District whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damage; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special testing.

1.05 INSPECTION

A. Material and equipment, and workmanship shall be subject to inspection and rejection when not in conformance with Contact Documents.

B. Remove defective work and products from Work site, whether in place or not, and replace or renew with work, material or equipment in conformance with Contract Documents.

C. Questions concerning acceptability of materials, classification of materials, and execution of the Work will be decided by the District.

D. Facilitate inspection by maintaining proper facilities and providing safe access to the Work, to shops where products are in preparation, and to warehouses and storage yards where products are stored.

E. Engineer's Observation of Work that will be Covered Up:

1. No work shall be covered unless it is inspected and approved or the Contractor is given authority to cover the work by the District.
2. Uncover, at Contractor's cost, work covered up for which the District was not given timely notification or reasonable time to conduct observations.
3. The District may specify time requirements for timely notification and for performing observations.
4.

1.06 SAMPLING AND TESTING

A. General:

1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in Sections where materials are specified.
2. When specified in Sections where products are specified,
   a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
   b. Test materials in accordance with standards of national technical organizations.

B. Sampling:

1. Furnish specimens of materials when requested.
2. Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.
3. Specimens of materials will be taken for testing whenever necessary to determine quality of material.
4. Assist the District in preparation of test specimens at site of Work, such as soil samples and concrete test cylinders.

C. Testing:

1. The District will employ and pay for services of independent testing laboratory to perform routine tests of materials to confirm compliance with requirements of Contract Documents unless otherwise indicated in the Contract Documents.
2. When protesting failed tests of material in place or to be used, take additional specimens and have specimens tested.
   a. When original test proves to have been in error, file claim for reimbursement of direct costs for sampling and testing.

D. Test Standards:

1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.
3. Standards and publication references in Contract Documents shall be edition or revision in effect on date stipulated in the Notice-To-Proceed.

1.07 TESTING LABORATORY SERVICES

A. Qualification of Laboratory:

1. Meets “Recommended Requirements for Independent Laboratory Qualification”, published by American Council of Independent Laboratories.
2. Meets requirements of ASTM E 329.
3. Has authorization to operate in state in which Project is located.
4. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
5. Has testing equipment calibrated at reasonable intervals by devices of accuracy traceable to NBS or accepted values of natural physical constants.

B. Laboratory Duties:

1. Cooperate with the District and Contractor.
2. Provide qualified personnel
3. Notify the District and Contractor, in writing, of response time needed to schedule testing or inspections after receipt of notice.
4. Perform specified inspections, sampling and testing of materials and methods of construction in accordance with specified standards to ascertain compliance of materials with requirements of Contract Documents.
5. Promptly notify the District and Contractor of observed irregularities or deficiencies of construction.

6. Promptly submit written report of each test and inspection; one copy each to the District and Contractor, and one copy to file of Project Record Documents. Each report shall include:
    a. Date issued.
    b. Project title and number.
    c. Testing laboratory name, address and telephone number.
    d. Name and signature of laboratory inspector.
    e. Date and time of sampling or inspection.
    f. Record of temperature and weather conditions.
    g. Date of test.
    h. Identification of product and Specification section.
    i. Location of sample or test in Project.
    j. Type of inspection or test.
    k. Results of tests and compliance with Contract Documents.
    l. Interpretation of test results, when requested by Engineer.

C. Limitations of Authority of Testing Laboratory: Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept portion of Work.
3. Perform duties of Contractor.

1.08 CONTRACTOR'S RESPONSIBILITIES:

A. Cooperate with laboratory personnel and provide access to construction and manufacturing operations.

B. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.

C. Provide to laboratory preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.

D. Furnish copies of product test reports.

E. Furnish incidental labor and facilities;

1. To provide access to construction to be tested.
2. To obtain and handle samples at Work site or at source of product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory in advance of when observations, inspections and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01 45 23
PERFORMANCE AND OPERATIONAL TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section contains requirements for the Contractor's to develop and perform startup and testing for the facility. This section supplements but does not supersede specific testing requirements found elsewhere in the contract documents.

1.02 QUALITY ASSURANCE

A. Quality Assurance Program – The Contractor shall prepare a quality assurance program that includes the following:

1. A testing plan setting forth the sequence in which all testing work required for this project will be implemented
2. A documentation program to record the results all equipment and system tests
3. A testing program for all mechanical, electrical instrumentation and systems
4. A calibration program for all instruments used for determining the performance of equipment and systems
5. A testing schedule conforming to the requirements specified in paragraph 2.02 C.

B. Calibration

1. All test equipment (gauges, meters, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed shall be calibrated to within plus or minus 2 percent of actual value at full scale. Test equipment used for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gauges shall be calibrated in accordance with ANSI/ASME B40.1.
2. Liquid flow meters installed in pipelines with diameters greater than 2 inches shall be calibrated in situ using a strap on ultrasonic meter. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than 10 percent to at least 75 percent of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by no less than three test runs with results which agree within plus or minus 2 percent.

C. References – This section contains references to the following documents:

Reference	Title
ANSI/ASME B40.1 ASTM E77	Gauges Pressure Indicating Dial Type-Elastic Element Method for Verification and Calibration of Liquid-in Glass Thermometers

1.03 SUBMITTALS

A. All submittals shall be provided in accordance with Section 01 33 13 Submittals and shall include:

1. Factory instrumentation calibration
2. Preoperational checkout procedures
3. Operational simulation testing procedure
4. Schedule for preoperational checkout and operational simulation testing

PART 1 – PRODUCTS

1.04 GENERAL

A. The Contractor shall prepare preoperational checkout and operational simulation testing procedures as specified in the following paragraphs. No preoperational checkout or operational simulation testing shall be performed until all test documentation has been submitted and accepted by the Engineer.

1.05 DEVELOPMENT OF TEST PLANS

A. The Contractor shall develop test plans describing the coordinated, sequential testing of each item to be tested. Test plans shall identify the equipment to be manipulated or observed during the testing and the specific results to be observed or obtained. The test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, and subcontractors' and manufacturers' representatives to be present and expected test duration. As a minimum, the test plans shall include the following features:

B. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device and yields the proper response for the imposed signal.

C. Calibration of all field instruments.

D. Preoperational checkout procedures for all mechanical, HVAC, and electrical equipment.

E. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the facilities operating conditions.

F. Overall system test that is designed to duplicate, as closely as possible, the intended operating conditions.

1.06 TESTING SCHEDULE

A. The Contractor shall produce a testing schedule for performing the test work. The schedule shall show the start date and duration of each test. The test schedule shall be submitted no later than 2 weeks in advance of the date testing is to begin. No preoperational checkout or operational simulation testing shall be performed until the test schedule has been submitted and accepted by the Engineer.

1.07 WITNESS TESTING

A. The Engineer may require at their option to witness any testing under this Section. The Engineer shall provide the Contractor a 48-hour notice of any required witness testing based on the Contractor's testing schedule.

PART 2 – EXECUTION

1.08 GENERAL

A. The Contractor shall organize teams made up of qualified representatives of equipment suppliers, subcontractors, the Contractor's independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this contract. The objective of the testing program shall be to demonstrate, to the Engineer's satisfaction, that the structures, systems, and equipment constructed and installed under this contract meet all performance requirements and the facility is ready for the commissioning process to commence. In addition, the testing program shall produce baseline operating conditions for the Owner to use in a preventive maintenance program.

1.09 INSTRUMENTATION CALIBRATION

A. Calibration of analysis instruments, sensors, gauges, and meters installed under this contract shall proceed on a system-by-system basis. No equipment or system performance acceptance tests shall be performed until instruments, gauges, and meters to be installed in that particular system have been calibrated.

1.10 TEMPORARY FACILITIES FOR TESTING

A. The Contractor shall install temporary connections, piping and valves, and make other provisions to simulate anticipated operating conditions during the facility testing as required.

1.11 PERFORMANCE TESTS

A. In general, performance tests for any individual system shall be performed in the order listed below. The order may be altered only on the specific written authorization of the Engineer after receipt of a written request, complete with justification of the need for the change in sequence.

B. The Owner must oversee and approve of any water produced into the water system. The Contractor must provide a written request to the Engineer and receive approval from Owner at least one week in advance for any planned discharge into the Owner's water system.

C. The performance testing shall include the following:

   A. Pressure and leakage testing as specified in Section 01 21 19 Pressure and Leak Testing.

   D. Electrical acceptance testing as specified in Section 26 00 00 Requirements for Electrical Work.

   E. The Contractor shall develop preoperational checkout procedures and include all mechanical equipment per the following Sections:

      1. 26 00 00 Requirements for Electrical Work

F. Operational Simulation:

1. The Contractor shall provide operational testing procedures that will cover the operation of the control valves for the automatic controls of the facility.
2. Testing:
   a. Once all affected equipment has been subjected to the required preoperational checkout procedures and the Engineer has witnessed and has no found deficiencies in that portion of the work, individual items of equipment and systems shall be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications.
   b. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures, and vibration, to observe performance characteristics, and to permit initial adjustment of operating controls.
   c. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources capable of meeting the requirements of the machine, device, or system at no additional cost to the Owner.
   d. Disposal methods for test water shall be subject to review by the Engineer.
   e. During the operational simulation period, the Contractor shall obtain baseline motor operating data on all equipment to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the Owner to enter in their preventive maintenance system.
   f. Test results shall be within the tolerances set forth in the Specifications. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where any doubt, dispute, or difference should arise between the Engineer and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then the Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Engineer may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner. Otherwise, the costs shall be borne by the Contractor. Where the results of any functional test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the Contractor at their expense.
   g. The Contractor shall provide, at no expense to the Owner, all power, fuel, compressed air supplies, chemicals, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.
3. Retesting:
   a. If any equipment should fail to operational testing, the equipment shall be adjusted, altered, renewed, or replaced for the equipment to pass its operational test. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner, including the costs of the Engineer as a result of repeating such tests.

4. Post-Test Inspection:
    a. Once operational simulation testing has been completed all equipment shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer. Any defects found during the course of the inspection shall be repaired or the equipment replaced to the satisfaction of the Engineer at no cost to the Owner.

1.12 OPERATIONAL TEST

A. After completion of all performance testing, the Contractor shall conduct an operational test of the entire facility in conjunction with the Owner.

B. The Owner with support from the Contractor shall operate the facility as intended for a period of no less than one week. During this time, all parts of the facility shall be operated at various loading conditions, as directed by the Engineer.

C. Should the operational testing be halted for any reason related to the facilities constructed or the equipment furnished under this contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the operational period has been accomplished without interruption. All process units shall be brought to full operating conditions, including pressure and flow.

D. After the operational period has been completed, the commission of the facility shall take place in accordance with Section 33 08 10 Commissioning.

**** END OF SECTION ****

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SECTION 01 55 26
TEMPORARY TRAFFIC CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This work consists of furnishing, placing, maintaining and removing the various temporary traffic control setups in accordance with the plans and this specification.

B. The Contractor shall submit a traffic control plan to the County for work within the County right-of-way and receive approval from the County prior to any work. Copies of approved traffic control plans shall be submitted to the District prior to the commencement of work within the County right-of-way.

PART 2 - PRODUCTS

2.01 GENERAL

A. All barricades, warning signs, lights, temporary signals, and other protective devices shall conform to the provisions for Construction Signing as indicated in the "Manual on Uniform Traffic Control Devices for Streets and Highways", current edition, published by the Federal Highway Administration. Materials used for the fabrication or erection of such devices shall be approved by the County and the Engineer before use on the project. Traffic control devices not approved by the County and/or the Engineer will not be allowed to be used on the project and their use may justify suspension of Work.

1. All controls shall comply with the California Supplement to the Manual on Uniform Traffic Control Devices (MUTCD-CA), Part 6, most current version at time of notice to proceed.
2. Sign Panels: Sign panels will be constructed of 3/4-inch plywood or 6061-T6 or 5052-H38 aluminum alloy sheeting conforming to ASTM 209.
    a. Aluminum sign panels will be 0.125 inches thick and backed with metal backing angles; except that those sign panels 48 inches by 60 inches or smaller may be:
        1) 0.080 inches thick and backed with metal backing angles or 2-inch x 4-inch dimensional lumber or,
        2) Unbacked 0.125 inches thick.
    b. Wood sign panels will be backed with metal backing angles; except that backing is not required during the construction season for those sign panels 48 inches by 60 inches or smaller.
    c. All sign panels installed without backing during construction will be backed as described above at the Contractor’s expense prior to any suspension of work.
3. Barrels: Barrels will be plastic conforming to the Manual on Uniform Traffic Control Devices California Supplement (MUTCD-CA), with six-inch-wide stripes.

2.02 FLAGGING

A. The Flagging Code as adopted by the California Department of Transportation and made a part of the MUTCD-CA shall be adhered to at all times.

2.03 TRAFFIC CONTROL MAINTAINER

A. The Contractor shall designate an individual(s) who will be responsible at all times to see that all necessary maintenance of traffic control devices is performed. The name of this individual(s) and the telephone number where this person(s) can be contacted at any time will be submitted to the District before implementing any temporary traffic control on the project.

B. This individual(s) hereinafter entitled "TRAFFIC CONTROL MAINTAINER", will be responsible at all times to see that all necessary maintenance of traffic control devices is performed. Maintenance will include, but will not be limited to, the following:

1. Clean all devices
2. Repair, reset or replace any damaged devices
3. Reset undamaged devices knocked or blown down
4. Replace batteries, light bulbs, control panels, and other components of electrical devices.
5. Add fuel and motor oil to engines of power generating units for electrical devices, and maintain them in good operating condition.
6. Insure that all devices remain in their proper locations and are properly positioned in accordance with the traffic control plan in use.
7. Implement and enforce a system of relief flagging in which every flagger shall be relieved for at least fifteen (15) minutes every four hours for the duration of their shift.

C. Failure of Contractor to implement a TRAFFIC CONTROL MAINTAINER or failure of Maintainer to comply with the above stipulations will be considered just cause to suspend Work. The cost for a TRAFFIC CONTROL MAINTAINER is subsidiary to other bid items.

PART 3 - EXECUTION

3.01 REQUIREMENTS

A. Construction shall not commence on the portions of the project requiring traffic control until necessary construction warning signs are in place and approved by the Engineer. The Contractor shall notify the Owner in writing a minimum of one week in advance of any Work activity that will require temporary traffic control.

B. No traffic control will be paid for outside of the project limits which results from the haul of Contractor secured material sources. Such traffic control shall be approved by the District and adhere to the provisions for Construction Signing as indicated in the "Manual on Uniform Traffic Control Devices for Streets and Highways", current edition.. This additional control will be considered subsidiary to other bid items.

C. Contractor shall notify appropriate authorities in advance of any street closure. This includes notifying the County, local media, all emergency services, project engineer and all affected residents and businesses at least one week prior to closing any streets. Cal-trans shall be notified if the project includes or is adjacent to a road under their jurisdiction. Highways and/or streets closed to traffic shall be protected by barricades and obstructions shall be reflectorized and illuminated during hours of darkness. All flagging stations shall be fully illuminated, if they are providing traffic control during hours of darkness.

D. Reasonable access shall be maintained to each lot. Collector and arterial streets shall provide local access and emergency traffic flow.

E. Portable signs may be mounted on stands, skids, or on Barricades at the option of the Contractor. When not in use, however, signs and all mounting hardware shall be removed at least thirty (30) feet from edge of traveled way.

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SECTION 01 57 19
ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section addresses the minimizing of pollution to the air, water, or land; control of noise, the disposal of solid waste materials, and protection of historical or archaeological interests.

1.02 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 13 Submittals.
2. Prior to the start of any construction activities submit:
   a. A detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.
   b. A drawing of the work area, haul routes, storage areas, access routes and current land conditions including trees and vegetation

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REGULATORY COMPLIANCE

A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations including the County.

3.02 LAND PROTECTION

A. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.

A. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.

B. Restore all disturbed areas including borrow and haul areas and establish permanent type of locally adaptable vegetative cover.

C. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.

D. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Engineer. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.

3.03 SURFACE WATER PROTECTION:

A. Utilize, as necessary, erosion control methods to protect side and back slopes, minimize and the discharge of sediment to the surface water leaving the construction site as soon as rough grading is complete. These controls shall be maintained until the site is ready for final grading and landscaping or until they are no longer warranted and concurrence is received from the Engineer.

B. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.

C. A Storm Water Pollution Prevention Plan (SWPPP) is required for this project.

3.04 SOLID WASTE DISPOSAL:

A. Collect solid waste on a daily basis.

B. Provide disposal of degradable solid waste to an approved solid waste disposal site.

C. Provide disposal of non-degradable solid waste to an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.

D. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.

3.05 FUEL AND CHEMICAL HANDLING:

A. Store and dispose of chemical wastes in a manner approved by regulatory agencies.

B. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering drainage ways.

C. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.

D. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.

3.06 AIR POLLUTION CONTROL

A. The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of any legally constituted authority. They shall also abate dust nuisance by cleaning, sweeping, and sprinkling with water or other means as necessary. The use of water, in amounts which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods.

B. Control of Dust:

1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants. The use of chemical agents such as calcium chloride must be approved by the State of California DOT.
2. The Engineer will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.

C. Burning:

1. Do not burn material on the site. If the Contractor elects to dispose of waste materials by burning, make arrangements for an off-site burning area and conform to all agency regulations.

3.07 NOISE CONTROL

A. Noise from Contractor's operations shall not exceed limits established by applicable laws or regulations and in no event shall exceed 86 dBA at a distance of 50 feet from the noise source.

B. Control noise by fitting equipment with appropriate mufflers and/or sound attenuation devices.

3.08 VISUAL

A. Project is in a residential area, Contractor shall conform to all welding regulations associated to similar areas.

3.09 COMPLETION OF WORK

A. Upon completion of work, leave area in a clean, natural looking condition.

B. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed.

C. Grade, fill, and hydro-seed all disturbed areas.

3.10 HISTORICAL PROTECTION

A. If during the course of construction, evidence of deposits of historical or archaeological interests is found, cease work affecting find and notify Engineer. Do not disturb deposits until written notice from Engineer is given to proceed.

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SECTION 01 58 13

TEMPORARY UTILITIES AND SIGNAGE

PART 1 – GENERAL

1.01 TEMPORARY POWER

The Contractor shall provide power for construction at the project site. They shall make arrangements with the electrical utility and with the District for power takeoff points, voltage and phasing requirements, transformers and metering, and shall pay the costs and fees arising therefrom. The Contractor shall provide the special connections required for their work.

1.02 TEMPORARY WATER

The Contractor shall provide all necessary water for construction at the project site. They will make arrangements with the District to determine an appropriate location to obtain water for the project, including obtaining a water meter to keep track of water use. The Contractor shall provide the special connections required for this work. The District will not charge for the use of construction water associated with this project. Backflow prevention devices shall be installed on temporary water lines to reduce the risk of cross contamination of the District's distribution system.

1.03 SANITARY FACILITIES

The Contractor shall provide toilet and hand washing facilities for their work force at the project site. The facilities shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

**** END OF SECTION ****

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SECTION 01 60 00

MATERIAL AND EQUIPMENT

PART 1 – GENERAL

1.01 COMPLETION OF WORK

A. It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and satisfactorily deliver the Work within the specified time.

B. The Contractor is responsible for the purchase of all materials required for this project.

1.02 CONTRACTOR RESPONSIBILITY

A. Materials and equipment shall be so stored as to insure the preservation of its quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection. The Contractor shall be responsible for the condition of all materials which he has furnished and shall replace all such material found to be defective or which have been damaged. This includes the replacement of material which is found to be defective at any time prior to expiration of the warrantee period.

B. Storage areas for all material and equipment shall be furnished on the job or at a site approved by the District, and all Contractor's equipment, including refueling and service areas, are to comply with all applicable local, state and federal regulations, including those relating to water pollution. No volatiles or oils are to reach a surface water or leave the Contractor's work site. Berms, straw bales, or other necessary protection methods may be required to control both run-on and run-off.

1.03 MANUFACTURER’S RECOMMENDATIONS

A. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

B. All suppliers of material and equipment shall review the design drawings and specifications regarding the use of the proposed material or equipment. If the supplier believes the material or equipment is not being used correctly or believes additional considerations are required for its use, they shall notify the District in writing of such concerns. If no concerns are raised, it is assumed the supplier agrees with the proposed use.

C. The Contractor shall make arrangements whenever required, to have manufacturer's representatives on-site to assure proper installation, operation and start-up of all components.

1.04 SAMPLES

A. Materials, supplies, and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 01 70 00

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 ADMINISTRATIVE PROCEDURES

Comply with requirements stated in the General Conditions of the Contract and Specifications for administrative procedures in closing out the Work.

1.02 RE-INSPECTION FEE

Should the Engineer perform re-inspections due to failure of the Work to comply with the claims of status of completion made by the Contractor, the Owner will deduct the amount of any re-inspection costs from the final payment to the Contractor.

1.03 CLOSEOUT SUBMITTALS

The Contractor shall provide the following documents as part of the final project closeout:

A. Project Record Documents
B. Operating and Maintenance Data and Instruction to Owner's Personnel
C. Spare Parts: As specified in the individual sections and herein.
D. Evidence of Payment and Release of Liens: As specified in the General and Supplementary Conditions
E. Two (2) copies of each specified special bond, warranty, and service contract
F. Two (2) copies of Supplier Warranty for Project
    1. Complete Supplier Warranty form for Project
    2. Fully executed copies of Certificates of Substantial Completion for the Project

PART 2 – PRODUCTS

2.01 SPARE PARTS

A. Provide spare parts, maintenance materials, and special tools as specified in the individual specification sections.
B. Package all spare parts adequately protected and labeled for long-term storage.

PART 3 – EXECUTION

3.01 FINAL CLEANING

A. Execute final cleaning prior to final inspection.
B. Clean site, sweep paved areas, rake clean landscaped surfaces.
C. Remove waste and surplus materials, rubbish, and construction facilities from the site.

3.02 SUBSTANTIAL COMPLETION READY FOR PUNCH LIST

A. When Contractor considers the Work complete, submit written certification that:

1. Contract Documents have been reviewed
2. Work has been inspected for compliance with Contract Documents
3. Work has been completed in accordance with Contract Documents
4. Equipment and systems have been tested in the presence of the Engineer and are operational
5. Work is completed and ready for final inspection
6. All O&M Manuals have been delivered in final accepted form
7. All Shop Drawings have been delivered in final accepted form with all revisions and notations corrected on as-built drawings

B. The Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should the Engineer consider that the Work is incomplete or defective:
   1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective Work
   2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to the Engineer that the Work is complete
   3. The Engineer (or their assigned) will re-inspect the Work

D. When the Engineer finds that the Work is acceptable under the Contract Documents, the Contractor shall be requested to make closeout submittals.

3.03 PROJECT RECORD DOCUMENTS

A. Maintain, on site, one set of the following record documents; record actual revisions to the work:
   1. Contact drawings
   2. Specifications
   3. Addenda
   4. Change orders and modifications to the Contract
   5. Reviewed shop drawings, product data, and samples
   6. Applications for payment

B. Store record documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Record documents and shop drawings. Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish elevation
   2. Measured horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements
   3. Measured locations of internal utilities and appurtenances concealed in construction referenced to visible and assessable features of the work

4. Field changes in dimensions
5. Details not on original contract drawings

E. Submit full set of above documents to the Engineer with final Application of Payment.

3.04 DELIVERY TO THE OWNER

A. At or prior to the time of the final inspection, suppliers shall deliver all required items to the site and place as designated by the Engineer.
   1. Suppliers and representatives of the Owner shall inspect and inventory all items delivered

B. Submit to the Engineer a Detailed Bill of Lading of all Items Delivered:
   1. Contractor and the supplier's representatives shall sign bill of lading certifying that all items listed were delivered and that, unless otherwise noted on the invoice, all items were in good condition at the time of delivery to Owner

C. Contractor shall deliver all additional items identified by the Engineer and replace all damaged and defective items noted on the original invoice before requesting final inspection.

3.05 FINAL APPLICATION FOR PAYMENT

Upon completion of the closeout submittal, the Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

3.06 PAYMENT

Final payment will be made when all equipment operates satisfactorily, all specified spare parts, maintenance materials, and special tools have been delivered to the Owner are in acceptable condition, and all contract requirements have been met.

**** END OF SECTION ****

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SECTION 01 71 33

PROTECTION, TESTING, AND RESTORATION OF EXISTING FACILITIES

PART 1 – GENERAL

1.01 REQUIREMENTS

A. This section is intended to include requirements associated with protection, testing, and restoration of existing facilities such as underground utilities, sprinkler systems, utility poles, surface improvements, and survey markers.

1.02 NOTIFICATION OF UTILITIES

A. Utility Owners, including the County, are to be contacted by the Contractor prior to any excavation activities requesting locations on underground utilities and services on a street by street basis. Should any apparent interferences exist, the Engineer shall be immediately notified.

B. Contractor shall utilize the services of Underground Service Alert (USA) and shall obtain a USA ticket and keep the ticket current during excavating. USA may be contacted at 1-800-227-2600.

C. In the event that a conflicting utility is damaged, the utility owner shall be notified and given the opportunity to specify alternative repair materials or methods.

1.03 INTERRUPTION TO UTILITIES

A. Any underground facilities located by utility owners, the Owner, or indicated in Contract Documents shall be treated as directed in the General Conditions to the Construction Contract.

B. Any underground facilities not located by utility owners and not indicated in Contract Documents shall be treated according to Section General Conditions and Special Provisions.

C. Exact locations and depths of all underground utilities shall be verified, by uncovering, prior to commencing any work activities. When such exploratory excavations show the underground utility locations as indicated in Contract Documents to be in error, the Contractor shall immediately notify the Engineer in writing.

D. Where utilities are to be relocated, Contractor shall make proper application to the owners of the conflicting utilities and notify Engineer of specified time and conditions of necessitated work.

E. All restorations made to utilities shall be inspected and approved by an authorized representative of the utility before being concealed by backfill or other work.

F. No additional compensation for any breaks or other delays associated with working around existing utility lines (gas, water, sewer, irrigation, etc) will be made. The Contractor assumes the responsibility to retain and protect existing utility lines within or without the specified pay limits.

G. Contractor is responsible and assumes all liability to retain and protect all utility poles within or beyond the specified pay limit.

H. Contractor accepts responsibility for repair of utilities damaged during construction whether shown on the plans or not.

1.04 PROTECTION OF SURVEY AND STREET MARKERS

A. Survey markers or other existing street markers shall not be destroyed, removed, or otherwise disturbed without proper authorization. No pavement breaking or excavation shall be started until all surveyor or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration.

B. All survey markers or points disturbed without proper notification and/or authorization by the Owner, will be accurately restored by the Owner or their agent at the Contractor's expense after all work is complete.

1.05 PROTECTION OF TREES

A. Any construction work within the drip line of any tree shall conform to the Sacramento County Tree Ordinance and the following: No tree shall be removed without the expressed written permission of the property owner. Roots over 2 inches in diameter shall be protected and if accidentally damaged, shall be treated with sealer material or as approved by the Owner. Hand excavation may be required to avoid damage to roots 2 inches in diameter and larger. Cutting or breaking roots 2 inches in diameter or larger may require trimming of the tree to the satisfaction of the property owner or Sacramento County requirements.

1.06 RESTORATION STANDARDS

A. Surfaces shall be restored in accordance with the requirements of Sections 4-24, 4- 25, and 4-31 of the Sacramento County Standard Specifications, except for the following:

1. Subsections entitled "Item and Payment" shall not apply. Measurement and payment shall be as specified in Section 01 22 00 Measurement and Payment herein.

PART 2 – PRODUCTS

2.01 REPLACEMENT IN KIND

A. Unless indicated otherwise, or specifically authorized by a utility owner, reconstruct utilities with new material of the same size, type, and quality as that removed.

PART 3 – EXECUTION

3.01 GENERAL

A. Replace in kind improvements such as curbs and gutters, barricades, traffic islands, signalization, fences, signs, etc. that are cut, removed, damaged, or otherwise disturbed by construction.

B. Where utilities are parallel to or cross the construction but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated in the drawings. Notify the utility owner a minimum of 48 hours in advance of the crossing construction and coordinate the construction schedule with the utility owner's requirements.

C. Determine the true location and depth of utilities and service connections that may be affected by or affect the work. Determine the type, material, and condition of these utilities. In order to provide sufficient lead time to resolve unforeseen conflicts, order materials and take appropriate measures to ensure that there is no delay in work.

3.02 PROCEDURES

A. Protect in place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified.

B. Remove and Reconstruct: Where so indicated in the drawings, or as required by the Owner’s representative, remove the utility and, after passage, reconstruct it with new materials. Provide temporary services for the disconnected utility.

3.03 COMPACTION

A. Utilities Protected in Place: Contractor shall backfill and compact under and around the utility.

B. Alternative Construction -Sand Slurry: Sand slurry consisting of one sack (94 pounds) of Portland cement per cubic yard of sand and sufficient moisture for workability may be substituted for other backfill materials to aid in reducing compaction difficulties. Submit specific methods and procedures for the review of the Owner’s Representative prior to construction.

3.04 LAWN REPLACEMENT

A. Any lawns damaged by construction shall be replaced with nursery grown sod and repaired at no cost to the Owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to pre-construction conditions.

3.05 LANDSCAPING REPLACEMENT

A. All landscaping, including plants, flowers, and/or other vegetation damaged by construction shall be replaced or repaired at no cost to the Owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to pre-construction conditions.

3.06 YARD STRUCTURES

A. Any structures including: fences, sheds, decks, walkways, concrete, asphalt, etc. Damaged by construction shall be replaced or repaired at no cost to the Owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to pre-construction conditions.

3.07 PAVEMENT AND STRIPING

A. All pavement and striping disturbed during the project shall be replaced in kind. Pavement and striping within commercial areas shall be approved by the

property owner. Approvals shall be provided to the Owner in the form of a letter signed by the owner.

3.08 PRIVATE UTILITIES

A. All private utilities such as irrigation systems, swimming pool piping, yard lighting systems, etc., shall be replaced or repaired at no cost to the Owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to preconstruction conditions.

3.09 DRIVEWAYS

A. Driveways shall be replaced in kind by removing and replacing the entire damaged portion between joints or scores, except as follows:

   1. If there are no joints or scores in the damaged driveway, the Contractor may saw cut scores into the driveway in a symmetrically pleasing manner that is approved by the Owner and the property owner, to create concrete panels that are no larger than 10’ x 10’, and replace the newly created damaged portion;

   2. In the event that existing driveway panels are greater than 10’ x 10’, the Contractor may saw cut the driveway in a symmetrically pleasing manner that is approved by the Owner and the property owner, to create panels smaller than 10’ x 10’, and remove and replace only the damaged portion.

B. It is the intent of this specification that the Contractor will not be required to replace more than 10’ x 10’ of any single driveway but that if the Contractor is required to saw cut new panels into a driveway, the new panels will be required to be as close to 10’ x 10’ as possible.

**** END OF SECTION ****

SECTION 01 75 16
START UP PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes:

1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
2. Requirements for Substantial Completion Submittals.

B. Related Sections include but are not necessarily limited to:

C. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract

D. Division 1 - General Requirements

E. Division 11 - Equipment

F. Division 16 - Electrical

1.02 DEFINITIONS

A. Project Classified System (PCS): A defined part of the Project, consisting of an arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent system.

B. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:

1. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
2. Equipment startup.
3. Personnel training.

C. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the facility Project Classified System and starts up and operates the Project Classified Systems facility, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.

D. Substantial Completion: See General Conditions.

1.03 SUBMITTALS

A. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.

1. Master operation and maintenance training schedule:
   a. Submit 15 days (minimum) prior to first training session for Owner’s personnel.
   b. Schedule to include:

1) Target date and time for [Owner, District, Agency] observing each system initial startup.
2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
3) Target date for initiation of Demonstration Period.

c. Submit for review and approval by Construction Manager and Owner.
d. Include holidays observed by Contractor, Construction Manager, and District staff.
e. Attend a schedule planning and coordination meeting 30 calendar days prior to first anticipated training session.
1) Provide a status report and schedule-to-complete for requirements prerequisite to manufacturer's training.
2) Identify initial target dates for individual manufacturer's training sessions.
f. Construction Manager and Owner reserve the right to require a minimum seven-days notice of rescheduled training session not conducted on master schedule target date for any reason.
g. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:
a. File Contractor's Notice of Substantial Completion and Request for Inspection.
b. Approved Operation and Maintenance manuals received by Construction Manager minimum one week prior to scheduled training.
c. Written request for Construction Manager and Owner to witness each system pre-demonstration startup. Request to be received by Owner minimum one week before scheduled training of Owner’s personnel on that system.
d. Equipment installation and pre-demonstration startup certifications.
e. Letter verifying completion of all pre-demonstration startup activities including receipt of all specified items from manufacturers or suppliers as final item prior to Demonstration Period.

1.04 SEQUENCING AND SCHEDULING

A. Phased Construction: Contractor to specify and submit phasing plan with schedule. Phasing plan to include proposed facility startup and testing of phased construction components.

1.05 COST OF STARTUP

A. Contractor to pay all costs, including the cost of all sodium hypochlorite, associated with Facility startup

PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.01 GENERAL

A. Facility Startup Divided into Two Periods:

1. Pre-Demonstration Period including:
a. Completion of construction work to bring Project to a state of Substantial Completion.
b. Startup of Equipment.
c. Training of Personnel.

d. Completion of the filing of all required submittals.
e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.

2. Demonstration Period including:
   a. Demonstration of functional integrity of facility.

3.02 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:

1. Complete the work to bring the Project to a state of substantial completion.

B. Equipment Startup:

1. Requirements for individual items of equipment are included in Divisions 2 through 16 of these Specifications.
2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
3. Perform Equipment Startup to extent possible without introducing product flow.
4. Test tanks, pumping and similar equipment requiring a fluid, using clean water supplied at Contractor's expense.
5. Dispose of water used for Equipment Startup.
6. Introduce product flow to complete Equipment Startup for the following equipment:
   a. Pumps.
   b. Chemical dosing system (metering pumps, injection quill).
   c. Generator.
   d. Flowmeters.
   e. Emergency equipment.
7. Procedures include but are not necessary limited to the following:
   a. Test or check and correct deficiencies of:
      1) Power, control, and monitoring circuits for continuity prior to connection to power source.
      2) Voltage of all circuits.
      3) Phase sequence.
      4) Cleanliness of connecting piping systems.
      5) Alignment of connected machinery.
      6) Vacuum and pressure of all closed systems.
      7) Lubrication.
      8) Valve orientation and position status for manual operating mode.
      9) Tankage for integrity using clean water.
      10) Pumping equipment using clean water.
      11) Instrumentation and control signal generation, transmission, reception, and response.
      12) Alarm conditions.
      13) Tagging and identification systems.
      14) All equipment: Proper connections, alignment, calibration and adjustment.
   b. Calibrate all safety equipment.
   c. Manually rotate or move moving parts to assure freedom of movement.
   d. "Bump" start electric motors to verify proper rotation.
   e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.

f. Documentation:
    1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Startup. Provide a place for the Contractor to record date and person accomplishing required work. Submit completed document before requesting inspection for Substantial Completion certification.

8. Obtain certifications, without restrictions or qualifications, and deliver to Construction Manager:
    a. Manufacturer's equipment installation check letters.
    b. Instrumentation Supplier's Instrumentation Installation Certificate.
9. Cleanup:
    a. After successful demonstration, discontinue process flow, drain system and clean as necessary to achieve safe and sanitary conditions.

C. Personnel Training:

1. See individual equipment specification sections.
2. Conduct all personnel training after completion of Equipment Startup for the equipment for which training is being conducted.
    a. Personnel training on individual equipment or systems will not be considered completed unless:
        1) All pre-training deliverables are received and approved before commencement of training on the individual equipment or system.
        2) No system malfunctions occur during training.
        3) All provisions of field and classroom training specifications are met.
    b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to [Owner, District, Agency].
3. Field and classroom training requirements:
    a. Hold classroom training on-site.
    b. Notify each manufacturer specified for on-site training that the Owner[Owner, District, Agency] reserves the right to video record any or all training sessions. Organize each training session in a format compatible with video recording.
    c. Training instructor: Factory trained and familiar with giving both classroom and "hands-on" instructions.
    d. Training instructors: Be at classes on time. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule. Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.
    e. Organize training sessions into maintenance verses operation topics and identify on schedule.
    f. Plan for minimum class attendance of five people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
    g. Instructors to have a typed agenda and well prepared instructional material. The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs. Deliver agendas to the Owner a minimum of seven days prior to the classroom training. Provide equipment required for presentation of films, slides, and other visual aids.
    h. In the on-site training sessions, cover the information required in the Operation and Maintenance manuals submitted according to Section 001300 and the following areas as applicable to PCS's.

1) Operation of equipment.
2) Lubrication of equipment.
3) Maintenance, repair, and replacement of equipment.
4) Troubleshooting of equipment.
5) Preventive maintenance procedures.
6) Adjustments to equipment.
7) Inventory of spare parts.
8) Optimizing equipment performance.
9) Capabilities.
10) Operational safety.
11) Emergency situation response.
12) Takedown procedures (disassembly and assembly).

i. Address above paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address above paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.
j. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.

D. Complete the filing of all required submittals:

1. Shop drawings.
2. Operation and Maintenance Manuals.
3. Training material.

E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project or PCS:

1. File the notice when the following have been completed:
   a. Construction work (brought to state of Substantial Completion).
   b. Equipment Startup.
   c. Personnel Training.
   d. Submittal of required documents.
2. Construction Manager will review required submittals for completeness. If complete, Construction Manager will complete inspection of the Work.
3. Construction Manager will inform Contractor in writing of the status of the Work reviewed.
   a. Work determined not meeting state of Substantial Completion:
      1) Contractor: Correct deficiencies noted or submit plan of action for correction within five days of Construction Manager's determination.
      2) Construction Manager: Reinspect work within five days of Contractor's notice of correction of deficiencies.
      3) Reinspection costs incurred by Construction Manager will be billed to the District who will deduct them from final payment due Contractor.
   b. Work determined to be in state of tentative Substantial Completion: Construction Manager to prepare tentative "Engineer's Certificate of Substantial Completion."
   c. Engineer's Certificate of Substantial Completion:
      1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
      2) Issued for Project as a whole or for one or more PCS.
      3) Issued subject to completion or correction of items cited in the certificate (punch list).
      4) Issued with responsibilities of [Owner, Owner and Contractor cited.

5) Executed by Construction Manager or Project Engineer.
6) Accepted by Owner.[Owner, Owner, Agency].
7) Accepted by Contractor.

d. Upon successful completion of Demonstration Period, Construction Manager will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.03 DEMONSTRATION PERIOD

A. General:

1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
2. Duration of Demonstration Period: 120 consecutive hours.
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. The Owner will provide operational personnel to provide process decisions affecting plant performance. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. The Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems, alarms, and alternate operating modes.
7. Contractor may demonstrate by PCS, either individually or a combination of two or more PCS.
8. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner and Construction Manager in advance of initiating Demonstration Period.
9. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
10. For the above systems, provide a total of 16 HRS instruction.
11. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

**** END OF SECTION ****

SECTION 01 78 23
OPERATION AND MAINTENANCE MANUAL

PART 1 – GENERAL

1.01 DESCRIPTION

This section specifies the format and content of operation and maintenance manuals along with the instruction to Owner's personnel.

1.02 REFERENCES

A. Section 01 33 13 Submittals
B. Section 01 45 23 Performance and Operational Testing
C. Section 01 70 00 Contract Closeout
D. Section 26 24 00 Electrical Panel

1.03 QUALITY ASSURANCE

Contractor to prepare instructions and data by manufacturer/suppliers experienced in maintenance and operation of equipment or systems.

1.04 HARD COPY FORMAT

A. Prepare data in the form of an instructional manual.
B. Binders: Commercial quality, three 8-1/2 x 11 inch D-size ring binders with durable plastic covers; 2-inch maximum ring size. Correlate data into related consistent groupings for each binder.
C. Documentation included shall be clear and legible.
D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of project; identify volume number for multiple volume references.
E. Provide tabbed index for each separate product and system, with typed description of product and major component parts of equipment.
F. Text: Manufacturer's printed data, or typewritten data on 24-pound paper.
G. Drawings: Provide reinforcement of bound edge. Bind in with text; fold larger drawings neatly to size of text pages. Preferably no drawings larger than 11” x 17” unless approved by the Engineer. Drawings larger than 11” x 17” shall be inserted into pockets.
H. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in four parts as follows:
    1. Part 1: Directory, listing names, addresses, and telephone numbers of Product Engineer, Contractor, Subcontractors, and major equipment suppliers.
    2. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors, supplies and parts distributor. Identify the following:

a. Significant design criteria
b. List of equipment
c. Parts list for each component
d. Operating instructions
e. Maintenance instructions for equipment and systems
f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data
   b. Certificates
   c. Photocopies of warranties
4. Part 4: Design Data

1.05 INSTRUCTION OF OWNER'S PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
C. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

1.06 SUBMITTAL OF OPERATION AND MAINTENANCE DATA

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before 25% of work is completed.
B. Submit one copy of completed volumes 14 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer's comments. Revise content of all document sets as required prior to final submission.
C. Submit four sets of revised final volumes in final form within 14 days after final inspection.

1.07 OPERATION AND MAINTENANCE MANUAL

The Contractor shall provide an Operation and Maintenance manual per Section 22 09 00 Field Instruments, 26 09 17 Controls and Automation, 32 31 19 Security Iron Fences and Gates, and 33 11 13 Piping Systems.

1.08 ELECTRONIC SUBMITTALS

A. Each USB compatible flash drive should be clearly marked to identify the contents on the drive.

B. Submit two (2) USB compatible flash drive containing all Contractor generated electronic documents contained in the final volumes (drawings, text, etc.). Files shall be in the AutoCAD and Microsoft Office file format so as to be editable.

C. Submit two (2) USB compatible flash drives containing the final instructional manual in an Adobe PDF format as described in Subsection 1.04.

PART 2 – (NOT USED)

PART 3 – (NOT USED)

**** END OF SECTION ****

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SECTION 01 79 00

TRAINING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section contains requirements for training the Owner's personnel, by persons retained by the Contractor specifically for the purpose of providing training in the proper operation and maintenance of the equipment and systems installed.

1.02 QUALITY ASSURANCE

A. Where required by the detailed specifications, the Contractor shall provide on-the-job training of the Owner's personnel. The training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers/suppliers.

B. Training shall include instruction in both operation and maintenance of the subject equipment.

1.03 SUBMITTALS

A. The following information shall be submitted to the Engineer in accordance with the provisions of Section 01 33 13 Submittals. The material shall be reviewed and accepted by the Owner as a condition precedent to receiving progress payments in excess of 50 percent of the contract amount and not less than 3 weeks prior to the provision of training.

1. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts visual aids, and other reference materials shall be included.
2. Subject of each training session, identity, and qualifications of individuals to be conducting the training and tentative date and time of each training session.

PART 2 - PROJECTS

2.01 GENERAL

A. Where specified, the Contractor shall conduct training sessions for the Owner's staff to instruct the staff on the proper operation, care, and maintenance of the equipment and systems.

B. Training shall take place at the site of the work and under the conditions specified in the following paragraphs.

C. Approved operation and maintenance manuals shall be available at least 30 days prior to the date scheduled for the individual training session.

2.02 LOCATION

A. Training sessions shall take place at the project site with times designated by the Owner.

2.03 FORMAT AND CONTENT

A. As a minimum, training session shall cover the following subjects for each item of equipment or system:

1. Familiarization:
   a. Review catalog, parts lists, drawings, and etc., which have been previously provided for the Owner's files and operation and maintenance manuals
   b. Review the installation of the specific equipment items
   c. Demonstrate the unit and indicate how all parts of the specifications are met
   d. Answer questions
2. Safety:
   a. Review safety references
   b. Discuss proper precautions around equipment
3. Operation:
   a. Review reference literature
   b. Explain all modes of operation (including emergency)
   c. Observe Owner's staff on proper use of the equipment
4. Preventive Maintenance:
   a. Review preventive maintenance (PM) lists including:
      1) Reference material
      2) Daily, weekly, monthly, quarterly, semiannual, and annual maintenance requirements
   b. Show how to perform preventative maintenance
   c. Show Owner's Staff what to look for as indicators of equipment problems
5. Corrective Maintenance:
   a. List possible problems
   b. Discuss repairs – point out special problems
   c. Open up equipment and demonstrate procedures, where practical
6. Parts:
   a. Show how to use previously provided parts list and order parts
   b. Check over spare parts on hand. Make recommendations regarding additional parts that should be available
7. Local Representatives:
   a. Where to order parts: name, address, telephone
   b. Service problems:
      1) Who to call
      2) How to get emergency help
8. Operation and Maintenance Manuals:
   a. Review any other material submitted
   b. Update material, as required

PART 3 - EXECUTION

3.01 TRAINING

A. Training shall be conducted in conjunction with the operational testing and commissioning periods. The Contractor shall arrange to have the training conducted on consecutive days, with no more than 6 hours of classes scheduled for any single day. Concurrent classes shall not be allowed.

B. Acceptable operation and maintenance manuals for the specific equipment shall be provided to the Owner prior to the start of any training.

C. The following services shall he provided for each item of equipment or system as required in individual specification sections. Additional services shall be provided, where specifically required in individual specification sections.

D. Hands-on equipment training for maintenance and repair personnel shall include:

1. Locate and identify equipment components
2. Review the equipment function and theory of operation
3. Review normal repair procedures
4. Perform start-up and shutdown procedures
5. Review and perform the safety procedures
6. Perform Owner approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems

END OF SECTION

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SECTION 01 89 00

SITE CONSTRUCTION PERFORMANCE STANDARDS

PART 1 – GENERAL

1.01 CONTRACTOR RESPONSIBILITY

Contactor's responsibility in performing the Services shall include the following obligations:

A. General

All improvements within Owner rights-of-way, easements and improvements shall be installed in accordance with the approved improvement plans and specifications, the Stormwater Quality Design Manual for the Sacramento and South Placer Regions, and the State of California Department of Transportation Standard Specifications ("Caltrans Standard Specifications"). Caltrans Standard Specifications shall apply where not superseded by these Construction Standards. The Contractor shall follow all applicable City, County, State and Federal laws and regulations relating to construction on the improvements.

B. Plans

Perform construction per plans signed and approved by Owner or Owner's Agents. Any additions, deletions or changes to the approved plans shall be submitted to Owner or Owner's Agents for review and approval prior to construction.

C. Testing

Constructed utilities shall be tested in accordance with these Construction Standards.

D. Cultural Resources

Contractor shall stop construction if cultural resources are discovered during excavation operations. It is possible that previous activities have obscured surface evidence of cultural resources. If signs of an archeological site, such as any unusual amounts of stone, bone, or shell are uncovered during grading or other construction activities, work shall be halted within 100 feet of the find and the Owner General Manager shall be notified immediately. A qualified archaeologist shall be consulted for an on-site evaluation. Additional mitigation may be required by the archaeologist.

E. Hazardous or Toxic Materials and Contaminated Soils

Should Contractor encounter hazardous or toxic materials, or contaminated soils, or materials which Contractor believes may be hazardous waste during any and all excavation or grading operations, as defined in Section 25117 of the Health and Safety Code, which require them to be moved to a Class I, Class II or Class III disposal site in accordance with provisions of existing law, the Owner General Manager shall be contacted immediately. The area which

contains the hazardous or toxic materials or contaminated soils shall be marked off until an investigation is conducted.

F. Working Hours

The normal hours of project construction shall be limited to:

7:00 a.m. to 6:00 p.m., Monday through Friday

Approval by the Engineer is required for construction to take place outside of the normal hours. Hours may be further limited as otherwise required by the local jurisdiction in which Contractor is performing the Services.

G. Emergency Contact

Prior to the commencement of construction, the Owner General Manager shall be furnished with the name and telephone number of a contact person who can be reached 24 hours per day regarding problems or emergencies at the site.

H. Temporary Fencing

Any excavation exceeding two (2) feet in depth, left unattended outside Project work hours, within a close proximity to or within any right-of-way shall be enclosed with a six (6) foot high temporary fence. Where temporary fencing is placed along the street in the gutter pan or at the back of any sidewalk, a delineator or cone shall be placed at a maximum fifty (50) foot interval along the outside of the fence.

I. Personnel

Only personnel competent in the particular trade undertaken shall be employed for the construction work.

J. Weather

Construction work shall not commence or progress when the weather jeopardizes a safe working environment or the quality of the project in any manner.

K. Street Cleaning

Where dirt, mud, rock, sand or other foreign material are tracked onto public street pavement, Contractor shall clean the streets daily. If Contractor fails to keep the streets clean, Owner may clean the areas at the expense of the Contractor.

L. Record Drawings

PDF electronic, two sets of prints (1 set of 22”x34” and 1 set of 11”x17”) shall be submitted to the Owner General Manager as a condition of the Certificate of Completion.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

**** END OF SECTION ****

SECTION 02 07 20
DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all demolition required to perform the work covered under this contract including without limitation:

1. Remove existing construction shown to be removed.
2. Include removal of mechanical and electrical work that is to be abandoned and is contained in construction to be removed whether or not the mechanical and electrical work is shown. Disconnect and cap off utilities in accordance with applicable codes and safety regulations.
3. Where utilities that are not shown pass through construction that must be removed and those utilities serve other areas notify the Engineer before disrupting service. If rerouting is required to maintain service, the additional work required will be considered a changed condition per the General Conditions.
4. Store and protect items intended for reuse.
5. Assume ownership of debris and unwanted materials; remove from the site and dispose of legally.
6. If the presence of a hazardous material is suspected, the Contractor shall notify the Engineer and have material tested. If material is identified as hazardous, retain a qualified and licensed specialist to remove and dispose of it legally. Removal and disposal of hazardous materials shall be considered a changed condition per the General Conditions.

1.02 NOISE AND DUST CONTROL

A. Provide temporary partitions to control dust and noise and exclude unauthorized persons.

B. Perform work in a manner to cause least disturbance to surrounding neighbors and least damage to work to remain.

C. Maintain adequate means of safe, clear egress.

D. Employ best available techniques for construction noise abatement. Use remote air compressors equal with hospital grade muffler and the newest noise suppressed pneumatic and electric tools.

1.03 WARNING

A. The Contractor is advised that work under this Section may be hazardous. The Contractor is to take all necessary precautions to ensure the safety of the public, workers and property. Removal of and/or working in areas containing even minor amounts of hazardous material, including without limitation, asbestos, lead-based paint, PCBs, or other hazardous materials, requires special precautions, knowledge, and procedures. If hazardous material is suspected, notify the Engineer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REMOVAL OF CONSTRUCTION IN AREAS TO RECEIVE NEW WORK

A. In areas intended to receive new work and/or finishes, remove all unwanted concrete, fencing, equipment, and site work.

B. Remove all unwanted mechanical and electrical work (whether shown or not) that is not wanted and is not needed to serve other areas that is in, on, or concealed behind work being removed. Cap off or terminate all mechanical and/or electrical work that is to be abandoned.

C. Protect mechanical and electrical work that serves other areas. Relocate concealed mechanical and electrical work that is required to preserve service to other areas.

D. Remove structural work designated for removal. Take precautions not to damage structural work intended to remain.

E. If structural elements are encountered that were not shown, protect them from damage and report their presence to the Engineer.

3.02 REMOVAL OF LIMITED PORTIONS OF EXISTING CONSTRUCTION TO PERMIT MODIFICATIONS

A. Provide careful, selective cutting and removal of existing construction as required to permit relocation or modification. Cut and remove the least amount of work possible except when a larger area needs to be removed to permit strengthening existing construction or when required to remove finishes to a natural break line such as a corner or change in material.

B. Protect existing construction to remain.

C. When modifications are complete, replace removed work with new construction and finishes to match adjacent existing work. Standards of material and workmanship shall be in accordance with other portions of this Specification or, if not covered, then in accordance with current practice for this class of work. Salvaged materials may be used for replacement if in good condition and acceptable to the Engineer.

3.03 REMOVAL OF EXISTING CONSTRUCTION TO PROVIDE ACCESS TO PERFORM WORK

A. Provide careful, selective cutting and removal of existing construction where required to permit installation of new concealed mechanical or electrical work, or installation of equipment.

B. Treat existing mechanical, electrical, or structural work as described in other parts of this Section.

C. Replace and/or patch removed construction and finishes in accordance with other parts of this Section.

3.04 PROTECTION OF WORK TO REMAIN

A. Protect all work to remain. Repair damage with materials, workmanship and finishes matching existing work when new.

3.05 SALVAGE AND REUSED ITEMS

A. All items labeled salvage on the Drawings shall remain property of the Owner. Exercising due care, the Contractor shall remove, disassemble if appropriate, clean of loose dirt, haul, stock pile if so directed, and store at the project site in a location approved by the Owner or Engineer unless specifically directed otherwise on the Drawings.

B. Items designated on the Drawings for reuse shall be stored and protected until time of need on the jobsite.

3.06 IF HAZARDOUS MATERIALS ARE ENCOUNTERED

A. If hazardous materials are discovered, comply with paragraph 1.03 of this Section and all applicable laws.

3.07 REMOVAL AND DISPOSAL OF MATERIAL

A. Store debris in suitable covered containers located where directed by the Engineer and remove from the site when full. Burning on the site is not permitted.

B. Removed material other than material to be reused or salvaged shall become the property of the Contractor who shall remove it from the site and dispose of it in a legal manner.

**** END OF SECTION ****

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SECTION 02 07 50

PROTECTION, TESTING, AND RESTORATION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. This section is intended to include requirements associated with protection, testing, and restoration of existing facilities such as underground utilities, sprinkler systems, utility poles, surface improvements, and survey markers.

1.02 NOTIFICATION OF UTILITIES

A. Utility Owners, including the County, are to be contacted by the Contractor, prior to any excavation activities, requesting locations on underground utilities and services on a street by street basis. Should any apparent interference exist, the, Engineer shall be immediately notified.

B. Contractor shall utilize the services of Underground Service Alert (USA) and shall obtain a USA ticket and keep the ticket current during excavating. USA may be contacted at 1-800-227-2600.

C. In the event that a conflicting utility is damaged, the utility owner shall be notified and given the opportunity to specify repair materials or methods.

1.03 INTERRUPTION TO UTILITIES

A. Any underground facilities located by utility owners, the District, or indicated in Contract Documents shall be treated as directed in the General Conditions to the Construction Contract.

B. Any underground facilities not located by utility owners and not indicated in Contract Documents shall be treated according to Section General Conditions and Special Provisions.

C. Exact locations and depths of all underground utilities shall be verified, by uncovering, prior to commencing any WORK activities. When such exploratory excavations show the underground utility locations as indicated in Contract Documents to be in error, the Contractor shall immediately notify the Engineer in writing.

D. Where utilities are to be relocated, Contractor shall make proper application to the owners of the conflicting utilities and notify Engineer of specified time and conditions of necessitated WORK.

E. All restorations made to utilities shall be inspected and approved by an authorized representative of the utility before being concealed by backfill or other WORK.

F. No additional compensation for any breaks or other delays associated with working around existing utility lines (gas, water, sewer, irrigation, etc) will be made. The Contractor assumes the responsibility to retain and protect existing utility lines within or without the specified pay limits.

G. Contractor is responsible and assumes all liability to retain and protect all utility poles within or beyond the specified pay limit.

H. Contractor accepts responsibility for repair of utilities damaged during construction whether shown on the plans or not.

1.04 PROTECTION OF SURVEY AND STREET MARKERS

A. Survey markers or other existing street markers shall not be destroyed, removed, or otherwise disturbed without proper authorization. No pavement breaking or excavation shall be started until all surveyor or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration.

B. All survey markers or points disturbed without proper notification and/or authorization by the District, will be accurately restored by the District or their agent at the Contractor's expense after all WORK is complete.

1.05 PROTECTION OF TREES

A. Any construction work within the drip line of any tree shall conform to the Sacramento County Tree Ordinance and the following: No tree shall be removed without the expressed written permission of the property owner. Roots over 2 inches in diameter shall be protected and if accidentally damaged, shall be treated with sealer material or as approved by the District. Hand excavation may be required to avoid damage to roots 2 inches in diameter and larger. Cutting or breaking roots 2 inches in diameter or larger may require trimming of the tree to the satisfaction of the property owner or Sacramento County requirements.

1.06 RESTORATION STANDARDS

A. Surfaces shall be restored in accordance with the requirements of Sections 4-24, 4-25, and 4-31 of the Sacramento County Standard Specifications.

PART 2 - PRODUCTS

2.01 REPLACEMENT IN KIND

A. Unless indicated otherwise, or specifically authorized by a utility owner, reconstruct utilities with new material of the same size, type, and quality as that removed.

PART 3 - EXECUTION

3.01 GENERAL

A. Replace in kind improvements such as curbs and gutters, barricades, traffic islands, signalization, fences, signs, etc. that are cut, removed, damaged, or otherwise disturbed by construction.

B. Where utilities are parallel to or cross the construction but do not conflict with the permanent work to be constructed, follow the procedures given below and as indicated in the drawings. Notify the utility owner a minimum of 48 hours in advance of the crossing construction and coordinate the construction schedule with the utility owner's requirements.

C. Determine the true location and depth of utilities and service connections that may be affected by or affect the work. Determine the type, material, and condition of these utilities. In order to provide sufficient lead time to resolve unforeseen conflicts,

order materials and take appropriate measures to ensure that there is no delay in work.

3.02 PROCEDURES

A. Protect in place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified.

B. Remove and Reconstruct: Where so indicated in the drawings, or as required by the District's representative, remove the utility and, after passage, reconstruct it with new materials. Provide temporary services for the disconnected utility.

3.03 COMPACTION

A. Utilities Protected in Place: Contractor shall backfill and compact under and around the utility.

B. Alternative Construction -Sand Slurry: Sand slurry consisting of one sack (94 pounds) of Portland cement per cubic yard of sand and sufficient moisture for workability may be substituted for other backfill materials to aid in reducing compaction difficulties. Submit specific methods and procedures for the review of the District's Representative prior to construction.

3.04 LAWN REPLACEMENT

A. Any lawns damaged by construction shall be replaced with nursery grown sod and repaired at no cost to the District or property owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to pre-construction conditions.

3.05 LANDSCAPING REPLACEMENT

A. All landscaping, including plants, flowers, and/or other vegetation damaged by construction shall be replaced or repaired at no cost to the District or property owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to pre-construction conditions.

3.06 YARD STRUCTURES

A. Any structures including: fences, sheds, decks, walkways, concrete, asphalt, etc. Damaged by construction shall be replaced or repaired at no cost to the District or property owner. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to pre-construction conditions.

3.07 PAVEMENT AND STRIPING

A. All pavement and striping disturbed during the project shall be replaced in kind. Pavement and striping within commercial areas shall be approved by the property owner. Approvals shall be provided to the District in the form of a letter signed by the owner.

3.08 PRIVATE UTILITIES

A. All private utilities such as irrigation systems, swimming pool piping, yard lighting systems, etc., shall be replaced or repaired at no cost to the District. Every attempt shall be made to satisfy the property owner that the repair has been made to restore private property to preconstruction conditions.

3.09 DRIVEWAYS

A. Driveways shall be replaced in kind by removing and replacing the entire damaged portion between joints or scores, except as follows:

1. If there are no joints or scores in the damaged driveway, the Contractor may saw cut scores into the driveway in a symmetrically pleasing manner that is approved by the District and the property owner, to create concrete panels that are no larger than 10’ x 10’, and replace the newly created damaged portion;
2. In the event that existing driveway panels are greater than 10’ x 10’, the Contractor may saw cut the driveway in a symmetrically pleasing manner that is approved by the District and the property owner, to create panels smaller than 10’ x 10’, and remove and replace only the damaged portion.
3. It is the intent of this specification that the Contractor will not be required to replace more than 10’ x 10’ of any single driveway but that if the Contractor is required to saw cut new panels into a driveway, the new panels will be required to be as close to 10’ x 10’ as possible.

**** END OF SECTION ****

SECTION 07 19 13
ACRYLIC WATER REPELLENTS

Part 1 - GENERAL

1.01 SUMMARY

A. This section specifies the application of an Acrylic Water Repellent on the exterior of the split face concrete masonry unit walls of the Control Building

1.02 QUALITY ASSURANCE

A. Follow the manufacturer's recommended procedure for the exterior surface preparation of concrete masonry units.

B. Coating Contractor – The Coating Contractor shall hold a current C-33 painting and decorating license and have a minimum 5 years of practical experience in the application of specified products to surfaces at similar facilities.

1.03 SUBMITTALS

A. The Contractor shall submit information to substantiate compliance with this specification in accordance with Section 01 33 13, Submittals. In addition, the following specific information shall be provided:

B. Material Safety Data Sheets (MSDSs) for all products.

C. Letter from the manufacturer stating that the product is suitable for intended use and is compatible with and will not cause discoloration of masonry units.

D. Field conducted water spray test results.

E. See Subsection 2.01, Materials, for additional submittal requirements for products not named in the specifications.

F. Warranty as required in Subsection 1.04.

1.04 SUBMITTALS

A. Provide manufacturer's standard 5-year performance warranty.

1.05 DELIVERY AND STORAGE

A. All materials shall be delivered to the site in the manufacturer's sealed containers. Each container shall be labeled by the manufacturer and shall be intact upon delivery. Labels shall give the manufacturer's name, brand, type of paint, batch number, color of paint, date of manufacture, storage life and instructions for reducing.

B. The Contractor shall store all materials and equipment in a storage place protected from weather and excessive heat and cold. Necessary precautions shall be taken to reduce hazards to a minimum. Materials exceeding the storage life recommended by the manufacturer shall be removed from the site.

Part 2 - PRODUCTS

2.01 MATERIALS

A. Liquid Water Repellent: Clear, non-staining, non-yellowing, deep penetrating silane sealer.

2.02 ACCEPTABLE MANUFACTURES

A. The following manufacturers are acceptable:

1. Liquid water repellent
   a. L & M Construction Chemicals (Pentane WB40).
   b. Nox-Crete Chemicals Inc. (Stifel VC).
   c. Or an approved equivalent

Part 3 - **EXECUTION**

3.01 PREPARATION

A. Protect adjacent surfaces not intended to be covered.

B. Clean surfaces to be covered in accordance with manufacturer's recommendations.

C. Make all mortar repairs at least 48 hours prior to application.

D. Allow masonry surfaces to cure minimum of 10 days prior to application.

3.02 INSTALLATION AND APPLICATION

A. Install products in accordance with manufacturer's instructions.

1. Apply as much material as required to obtain results required by Subsection 3.03, but as a minimum, and apply material in accordance with manufacturer's recommendations.

B. Apply to exterior concrete block surfaces.

3.03 FIELD QUALITY CONTROL

A. The manufacturer's designated representative shall conduct a water spray test on an area of wall for a period of 3 hours. Water from the spray shall impact the wall at a 45-degree angle to the vertical and shall cover an area of not less than 9 square feet.

B. Water flow shall be minimum 5 GPM at 60 PSI pressure. If within 3 hours the water transmission appears on the inside face of the wall within the test area, the wall shall be recoated.

C. Retest as required.

D. Recoat as required until wall area remains dry within limits of testing procedure.

E. Results of this test shall be used to determine material quantity in excess of the manufacturer's minimum recommended amounts to be applied per square foot to the building wall.

F. Protect adjacent materials not required to be coated.

3.04 ATMOSPHERIC CONDITIONS

A. Follow the manufacturer’s recommendations for application conditions.

****END OF SECTION****

SECTION 07 21 05
BUILDING INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the attic insulation for the control building.

1.02 REFERENCES

A. Referenced Standards:

1. American Society for Testing and Materials (ASTM):
   a. C516, Standard Specification for Vermiculite Loose Fill Thermal Insulation
   b. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
   c. E84, Standard Test Method for Surface Burning Characteristics of Building Materials
2. Underwriters Laboratories Inc. (UL):
   a. Building Materials Directory

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 13.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced
   b. Manufacturer's installation instructions
   c. Manufacturer's recommendations on sealants and mastics

B. Miscellaneous Submittals:

1. See Section 01 33 13.
2. Letter from insulation manufacturer stating that insulation proposed is acceptable for intended use per the Drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contact Documents, the following manufacturers are acceptable for blanket or batt insulation (foil backed):

1. Owens-Corning Fiberglass Corp
2. CertainTeed

2.02 MATERIALS

A. Blanket or Batt Insulation:

1. Glass or other inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets
2. Thermal conductivity (k-value at 75°F): 0.27
3. Foil faced vapor barrier laminated to one face with 1-inch flanges on long edges
4. Flame spread: ASTM E84, not greater than 25

5. Minimum thickness as noted on Drawings

B. Vapor Barrier:

1. Minimum 1 mm thick aluminum foil between two layers of 1/2 mm thick Mylar polyester
2. Perm rating: Not exceeding 0.02
3. Flame spread: ASTM E84, 25 maximum
4. Similar to alumiseal "Zero-Perm Vapor Barrier"

C. Vapor Barrier Tape:

1. As recommended by vapor barrier manufacturer

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:

1. Insulate full thickness over surfaces to be insulated
2. Fit tightly around obstructions, fill voids
3. Cover all penetrations with insulation
4. Seal all joints with sealant or tape as applicable
5. Seal or tape to abutting materials to maintain vapor tightness
6. Tape butted joints of Batt or blanket insulations
7. Apply single layer to achieve total thickness
8. Do not use broken or torn pieces of insulation
9. Install so that completed installation is vapor tight
10. If vapor barrier tape fails to adhere to any surface, apply sprayed-on adhesive as recommended by tape manufacturer to promote adhesion

C. Blanket or Batt Insulation with or without Vapor Barrier:

1. Set with vapor barrier to warm side of building attic. Do not obstruct ventilation spaces
2. Fill all miscellaneous voids indicated on Drawings to be insulated
3. Tape joints and ruptures in vapor barrier
4. Use vapor barrier tape and seal each area of insulation to surrounding construction to assure vapor-tight installation
5. At Contractor's option, provide blanket or Batt insulation without vapor barrier and provide separate vapor barrier as specified

3.02 FIELD QUALITY CONTROL

A. Repair or replace damaged insulation as directed by the Engineer.

**** END OF SECTION ****

SECTION 07 25 00
WEATHER BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes sheet and sealant materials for controlling air and vapor diffusion under concrete slabs and wall panels.

1.02 REFERENCES

A. ASTM International:

1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

B. Sealant, Waterproofing and Restoration Institute:

1. SWRI - Sealant Specification

1.03 PERFORMANCE REQUIREMENTS

A. Vapor retarder permeance: Maximum .036 perm under slab and 0.13 at interior wall and ceiling construction when tested in accordance with ASTM E96, Procedure A.

SUBMITTALS

A. Comply with Section 01 33 13 Submittals

B. MSDS data sheet

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with SWRI - Sealant and Caulking Guide Specification requirements for materials and installation

1.05 SEQUENCING

A. Sequence work to permit installation of materials in conjunction with other retardant materials and seals

B. Do not install vapor retarder until items penetrating vapor retarder are in place

PART 2 - PRODUCTS

2.01 VAPOR AND AIR BARRIERS

A. Under Slab Vapor Barrier: 10 mil minimum, 52#/in tensile strength, 2600g puncture resistance, 0.036 perm rating maximum; seams to be lapped and sealed per manufacturer; Vapor Block 10 (VB10) by Raven Industries, Inc. www.vaporblock.com

2.02 ACCESSORIES

A. Thinner and cleaner for sheet: As recommended by sheet material manufacturer

B. Tape: Self-adhering type, compatible with sheet material, as recommended by the system manufacturer

PART 3 - EXECUTION

3.01 PREPARATION

A. Remove loose or foreign matter capable of impairing adhesion

B. Clean and prime substrate surfaces to receive Barrier and Tapes

3.02 INSTALLATION

A. Slab Vapor Retarder: Secure sheet retarder to solid construction with tape or continuous metal bar with anchors. Lap edges and ends 6 inches and adhesive seal or caulk per manufacturer's instructions to ensure complete and continuous seal.

B. Apply retarders and barriers within recommended application temperature ranges. Consult manufacturer when material systems cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.

**** END OF SECTION ****

SECTION 07 32 16
CONCRETE TILE ROOF

PART 1 - GENERAL

1.01 GENERAL

A. This section describes the control building's concrete tile roof and its appurtenances.

1.02 SUBMITTALS

A. The Contractor shall submit information to substantiate compliance with this specification in accordance with Section 01 33 13, Submittals. In addition, the following specific information shall be provided.

1. Color chart of the available colors of the concrete tile.
2. One sample tile of the color selected by the District.
3. Vendor literature

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Boral Saxony 900 Shake or an approved equal.

2.02 APPURTENANCES

A. Provide underlayment and battens as recommended by the supplier and the Tile Roofing Institute.

B. Provide ridge and gable edge tiles as required.

C. Provide flashing as per Section 07 60 00.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Roofing shall be provided by a contractor regularly engaged in tile roof installation for the last five years.

B. Install the tile roof as recommended by the supplier and the Tile Roofing Institute.

****END OF SECTION****

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SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the control building's architectural flashing and sheet metal work.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. The Aluminum Association (AA):
   a. 45, Designation System for Aluminum Finishes
2. American Society for Testing and Materials (ASTM):
   a. A653, Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanized) by the Hot-Dip Process
   b. B32, Specification for Solder Metal
   c. B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   d. B308, Specification for Aluminum-Alloy 6061_T6 Standard Structural Profiles
3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
   a. Architectural Sheet Metal Manual Fourth Edition, 1987
   b. Architectural Sheet Metal Specifications

B. Qualifications:

1. The sheet metal fabricator shall have minimum of 10 years of experience in fabrication of sheet metal items similar to items specified.
2. The sheet metal installer shall have minimum of 5 years of experience installing sheet metal items specified.

1.03 DEFINITIONS

A. Installer or Applicator – Installer or applicator is the person actually installing or applying the product in the field at the Project site.

1. Installer or applicator is synonymous

1.04 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 13.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced
   b. Manufacturer's installation instructions
3. Fabrication and/or layout drawings:
   a. Scaled drawing showing expansion joint locations, special conditions, profile, fastening, and jointing details.

B. Samples:

1. Finish and color samples for each product specified for the Engineer's selection.
   a. Colored pictures or color cards are not acceptable

C. Miscellaneous Submittals:

1. Fabricator qualifications
2. Installer qualifications
3. Warranty

1.05 WARRANTY

A. Furnish 5-year warranty on sheet metal work signed jointly by the Contractor and the sheet metal installer

1. Agree to repair or replace work which leaks water or, where applicable, air or deteriorates excessively, including color failure, or otherwise fails to perform as watertight and, where appropriate, airtight flashing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable for the reglets:

1. Fry Reglet Corp
2. Superior
3. Cheney

2.02 MATERIALS

A. Fasteners: Non-ferrous, compatible with sheet metal

B. Retainer Clips and Continuous Cleats: Galvanized steel or stainless steel

C. Solder: ASTM B32

D. Dissimilar Metal Protection: Provide materials with appropriate dielectric attachments that prevent corrosion due to dissimilar metals

E. Reglets: Non-ferrous, compatible with sheet metal

2.03 ACCESSORIES

A. Accessories as required to form a complete water and airtight system

2.04 FABRICATION

A. Retainer Clips and Continuous Cleats: 16 GA galvanized steel, G60 coating minimum

B. Reglets:

1. Profiles required for uses shown on Drawings
2. Use 24 GA galvanized steel with galvanized steel sheet metal
3. Provide interior and exterior factory fabricated corners at all corner locations
4. Use 0.020-in stainless steel with aluminum or stainless steel sheet metal
5. Fabricate as required to fit special conditions
6. Similar to Fry Reglet Corporation "Original Reglet" for use in masonry

C. Shop fabricate items to maximum extent possible

1. Fabricate true and sharp to profiles and sizes indicated on Drawings
   a. Shop fabricate and weld or solder all corners

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.

B. If such items are not provided in time for installation, the sheet metal fabricator shall cut in and install.

3.02 INSTALLATION

A. Install products in accordance with the manufacturer's instructions, SMACNA, and as indicated on Drawings

B. Solder steel and weld aluminum to achieve weather tight joints and required details; do not solder or weld slip joints and prefinished items

C. Set top edges of membrane flashing and sheet metal flashing into reglets

D. Fasten materials at intervals recommended by SMACNA

E. Install slip joints to allow for thermal movement as recommended by SMACNA and manufacturer.

1. Maximum spacing: 10 ft OC
2. Provide slip joint 24 in from corners
3. Provide slip joint at each vertical expansion joint location in wall
    a. Provide break in continuous cleat at each vertical expansion joint

F. Caulk slip joints with two beads of sealant on each side of slip joint overlap

G. Caulk all exposed joints of coping with sealant to match color of metal being sealed

H. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures

I. Provide dissimilar metals and materials protection where dissimilar metals come in contact or where sheet metal contacts mortar, concrete masonry, or concrete

J. Provide all components necessary to create watertight junctures between roofing and sheet metal work

K. Provide all miscellaneous sheet metal items not specifically covered elsewhere as indicated or required to provide a weather tight installation

**** END OF SECTION ****

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SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Fire stopping and through-penetration protection systems, materials and accessories; fire stopping tops of fire rated walls; and smoke sealing at joints between floor slabs, roof deck penetrations and exterior walls. Fire safing at columns, beams, walls, metal decking, building cladding and other areas shown or indicated on Drawings.

B. All penetrations through masonry and fire rated walls.

C. Related sections

1. Section 09 22 16 – Non-Structural Metal Framing
2. Section 09 21 00 – Gypsum Board Assemblies
3. Plumbing & Mechanical Penetrations - Division 15
4. Electrical Penetrations - Division 16

1.02 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Fire stops.
4. L 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.03 PERFORMANCE REQUIREMENTS

A. Fire stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

B. Fire Resistance Classification: Provide assemblies that have been tested and certified by UL or W/H for fire ratings indicated on the drawings.

C. Applicator shall meet on site with fire stopping and safing materials manufacturer and review material and installation systems verifying that each system is applicable to as constructed conditions. All changes necessary to meet fire rating shall be done at no additional cost to Owner.

1.04 SUBMITTALS

A. Comply with section 01 33 13 Submittals

B. MSDS data sheet

C. Engineering judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

D. Provide submittals for each penetration condition and reviewed and approved for application by Fire Stopping material manufacturer

1.05 QUALITY ASSURANCE

A. Through penetration fire stopping of Fire Rated assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour

   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour

B. Fire resistant joints in Fire Rated wall assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed

C. Surface burning characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84

1.06 QUALIFICATIONS

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

B. Applicator: Company specializing in performing work of this section with minimum three years documented experience, and approved by materials manufacturer

1.07 ENVIRONMENTAL REQUIREMENTS

A. Provide ventilation in areas to receive solvent cured materials

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C)

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials

1.08 DELIVERY, STORAGE AND HANDLING

A. Provide protection:

1. Store in dry area on pallets off floor
2. Protect materials from physical damage, from becoming wet or soiled and from low or excessively high temperatures
3. Comply with manufacturer's recommendations for handling, storage and protection during installation

1.09 SEQUENCING

A. Sequence work to permit fire safing materials to be installed after adjacent and surrounding work is complete

1.10 WARRANTY

A. Provide warranty that products meet or exceed UL/WH requirements

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Specified Technologies Inc. Somerville NJ. (916) 386-1100

B. Cafco (201) 347-1200

C. Pecora

D. 3M St Paul, Minn.

E. Fire Shield Material: Hilti Corp., Tulsa OK.

F. USG Therma Fiber

G. W. R. Grace “Flame Safe”

2.02 MATERIALS

A. Mineral wool batts: USGA Thermafiber, UL/WH approved, complying with requirements for safing and caulking systems being used. Minimum Thickness: 3" 6 psf.

B. Top of Wall Fire stop Fill Material:

1. Specified Technologies Inc. HWD 0456
2. Cantilever 1-1/2 inch : Specified Technologies Inc. HWD 0365
3. Perpendicular condition: Specified Technologies Inc. HWD 0136
4. Systems as detailed, specified or as otherwise required

2.03 RATED WALL PENETRATIONS

A. Complete fire stopping system meeting listed fire ratings as shown, indicated and required. All materials by one (1) manufacturer. Each penetration fire stopping system shall consist of all pads, mats, safing, caulking, sealants and other items required to achieve UL listed systems. Meeting listed wall ratings.

B. Through Wall Fire Stop Material

1. Specified Technologies Inc. WL 1222 Pipes through gypsum drywall partitions 1 hr. rating, similar at masonry walls
2. Specified Technologies Inc. WL 8026 multiple pipes through gypsum drywall partitions 1 hr. rating, similar at masonry walls

2.04 DATA CABLE

A. Through Wall: Specified Technologies Inc. EZ Path 33 series, UL: WL 3218

2.05 ACCESSORIES

A. Primer: Type recommended by fire stopping manufacturer for specific substrate surfaces and suitable for required fire ratings

B. Dam Material: Permanent:

1. Mineral fiberboard
2. Mineral fiber matting

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place

PART 3 - EXECUTION

3.01 INSTALLATION

A. Do not apply masonry water repellent prior to fire stopping installation

B. Prepare and clean substrate, apply bonding adhesive and install material in accordance with manufacturer's written instructions and UL approval

C. Protect adjacent surfaces from damage by material installation

D. Dam material shall be non-combustible

E. Apply material in sufficient thickness to achieve rating, following manufacturer's instructions and UL/WH requirements

3.02 FIRE CAULKING

A. Install material at walls, floors, partition openings, penetrations and other areas as shown or indicated on drawings, which contain penetrating sleeves, piping, ductwork, conduit and all other items requiring fire stopping

3.03 CLEANING

A. Clean up after completion. Clean up rubbish resulting from work, remove from premises and dispose of it off site in a legal manner. Leave adjacent areas not scheduled to be fireproofed clean of debris, over spray, drips, etc. Protect adjacent surfaces from damage by material installation.

**** END OF SECTION ****

SECTION 07 91 00

PREFORMED JOINT FILLERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies preformed joint fillers as required to complete the required work as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Reference – This section contains references to the following documents:

Reference	Title
ASTM D994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

B. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

PART 2 - PRODUCTS

2.01 PREFORMED ASPHALT FIBERBOARD

A. Preformed asphalt fiberboard joint filler shall be in accordance with ASTM D994 and shall be 1/2 inch thick unless otherwise specified.

2.02 PREFORMED RESIN-BONDED CORK

A. Preformed resin-bonded cork joint filler shall be in accordance with ASTM D 1752, Type II. Cork joint filler thickness shall match the specified joint width.

2.03 PRODUCT DATA

A. The Manufacturer’s recommendations for the handling and installation of the material shall be provided in accordance with Section 01 33 13.

PART 3 - EXECUTION

3.01 GENERAL

A. Preformed joint fillers shall be placed into position before the concrete is poured. Where it is necessary for the filler to be fixed to existing concrete or other building materials, a suitable adhesive recommended by the filler manufacturer shall be used. Filler surfaces shall be clean and dry prior to the placement of the concrete.

3.02 PREFORMED ASPHALT FIBERBOARD

A. Preformed asphalt fiberboard joint fillers shall be used for expansion joints in concrete sidewalks, curbs, and roadways.

3.03 PREFORMED RESIN-BONDED CORK

A. Preformed resin-bonded cork joint filler shall be used for expansion joints in concrete structures. The expansion joint shall be sealed with a backer rod and sealant as specified in Section 07 92 00.

**** END OF SECTION ****

SECTION 07 92 00
SEALANTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies sealants as required to complete the required work as shown on the Drawings and specified herein.

1.02 REFERENCES

A. This section contains references to the following documents:

Reference	Title
FEDSPEC TT -S-00230C	Sealing Compound: Elastomeric Type, Single Component
FEDSPEC IT-S-00227E	Sealing Compound: Elastomeric Type, Multi-Component

PART 2 - PRODUCTS

2.01 POLYURETHANE SEALANT

A. Acceptable Products – Acceptable products shall be Sikaflex by Sika Chemical Corporation, Vulkem by Mameco International, U-Seal Joint Sealant by Burke Company, or Rubber Calk by Products Research and Chemical Corporation.

B. General – Polyurethane sealants shall conform to FEDSPEC IT-S-0230C for one-component systems and FEDSPEC TT-S-00227E for two-component systems. Polyurethane sealant shall be one of the following two types:

1. Self-Leveling – Self-leveling polyurethane sealant shall be Type I, Class A as specified by the FEDSPECs referenced above.
2. Non-sag – Non-sag polyurethane sealant shall be Type II, Class A as specified by the FEDSPECs referenced above.

C. Primer – Primer shall be as recommended by the sealant manufacturer.

D. Backer Rod or Backer Tape – Backer rod shall be open cell polyethylene or polyurethane foam. Rod shall be cylindrical unless otherwise specified. Backer tape shall be polyethylene or polyurethane with adhesive on one side.

2.02 MASTIC SEALANT

A. General – Mastic joint sealant shall consist of a blend of refined asphalts, resins and plasticizing compounds, reinforced with fiber. Sealant shall be compatible with joint fillers and shall be pressure grade.

B. Primer – Primer shall be as recommended by the mastic sealant manufacturer.

2.03 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 33 13 Submittals:

1. Manufacturer's product data showing conformance to the specified products.
2. Manufacturer's recommendations for storage, handling and application of sealants and primers.

PART 3 - EXECUTION

3.01 GENERAL

A. Sealants and primers shall be applied according to the sealant manufacturer's recommendations. Polyurethane sealants shall be used on all expansion joints and specified construction joints.

B. Joints and spaces to be sealed shall be clean, dry and free of dust, loose mortar, concrete and plaster. Additional preparation of joints and spaces shall be provided in accordance with manufacturer's recommendations. Primer shall be applied only to the surfaces that will be covered by the sealant.

3.02 SURFACE CONDITIONS

A. Inspection:

1. Prior to all caulking, carefully inspect the surfaces to which caulking is to be applied and verify that they are clean, sound, and free from deleterious material which might adversely affect the bond
2. Verify that caulking may be installed in accordance with the manufacturer's recommendations

B. Corrections:

1. Clean all surfaces as necessary
2. In the event of discrepancy, immediately notify the Engineer
3. Do not proceed with installation of caulking in areas of discrepancy until all such discrepancies have been resolved

3.03 CHOICE OF CAULKING MATERIAL

A. Use only that caulking material which is best suited to the installation and is so recommended by the caulking material manufacturer.

3.04 PREPARATION AND INSTALLATION

A. Joint Design: Size of joint shall be calculated to allow for anticipated movement to be within the capabilities of the approved sealant. Unless otherwise required by sealant manufacturer's printed recommendations, use backing material to control sealant depths as follows:

1. Minimum Width: Not less than 1/4" wide.
2. Minimum Depth: Not less than 1/4" deep.
3. Maximum Movement: The width of the joint shall be wide enough to allow the sealant to work within its limitations.
4. Width/Depth Ratio: The depth of the sealant should be no greater than the width. As a general rule the width should be twice the depth. If joint width is over ½ inch, caulking shall remain ½ inch thick across joint.

B. Joint Cleaning: Clean all joints thoroughly, and blow out or vacuum loose particles from joints. Material in contact with sealant shall be dry, fully cured, and free of laitance, loose aggregate, form release agents, curing compounds, water repellants, paint, and other surface treatments. Surfaces with protective coatings shall be cleaned to remove protective coatings or oil deposits. Joints in masonry and concrete work shall not be sealed until substrate has cured a minimum of 12 days minimum.

C. Primers: Primer shall be provided on metal, masonry, concrete, and wood surfaces, and other surfaces as recommended by the sealant manufacturer. Primer shall not be applied to surfaces which will be exposed after caulking is completed.

D. Joint Backing: Backing shall be installed in all joints to receive sealant. Backing shall be sized to require 20% to 50% compression upon insertion, and placed in accordance with "Joint Design" paragraph. In joints not of sufficient depth to allow backing, install bond breaking tape at back of joint. Avoid lengthwise stretching of backing material.

1. Backing material shall be a resilient type such as Soft-Backer Rod closed cell backer rod, as recommended by the manufacturer. Oakum or other types of absorptive materials shall not be used as a backing material. When closed cell backing is used, care must be exercised to avoid puncturing of the skin opening up the cell structure.
2. Install closed cell rod 24 hours prior to application of sealant to allow outgassing of rod.

3.05 APPLICATION

A. Apply sealant immediately after joints are cleaned, primed and backed. Work in vertical surfaces shall be done with standard hand-caulking guns or power actuated caulking guns. The sealant shall be extruded through nozzles of such diameter as to allow a full bead of materials to run into joint, and not to exceed width of joint. Force sealant into joint by tooling to ensure full contact with side-walls and backing.

3.06 JOINT FINISHING

A. Neatly tool joints to slightly concave surface using methods recommended by sealant manufacturers. Repair any air pockets exposed by tooling. Tool so as to compress material and improve adhesion to surface joints. At horizontal traffic joints, tool joints 1/8" below finish grades. At horizontal building flashing joints, tool material to divert water away from joint or to prevent the ability to collect water.

3.07 CLEAN UP

A. All surfaces adjacent to the sealant shall be cleaned of all excess sealant or primer and left in neat condition subject to the approval of the Engineer.

3.08 SCHEDULE

A. Polyurethane: Concrete, masonry, aluminum, wood, door and window frames, exterior trim

B. Silicone: Glass to Glass, Glass to Aluminum, Solid Surfacing, Plastics and Metals, other as approved by material manufacture and Engineer

C. Acrylic Latex: Interior Use Only. Paint, Gypsum Drywall, trim, etc

3.09 POLYURETHANE SEALANTS

A. General – Non-sag polyurethane sealants shall be used on vertical joints. Self-leveling polyurethane sealants shall be used on horizontal joints.

B. Joint Dimensions – Unless otherwise specified, joints and spaces to be filled shall be constructed to the following criteria. Joints and spaces shall have a minimum width of 1/4 inch and a maximum width of 1 inch. The depth of the sealant shall be one-half the width of the joint, but in no case less than 1/4 inch deep. Sealant depth shall be measured at the point of smallest cross section. When joints exceed the depth

requirements, backing rod shall be inserted to provide the joint depth specified. If the joint sealant depth is within the specified tolerances, backer tape shall be placed in the bottom of the joint.

3.10 MASTIC SEALANT

A. Joint Dimensions – Joints to be sealed shall be 2 inches deep, 1 inch wide at the top, and 3/4 inch wide at the base.

**** END OF SECTION ****

SECTION 08 11 13
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies control building's electrical room steel doors and frames.

1.02 QUALITY ASSURANCE

A. References – This section contains references to the following documents:

1. ANSI A123.1
2. ANSI/SDI-100.
3. Underwriters' Laboratories: Requirements for Construction and Labeling on Fire Doors.
4. NBHA: "Recommended Locations for Builders Hardware."
5. FS FF-S-325.
6. FS DD-G-451.
7. DHI: Door and Frame Preparation for Hardware.

B. Certificates of Compliance – The manufacturer's certificates shall be provided attesting that doors, frames, and accessories meet the specified requirements. The grade and model number of each door shall be included.

1.03 SUBMITTALS

A. Product Data:

1. Submit product data in accordance with Section 01 33 13.
2. Submit material list of items proposed to be provided under this section.

B. Shop Drawings – Shop drawings will be provided by the Contractor and include the following information:

1. Elevations of each door type
2. Size of doors and frames
3. Metal gauges
4. Details of door and frame construction
5. Methods of anchorage
6. Louver details
7. Glazing details
8. Weather stripping
9. Provisions for and location of hardware
10. Details of installation
11. Schedule showing location of each door, frame, and swing of door
12. Submit detailed specifications and instructions for installation, adjustments, cleaning, and maintenance.

1.04 PRODUCT HANDLING

A. Doors, frames, and accessories shall be delivered undamaged and with protective wrappings or packaging. Doors and frames shall be stored on platforms under cover in clean, dry, ventilated, and accessible locations with 1/4-inch airspace between doors. Damp or wet packaging shall be removed immediately and affected surfaces wiped dry. Damaged materials shall be replaced with new.

PART 2 - PRODUCTS

2.01 STEEL DOORS

A. General – Steel doors shall be 1-3/4 inches thick and conform to ANSI 100 and shall be used for the electrical room of the control building. Doors shall be either hollow steel construction or composite construction, and shall be prepared to receive hardware specified in Section 08 17 43.

B. Hollow Steel Doors – Unless otherwise specified, hollow steel doors and transom panels shall be fabricated from cold rolled steel and shall be extra heavy duty doors conforming to ANSI 100, Grade III, Model 3, of the sizes and designs specified. Face sheets, as well as lock and hinge edges, shall have a smooth, seamless, and unbroken surface with top and bottom edges closed flush to the door face sheets. No inverted channels will be allowed.

C. The inner structure shall be formed as a unitized grid composed of minimum 18-gage steel vertical and horizontal channels with rigidized webbing. The grid shall be unitized by double projection welding at each junction and the applicable hardware reinforcements attached by multiple welds. The grid shall form the flush top and bottom sections of the door. Hinge and lock accommodations shall be pre-formed as an integral part of the continuous vertical member forming the periphery of the unitized grid. The back-up reinforcement of hinges and lock shall extend no less than 5 inches into the interior of the unitized grid and join the parallel inner vertical member of the grid structure. Inside surfaces of the face sheets shall be coated with a synthetic resin based sound deadener. The face sheets shall be attached to the grid assembly by double projection multiple series welds.

D. All doors and transom panels shall be insulated and shall have a full door thickness of polystyrene or polyurethane insulation to provide an overall door insulation value of R7.

2.02 STANDARD STEEL FRAMES

A. General – Steel frames shall conform to ANSI 100, shall be of the sizes and shapes specified, and unless otherwise specified, shall be fully welded unit type frames. Steel frames shall be provided for doors, transoms, and windows.

1. Welded Frames – Frame faces shall be continuously welded at comer joints. Stops and rabbets shall be mechanically interlocked or continuously welded. All welds shall be ground smooth. Frames shall be mortised and reinforced with heavy gage reinforcements for hinges and lock strikes. Steel spreaders to ensure proper alignment of the frame shall be used and shall remain in place until adjacent wall construction is complete.
2. Anchors:
    a. General – Steel anchors shall be provided to secure the frame to adjoining construction. Anchors shall be zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.
    b. Wall Anchors – A minimum of three anchors shall be provided for each jamb. Anchors shall be located opposite top and bottom hinges and midway between.
        1) Anchors for masonry work shall be corrugated or perforated steel straps or 3/16-inch diameter steel wire, adjustable or T -shaped
        2) Anchors for stud partitions shall be welded or otherwise securely fastened to backs of frames. Anchors shall be designed and fastened to wood

studs with nails, to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding

3) Frames shall be secured to previously placed concrete or masonry with expansion bolts in accordance with SDI III-F
4) Anchors for solid plaster partitions shall be secured solidly to back of frames and tied into the lath. Adjustable top strut anchors shall be provided on each side of frame for fastening to structural members or ceiling construction above. Size and type of strut anchors shall be as recommended by the frame manufacturer

c. Floor Anchors – Floor anchors drilled for 3/8-inch anchor bolts shall be provided at bottom of each jamb member. Where floor fill occurs, bottom of frames shall be terminated at the indicated finished floor levels and supported by adjustable extension clips resting on and anchored to the structural slabs.

2.03 WEATHERSTRIPPING

A. Weatherstripping shall be as required by door manufacturer.

2.04 HARDWARE PREPARATION

A. Doors and frames to receive finish hardware shall be reinforced, drilled, and tapped for hardware in accordance with the applicable requirements of SDI 107 and ANSI A115.1 and A115.4. Drilling and tapping for surface-applied hardware shall be done in the field, but additional reinforcing for surface-applied hardware shall be built into the door at the factory. Hardware shall be located in accordance with the requirements of ANSI 100, as applicable.

B. Provide louvers as shown on the drawings.

2.05 FINISHES

A. Hot-Dip Zinc Coated and Factory Primed Finished – Doors and frames shall be fabricated from galvanized steel, ASTM A653, Coating Designation G60 or A60 (galvannealed). Damaged zinc-coated surfaces shall be repaired by the application of zinc dust paint conforming to DOD-P-21035. Zinc-coated surfaces shall be phosphate treated and factory primed as specified in ANSI 100.

2.06 FABRICATION AND WORKMANSHIP

A. Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Exposed welded and soldered joints shall be ground smooth. Door frame sections shall be designed for use with the wall construction specified. Corner joints shall be well formed and in true alignment. Fastenings shall be concealed where practicable. On wraparound frames for masonry partitions, a throat opening shall be provided 1/8-inch larger than the actual masonry thickness. Frames in exposed masonry walls or partitions shall be designed to allow sufficient space between the inside back of trim and masonry to receive caulking compound.

2.07 PRODUCT DATA

A. Certificates of compliance specified in paragraph 1.02 B shall be provided.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Frames – Frames shall be set in accordance with SDI 105, and plumbed, aligned, and braced securely until permanent anchors are set. Bottoms of frames shall be anchored with expansion bolts or powder-actuated fasteners. Wall anchors shall be built in or secured to adjoining construction. Where frames require ceiling struts or overhead bracing, frames shall be anchored to the struts or bracing. Frames shall be backfilled with mortar. When an additive is provided in the mortar, inside of frames shall be coated with corrosion-inhibiting bituminous material.

B. For frames to be installed in exterior walls and to be filled with mortar or grout, the stops shall be filled with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

C. Doors – Doors shall be hung in accordance with clearances specified in ANSI 100. After erection and glazing, hardware shall be cleaned and adjusted.

3.02 PROTECTION

A. Doors and frames shall be protected from damage and damaged doors and frames repaired prior to completion and acceptance of the project or replaced with new, as directed. Rusted frames shall be wire brushed until all rust is removed, cleaned thoroughly, and applied with an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.03 CLEANING

A. Upon completion, exposed surfaces of doors and frames shall be cleaned thoroughly. Mastic smears and other unsightly marks shall be removed.

**** END OF SECTION ****

SECTION 08 17 43
FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies finish hardware, including trim, attachments, and fastenings specified or required for proper and complete installation.

1.02 SUBMITTALS

A. Product Data

1. Submit product data in accordance with Section 01 33 13.
2. Submit materials list of items proposed to be provided under this section.

B. Hardware List – The Contractor shall submit a hardware list, identifying each hardware item by manufacturer, manufacturer's catalog number, catalog cuts, and exact location in the work. The hardware list shall be in suitable form to facilitate ready checking and approval by the Engineer. Approval of the hardware schedule does not relieve the hardware supplier from the responsibility of furnishing the job complete.

1.03 PRODUCT HANDLING

A. Individually packaged each unit of finish hardware, complete with proper fastenings and appurtenances, clearly marked on the outside to indicate contents and specific locations in work.

PART 2 - PRODUCTS

2.01 GENERAL

A. Door Locks:

1. Furnish “Schlage” lever lock equipped with a cylinder that will fit a type “3” keyway with 6 pins to match the District keying system. Lock shall have a corrosion resistant finish suitable for marine applications. Lock shall have “storeroom function” defined as requiring a key for each outside entry and using a “Panic Bar” to allowing exit the rooms without a key.
2. Locks are not required for interior doors.

B. Latch Guards:

1. Furnish heavy duty exterior door latch guard construction of stainless steel, 3 inch wide and 11 inches tall to protect latch

C. Fasteners:

1. Furnish necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use.
2. Where necessary, furnish fasteners with toggle bolts, expansion shields, hex bolts, and other anchors approved by the Engineer, according to the material to which the hardware is to be applied and according to the recommendations of the hardware manufacturer.
3. Provide fasteners which match with the hardware as to finish and material.

4. All screws shall be full thread and shall have “Phillips” heads.

D. Flush Bolts:

1. Furnish and install flush bolts at the top and bottom of the door opposite the door lock.
2. Flush bolts shall be specifically designed for use with metal doors.
3. The Contractor shall make provisions at the top and bottom of the door frames for proper latching of the bolts.
4. Bolts shall be dark bronze and fully automatic.

E. Where butts are required to swing 180 degrees, furnish butts of sufficient throw to clear the trim. Butts on reverse bevel doors with locksets shall be non-removable pin (NRP).

F. Furnish silencers for door frames at the rate of three for each single door and two for each door or pair of doors; except doors with weather-strip, light seals, or sound seals.

G. Furnish thresholds and door bottoms as specified or as detailed.

2.02 KEYING

A. Key locks and cylinders as directed by the Engineer. Dead bolt and padlocks shall be keyed to meet the District’s standard keys.

B. Furnish four construction keys for each lock, for the Engineer’s inspection access and for operational access, and any additional quantity required by the Contractor.

C. Construction Keying:

1. Furnish a construction key system with construction keys for locks and cylinders.
2. Use only the construction keys during construction.

D. Upon acceptance of the pump station by the Owner, the Contractor shall utilize the services of a locksmith to field re-key locks to match Owner supplied standard keys for facility padlocks and deadbolts. Once the re-keying is completed, all standard keys will be returned to the Owner. This locksmith shall not provide copies of the standard keys to the Contractor.

2.03 DOOR STOPS AND HOOKS

A. The Contractor shall use an aluminum heavy duty wall mounted door stop with hook and holder by CRL or an approved equivalent for each of the doors.

2.04 DOOR CLOSERS

A. A Sargent 351 Series aluminum door closer or an approved equivalent shall be used for the electrical room doors.

B. A heavy duty corrosion resistant door closer shall be used for the chlorine room. The Contractor shall submit a suitable door closer for use in a chlorine room to the Engineer for their approval.

2.05 DOOR BUTTS

A. Hinges shall be full mortise, template type, unless half mortise hinges are required. Hinges shall have non-rising loose pins, ball or oil tight bearings and flat button tips, except when otherwise specified. Where necessary to keep door leaf clear of walls, casings, jambs, or reveals in door openings, wide throw hinges of an approved type

shall be furnished. For out swinging doors, hinges shall have a screw in the barrel to prevent removal of pin when door is closed.

2.06 TEMPLATES

A. In order to ensure proper placement and fit, all hardware for metal doors or metal frames shall be made and installed with a template. Templates or physical hardware items shall be furnished to manufacturers concerned and shall be supplied sufficiently in advance to avoid delay in the work.

2.07 TOOLS AND MANUALS

A. Deliver to the Engineer one complete set of adjustment tools and one set of maintenance manuals for locksets, latch sets, and closers.

2.08 CORROSIVE ENVIRONMENT HARDWARE

A. All finish hardware located inside the chlorine room shall be resistant to chlorine corrosion and be made out of aluminum, stainless steel, or PVC.

2.09 SCHEDULE OF HARDWARE

A. Single source for items:

1. Except as specifically otherwise approved in advance by the Engineer, furnish for each item only the product of a single manufacturer.
2. To the maximum extent practicable, furnish similar items as the product of a single manufacturer.

B. For each of the required items of finish hardware, provide from the specified manufacturer or and approved equivalent:

Item	Manufacturer
Butts	PBB or Stanley
Locks	Schlage
Key Lock Box	Mortise
Thresholds	Reese
Seals	Reese
Door Latch Guard	Latch
Flush Bolts	Trimco

C. All Schlage locksets shall have a type “C” keyway and will be lockable with “storeroom” function.

D. Weather stripping – Pemko, NGP, or an approved equal. Stripping to be surface mounted at head and jamb.

E. Exit Device – All doors shall be equipped with a panic bar.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

B. Upon completion of the work, as a condition of its acceptance, provide inspection, adjustment reports

3.02 INSPECTION AND ADJUSTMENT

A. The Contractor shall be responsible for proper installation and adjustment of all hardware items. Installation of hardware shall be checked by the Engineer after completion by the Contractor. Any items that do not fit properly, close, or otherwise perform in the manner intended or specified, shall be corrected prior to acceptance.

**** END OF SECTION ****

SECTION 08 62 23

TUBULAR SKYLIGHT

PART 1 - GENERAL

1.01 DESCRIPTIONS

A. This Section describes the tubular skylight (skylight) which consists of a roof dome, reflective tube, and diffuser assembly. The location of the skylight is shown on the drawings.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
2. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008a
3. ASTM A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; 2006
4. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; 2007
5. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004
6. ASTM E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System; 2006
7. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors; 2002
8. ASTM E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000
9. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
10. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane
11. ASTM D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position; 2006
12. ASTM D-1929 - Test Method for Ignition Properties of Plastics; 1996 (2001)
13. UL 181 - Factory Made Air Ducts and Air Connectors
14. ICC AC-16 - Acceptance Criteria for Plastic Skylights; 2008

B. Completed skylight assemblies shall be capable of meeting the following performance requirements:

1. Air Infiltration Test – Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283
2. Water Resistance Test – No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547
   a. Uniform Load Test:

b. No breakage, permanent damage to fasteners, hardware parts, or damage to make system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 60 psf (2.87 kPa) in accordance with ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPA) if tested per ICC AC-16 Section B
c. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330

3. Fire Testing:
   a. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the 2006 International Building Code
   b. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929
   c. Smoke Density - Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C
   d. Rate of Burn and/or Extent - Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635
   e. Rate of Burn and/or Extent - Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635

1.03 DEFINITIONS

A. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.

1.04 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 13 Submittals.
2. Fabrication and/or layout drawings:
   a. Submit shop drawings for all fabrications and assemblies including anchorage flashings, and accessories
3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced
   b. Preparation instructions and recommendations
   c. Manufacturer's installation instructions
   d. Storage and handling requirements and recommendations
4. Verification Samples: As requested by the Engineer
5. Test Reports – Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.
6. Manufacturer’s Qualifications – Engaged in manufacture of skylights for a minimum of 15 years.

1.05 WARRANTY

A. Skylight: Manufacturer’s standard warranty for 10 years.

B. Labor: Two years

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Solatube International, Inc.

B. Or approved equivalent

2.02 MATERIALS

A. Skylight General – Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. Acceptable Models:

   a. Solatube – Brighten Up Series, Model 160 DS, 10 inches
   b. Or an approved equivalent.

C. Roof Dome Assembly – Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

2.03 ACCESSORIES

A. Fasteners – Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire – Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant – Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installation, inspect and verify condition of substrate. Installation of product constitutes the installer's acceptance of substrate condition for product compatibility.

B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

C. Field welding aluminum is not permitted unless approved in writing by the Engineer.

D. Clean surface thoroughly prior to installation.

E. Prepare surfaces using methods recommended by the manufacturer for achieving the best result for the substrate under project conditions.

3.02 INSTALLATION

A. Install in accordance with the manufacturer's printed instructions.

B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of the Engineer. Correct if needed before proceeding with installation of subsequent units.

3.03 PROTECTION

A. Protect installed products until completion of the project.

B. Touch-up, repair, or replace damaged products before Substantial Completion

**** END OF SECTION ****

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SECTION 09 91 00
ARCHITECTURAL PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work – The requirements and products listed in this specification shall only apply to the interior and exterior painting of the masonry building, and painting of the air louvers doors, gutters, roof flashings, downspouts, and other architectural elements of the masonry building.

B. For all paint or coating systems that are not specifically applied to the masonry building or an architectural component of the masonry building, refer to Section 09 96 56 Protective Pipe Coatings.

C. The qualified painting contractor shall furnish all labor, materials, equipment, services, and facilities necessary for the satisfactory completion of the project.

D. All unfinished surfaces shall be painted.

E. General Requirements – Materials for the project shall be of the highest grade products regularly manufactured by the paint manufacturer and conforming to the paint specifications outlined below. Paint materials shall be delivered in sealed containers that plainly show the designated product name, batch number, color, manufacturer's directions for application, and name of manufacturer. The paint shall be free of lead and other material which will be toxic to personnel under normal conditions of use.

1.02 QUALITY ASSURANCE

A. Follow manufacturers recommended procedure for surface preparation.

B. Painting Contractor – The painting Contractor shall hold a current C-33 painting and decorating license and have a minimum of 5 years of practical experience in the application of specified products to surfaces at similar facilities.

1.03 SUBMITTALS

A. The Contractor shall submit information to substantiate compliance with this specification in accordance with Section 01 33 13 Submittals. In addition, the following specific information shall be provided:

1. Material Safety Data Sheets (MSDSs) for all products.
2. Complete data on each of painting and primer. This shall be done whether or not the product is named herein. The Manufacturer's published application instructions.
3. Color chart for each paint for color selection by the Owner. Submit color chart two (2) weeks in advance of required pre-painting conference and walk through.
4. See Subsection 2.01 Materials, for additional submittal requirements for products not named in the specifications.

1.04 DELIVERY AND STORAGE

A. All materials shall be delivered to the site in the manufacturer's sealed containers. Each container shall be labeled by the manufacturer, and shall be intact upon delivery. Labels shall give the manufacturer's name, brand, type of paint, batch

number, color of paint, date of manufacture, storage life, and instructions for reducing.

B. The Contractor shall store all paint materials and equipment in a storage place protected from weather and excessive heat and cold. Necessary precautions shall be taken to reduce hazards to a minimum. Materials exceeding the storage life recommended by the manufacturer shall be removed from the site.

1.05 PROTECTION FROM OVERSPRAY AND DUST

A. The Contractor shall furnish all labor, equipment, and means required and shall carry out protective measures wherever and as often as necessary to prevent their operations from producing overspray or dust in amounts damaging to property or causing nuisance. The Contractor shall be responsible for any damage resulting from overspray or dust originating from their operations. The abatement measures shall be continued until all surface preparation and painting is completed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All paint and coating materials furnished for each coating system shall be the products of a single manufacturer.

B. Only compatible materials shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats.

C. The volatile organic content (VOC) of the applied coatings, as determined in accordance with ASTM D3960, shall comply with current air pollution regulations.

2.02 ACCEPTABLE PAINTING MANUFACTURERS

A. Manufacturers:

1. Dunn Edwards
2. Pittsburgh Paint
3. Or approved equal

2.03 COLORS

A. All colors and shades of colors of all coats of paint shall be as indicated or selected by the Owner. Finish colors shall be as selected by the Owner from the manufacturer’s standard range of color samples.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify that substrate conditions are ready to receive work.

3.02 PAINT APPLICATION AND WORKMANSHIP

A. All work shall be of a quality that will give the best possible finish and which will provide the maximum durability which can be reasonably expected from a painted surface. The finished surfaces shall be free from “holidays”, runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The coverage shall be complete and, when necessary, a second coat or more shall be applied to provide complete coverage and to produce a uniform thickness. All paint materials

shall be applied in accordance with the manufacturer's instructions and local regulations. Special attention shall be given to ensure that all surfaces including edges, corners, and crevices receive a firm thickness equivalent to that of adjacent painted surfaces.

B. If proper lighting does not exist in the unit, the Contractor shall be responsible to provide adequate lighting during painting and inspection.

C. Care shall be exercised to prevent paint from being spattered onto surfaces which are not to be painted. Surfaces from which paint cannot be satisfactorily removed shall be repaired/replaced or painted, as required, to produce a finish equal to the quality specified for newly painted or finished surfaces.

D. All moving parts (i.e., hinges) shall be left in proper working order.

E. Sufficient time, as recommended by the manufacturer, shall elapse between successive coats to permit proper drying/curing. This period shall be modified as necessary to suit adverse weather conditions. Paints shall be considered dry for re-coating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or lose adhesion of the undercoat.

F. All door hardware shall be installed after painting.

3.03 MIXING AND THINNING

A. Paint shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Where necessary to suit conditions of surface, temperature, weather, and method of application, packaged paint may be thinned immediately prior to application in accordance with the manufacturer's directions. The use of thinner for any reason shall not relieve the Contractor from obtaining complete coverage.

3.04 ATMOSPHERIC CONDITIONS

A. Follow the manufacturer's recommendations for application conditions.

3.05 CLEANING

A. As work proceeds, promptly remove finishes where spilled, splashed, or splattered.

B. During Painting Operations – Contractor shall remove dirt, debris, waste rubbish, and implements of service from the buildings, the work area, and the site at the end of each day. Debris, waste, or unused materials shall not be left under, in, or about the buildings and shall be disposed off the site every day. All paint materials, tools, clothing, oily rags, and waste must be removed from the buildings every night at an approved location. DO NOT dispose of any painting materials in the area's toilets, sinks, grounds, or sewers.

C. At Completion of Work – All glass, hardware, anodized surfaces and working areas where painting has been done shall be cleaned of all paint over spray, drips, splatters, etc.

D. Remove from the premises all tools, surplus materials, debris, scaffolding, equipment each day. Clean the areas thoroughly and remove all marks, stains, fingerprints, dust, paint drippings, and the like from the premises.

E. All paint shall be stored in a secure location every night to prevent vandals from tampering with the paint.

3.06 SCHEDULE – SHOP PRIMED ITEMS FOR SITE FINISHING

A. Exterior Doors:

1. One (1) coat of etching primer
2. Two (2) coats of 100% acrylic semi-gloss latex

3.07 SCHEDULE – EXTERIOR SURFACES

A. Steel – Galvanized: Gutters, flashings, louvers, etc.

1. One (1) coat of metal primer
2. Two (2) coats of enamel, gloss

3.08 SCHEDULE – FASCIA SURFACES

A. Primer/sealer: One (1) coat of Dunn Edwards “EZ-PRIME” Premium Exterior Wood Primer EZPR00-1 or approved equivalent.

B. Topcoat: Two (2) coats of Dunn Edwards “Evershield” Exterior/Interior Semi-Gloss Paint EVSH50-2 or approved equivalent.

3.09 SURFACES NOT TO BE PAINTED

A. Unless otherwise specified, the following surfaces shall be left unpainted:

1. Stainless Steel
2. Aluminum
3. Hot Dip Galvanized Items
4. Concrete
5. Glass
6. Equipment Nameplates

**** END OF SECTION ****

SECTION 09 96 50
PROTECTIVE PIPE COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. All buried and exposed ductile iron and steel pipes except for the following:
   a. Stainless steel
   b. Rubber
   c. Plastic pipe, including polyvinyl chloride and similar items

B. Related Sections:

1. Section 33 11 13 Piping Systems

C. The Contractor is to base this bid on using the products specified. If the products specified are not available or not available in formulations that meet applicable regulations on volatile organic compounds (VOC) levels at time of application, the Contractor is to submit for review products of equivalent quality and function that comply with regulations in effect at that time.

D. All steel pipes shall be fusion-bonded epoxy lined and coated

E. All ductile iron pipe shall be

1. Cement lined
2. Underground: Bituminous coated with tubular polyethylene encasement
3. Above ground: Epoxy Painted

1.02 REFERENCES

A. American Water Works Specifications (Latest Addition):

1. AWWA C151 Ductile Iron Pipe
2. AWWA C105 Polyethylene Encasement
3. AWWA C213 Fusion-Bonded Epoxy Coating

B. National Sanitation Foundation (Latest Addition):

1. NSF 61 Drinking Water System Components Health Effects

C. SSPC – Steel Structures Painting Council Specifications

1.03 DEFINITIONS

A. Dry Film Thickness (DFT) - The fully cured applied paint thickness for each coat.

B. Exterior Surface – The outside of a pipe.

C. Stripe Coat - Coating applied to the edge, corner, welds or bolts, which is applied prior to application of additional system coats.

D. Submerged - Surfaces that are under water during normal operating conditions.

E. Definition of Painting Terms: ASTM D16

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 13 Submittals.

A. Prior to ordering material, submit a complete schedule of materials to be used. Include the manufacturer's brand name, product name, and designation number for each coat.

B. Prior to commencing work, submit a detailed list of all surfaces and equipment items upon which the Contractor intends to apply protective coatings.

C. If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Engineer may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost.

1.05 QUALITY ASSURANCE

A. Environmental Regulatory Requirements:

1. All work, material, procedures, and practices under this Section shall conform to requirements of the local Air Resources Board or Air Quality Management District having jurisdiction. Prime or finish coat painting done in locations other than the project site shall be in accordance with air quality regulations in effect at the place the coating is applied. Contractor is responsible to confirm that products proposed are in compliance with the applicable volatile organic compounds (VOC) levels allowable at the date these Specifications were issued for bid.
2. The Air Resources Board or Air Quality Management District having jurisdiction may prohibit the sale or application of paints and enamels containing more than the stipulated percentages of volatile organic solvents manufactured after a stated date. Provide material meeting applicable regulations effective at the date of manufacture or, if not available, provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC solvents content.
3. If the Contractor applies coatings that have been modified or thinned other than as recommended by manufacturer, they will be responsible for any fines, costs, remedies or legal actions that may result.

1.06 WARNINGS

A. Be advised that as a part of this work abrasive blasting may be required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect adjacent facilities and personnel, at no additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver all coating materials in unopened containers with the manufacturer's label which must include name, batch number, and date and VOC content.

B. Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Dispose of used rags, thinner and buckets daily. Solvents shall be stored in closed approved storage containers.

1.08 COATING CONTRACTOR REQUIREMENTS

A. The field coating activities under this Section shall require a C-33 painting and decorating license. The Contractor shall have a foreman with a minimum of 5 years of practical experience in the application of the specified coating products to surfaces

at similar facilities on site at all times during any site preparation and coating activities under this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paints used in each system shall be the product of one manufacturer.

B. Only compatible materials shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats.

C. All internal pipe coatings shall not contain lead and must be NSF–61 Certified.

D. Abrasives shall not be classified a hazardous material under California Title 22.

E. Materials – Paints and protective coatings listed in the Paint Systems and the Schedule in Part 3 of this Section refers to the following manufacturers and is specified as levels of quality. It is understood that the words "or equal" are included herein.

2.02 COLORS AND SAMPLES

A. Colors are to be factory mixed, using light-fast colorants proportioned by accurate measurement into proper type base. All coatings must be formulated to perform in the climate and environment to which they will be exposed.

B. For any above grade steel pipe the color shall be Engard's "Desert Sand", Glidden's "Pelt" or an approved equivalent.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION AND APPLICATION

A. Field Coating – Prepare surfaces in strict accordance with the manufacturer's instructions prior to application. Provide the manufacturer's instructions with submittal. Apply first coat immediately after surface preparation. Keep all paints at a consistency and applied in accordance with the printed directions of the manufacturer. The painting shall be done by hand, spray, or roller as approved by the manufacturer's recommendations. The Engineer and Contractor will review all surfaces to be painted on the job prior to application of any coatings. Once the Contractor begins undercoating or priming, this will be his guarantee that the surface is acceptable to paint. All painted surfaces are to be free from drips, ridges, holidays and brush marks. The following stipulations also apply:

1. Thinning permitted only when recommended by the manufacturer and only with thinner recommended for use with the particular product.
2. The use of additives to improve working characteristics or to lengthen or shorten set time is prohibited.
3. Items difficult or impossible to paint after installation are to be painted before installation and touched up after installation.
4. Apply each coat to a uniform, even coating; lay material on in one direction and finish at right angles. Allow material to thoroughly dry between coats.
5. Scuff, sand, runs, sags, overspray, surface roughness, and other defects shall be removed between each coat. Dust and wipe surface clean before applying next coat.

6. Apply no less than the number of coats or dry film thickness specified.
7. Apply additional coats if required for uniform coverage, full hiding, and to achieve continuity. Finished work is to be uniform in color, full coverage, smooth and free of sags and brush marks.
8. Apply each coat on all work only after all major construction is inactive and the work areas have been cleaned up and are dust free.
9. Apply all coatings within the manufacturer's recommended recoat window. If a topcoat passes the recoat window, submit a letter from the coating manufacturer stating what is required before the topcoat can be applied. Do not apply topcoat until the corrective action has been favorably reviewed by the Engineer.
10. Coat abrasive blast-cleaned surfaces with primer before visible rust forms. Apply painting system within 8 hours of blast-cleaning the surface.

3.02 FIELD QUALITY CONTROL

A. Pinhole and Continuity Testing:

1. After the application of the prime and finish coats of Paint Systems B, C and D, perform continuity and pinhole checking by means of a low voltage electrical resistance meter and check thickness with a magnetic thickness gauge to determine that pinhole free condition and specified film thickness of the paint system has been achieved over all of the painted surfaces. Repair all deficiencies in film integrity and thickness in accordance with the manufacturer's instructions. The Contractor shall provide pinhole and continuity testing equipment, conduct the test, and provide the test results to the Engineer. Notify the Engineer when the test will be held by at least 14 calendar days. The Engineer may elect or witness the test.
2. The Engineer or its independent testing consultant may perform its own continuity and pinhole checking and thickness checks in addition to the Contractor's required tests. The appropriate equipment and necessary support, if requested, is to be provided by the Contractor. Repair any additional deficiencies in film integrity and thickness per the manufacturer's instructions and to the satisfaction of the Engineer.
3. Attention is directed to the fact that past use of the low voltage electrical resistance meter has demonstrated that the painter must apply at least two and usually three or more stripe coats along all edges, angles and crevices formed by joining member in addition to the coats specified in order to achieve a pinhole free surface.

B. Adhesion Testing – Where there is a question of paint or coating adhesion to surfaces, demonstrate to the Engineer's satisfaction that the coating adhesion to the area in question is equal to or greater than that which the paint manufacturer literature states may be achieved by his product. An "Elcometer Adhesion Tester" shall be provided by and used by the Contractor to accomplish this test.

C. Continuity, Pinhole, and Adhesion Testing Support – Provide scaffolding, ladders, lighting, and labor as required to facilitate the Engineer's check. Repair any areas damaged during and by the testing operation.

D. Environmental Conditions:

1. Measure and record the temperature, dew point, and humidity daily (at the start of the day, prior to painting, and if conditions deteriorate). Maintain the records in

a place where the Engineer can check them. Submit the records to the Engineer at the end of the project.

2. Coatings shall be applied only to surfaces that are dry, and only under such atmospheric conditions as will cause evaporation rather than condensation. Coating shall not be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation. During damp weather, when the temperature of the surface to be coated is within 10°F of the dew point, the surfaces shall be heated to prevent moisture condensation thereon.
3. Bare metal surfaces, except those which may be warped by heat, may be dehydrated by flame heating devices immediately prior to coating application. During coating, and for a period of at least 8 hours after the coating has been applied, the temperature of the surfaces to be coated, the coated surfaces, and the atmosphere in contact shall be maintained at or above 50°F and not less than 10°F above the dew point. Coating, when applied, shall be approximately the same temperature as that of the surface on which it is applied. Fans or heaters shall be used inside enclosed areas where conditions causing condensation are severe.
4. Coating shall not be applied on surfaces hotter than 120°F or the maximum stated by the manufacturer if less.

E. Existing Coating Systems:

1. Unless otherwise specified, existing coating systems damaged by new construction shall be repaired and coated in accordance with the appropriate system specified for new work.
2. Contractor shall demonstrate that the existing coating is compatible with field coating by applying small test patches of specific coatings over existing coatings. If the existing coating is not compatible with the field coat (it lifts or ripples), the existing coating shall be re-primed with a primer compatible with both the existing coating and the field applied coating, or replaced with the proper prime coat. The primer shall be as recommended by the manufacturer of the field applied coatings.

3.03 QUALITY OF LINING AND COATING APPLICATION

A. The cured lining or coating shall be smooth and glossy with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.

3.04 CLEANING AND COMPLETION

A. At the completion of this portion of the work, remove all debris, remove all paint and stains from work for which paint finish is not intended, touchup all marred surfaces, and leave all buildings and structures in a clean condition, ready for use.

B. Refinish all damaged or imperfect painting to the satisfaction of the Engineer prior to final acceptance of the facility.

C. Finish work, except waterproofing mastics, is to present an even, pleasing and uniform color and appearance. Surfaces exhibiting coatings with shadows, streaks, overlap marks, sags, drips, roughness or non-uniform sheen will be considered as improperly applied and will not be considered acceptable.

D. Leave all machinery nameplate data tags clean and readable and all grease fittings clean and usable. Clean paint from windows and electrical equipment provided with factory coatings.

3.05 SPARE PAINT

A. Furnish one-gallon (minimum) container of each type and color of finish product used. Label containers. Each product shall have a minimum of 11 months of shelf life at project completion.

3.06 COATING SYSTEMS

A. The coating systems used for different types of surfaces are listed below and followed by specification for each:

Surface Type	System
Ferrous Metal – Continually or Intermittently Submerged	A
Ferrous Metal – Exposed to Atmosphere	B
Ferrous Metal – Fusion Epoxy Bonded	C
Underground Piping and Appurtenances	D
Underground Ductile Iron Pipe and Appurtenances	E

B. System A- Ferrous Metal – Continually or Intermittently Submerged:

1. General – All submerged metalwork, equipment, and exposed pipe work except as noted hereinafter shall be painted with this coating system. No coating is required on stainless steel or aluminum metal surfaces. Surface Preparation:
   a. All metal surfaces (non-galvanized) shall be field sandblasted according to SSPC-SP-10, “Near-White Metal Blast Cleaning”, to provide a surface profile of 1.5 to 2 mils.
   b. For non-ferrous and galvanized metal, pretreat with Paint System B-2b
2. Coatings:
   a. Tnemec: Prime coat shall consist of Tnemec 69-1211 H.B. Epoxyline II to a minimum dry film thickness of 3 mils. Finish coats shall consist of two or more coats of Series 69 - Color Epoxy, to a minimum dry film thickness of 10 mils. Total dry film thickness for this system shall be a minimum of 13 mils.
   b. Koppers: Prime coat shall consist of Koppers 654 Epoxy Primer to a minimum dry film thickness of 3 mils. Finish coats shall consist of one or more coats of Koppers Hi-Gard. Epoxy to a dry film thickness of 10 mils. Total dry film thickness for this system shall be a minimum of 13 mils.

C. <u>System B - Ferrous Metal, Miscellaneous Items – Exposed to Atmosphere</u>

1. General – All new exposed ferrous metal surfaces shall be pretreated and coated with this system with the exception of the generator, the motor control center, electrical panels, fusion epoxied pipe, and other equipment which may be factory coated per System C or a similar approved system. Exposed ferrous metal surfaces to be coated include all piping, fittings, and valves. Exposed conduits, junction boxes, communication and small power panels, and supports to be coated per System B unless otherwise specified.
2. Surface Preparation:
   a. All metal ferrous surfaces, except those with a factory pretreatment and primer, shall be sandblasted according to SSPC-SP-10, “Near-White Blast Cleaning”

b. For nonferrous and galvanized metal shall be prepared in accordance with SSPC-SP-7 (Brush-off Blast Cleaning). Nonferrous and galvanized metal not in contact with water shall be cleaned prior to the application of the prime coat in accordance with SSPC-SP-1 (Solvent Cleaning)

3. Coatings:
   a. Tnemec: Prime coat shall consist of Tnemec 135 (epoxy) to a minimum dry film thickness of 5 mils. Finish coats shall consist of one or more coats of Tnemec Series 75 (aliphatic acrylic polyurethane) to a minimum dry film thickness of 5 mils. Total dry film thickness for this system shall be a minimum of 10 mils
   b. Carboline: Prime coat shall consist of Carboline Series 893 Primer (polyamide epoxy) to a minimum dry film thickness of 3 to 5 mils. Finish coats shall consist of two or more coats of Carboline Series 133 HB (aliphatic acrylic polyurethane). Total dry film thickness for this system shall be a minimum of 10 mils

D. System C – Ferrous Metal – Above Grade Discharge Piping and Electrical Panel

1. General – All new above grade steel discharge piping, sample station enclosures, and meter control cabinet shall be lined and coated in the shop with a fusion-bonded epoxy.
2. Shop Application of Fusion-Bonded Epoxy Lining and Coating – Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed one square foot per item or piece of equipment. Do not use any item, pipe, or piece of equipment in which these requirements cannot be met.
3. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp comers, such as the outside edges of flanges, to a minimum radius of 1/4 inch.
4. Uniformly preheat the pipe, item, or piece of equipment prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.
   Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.
5. Apply a phosphoric acid wash to the pipe, item, or piece of equipment after sandblasting. The average temperature, measured in three different locations, shall be 80°F to 130°F during the acid wash procedure. The acid wash shall be a five percent by weight phosphoric acid solution. The duration in which the acid is in contact with the surface shall be determined by using the average temperature as tabulated below:

Pipe Temperature (°F)	Contact Time (Seconds)
80	52
85	45
90	36
95	33
100	28
105	24

110	21
130	10

6. After the acid wash has been completed, remove the acid with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.
7. Apply lining and coating by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 15 mils. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.
8. Apply lining and coating per AWWA C213 except as modified herein.
9. Grind 0.020 inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.
10. Coatings – Lining and coating shall be a 100 percent solids, thermosetting, fusion-bonded, dry power epoxy resin NSF 61 certified for potable water systems: Scotchkote 134 or 206N, Lily Powder Coatings "Pipeclad 1500 Red," H.B. Fuller IF-3003, or equal. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness	Barcol 17 (ASTMD 2583, Rockwell 50 (“M” scale)
Abrasion Resistance (maximum value)	1,000 cycles: gram removal 5,000 0.115 gram removal ASTM D 1044, Tabor CS 17 wheel, 1,000 gram weight
Adhesion (Minimum)	3,000 (Elcometer)
Tensile strength	7,300 psi (ASTM D 2370)
Penetration	0 mil (ASTM G17)
Adhesion overlap shear, 1/8-inch steel panel, 0.010 glue line	4,300 psi, ASTM 1002
Impact (minimum value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

11. Field-Applied Epoxy Coating for Patching – Use a two-component, 80 percent solids liquid resin, such as Scotchkote 306 or an approved equivalent.
12. Coating of Flexible Pipe Couplings – Line and coat couplings the same as the pipe. Color shall match the color of the pipe fusion epoxy coating.
13. Etch and coat above grade piping with color as stated in section 2.02 per paint system B

E. System D – Underground Steel Pipe and Appurtenances

1. General – Unless otherwise specified or factory painted with an approved system, buried pipeline items, such as valves, couplings and bolts shall be coated with this system.
2. Surface Preparation – Apply only to clean, dry surfaces. Remove rust, paint and other foreign matter by sand blasting (SSPC-SP-6), wire brushing, or scraping.
3. Coating:
   a. Lined and coated per AWWA C213
   b. Koppers: Two coats of Bitumastic Super Service Black, 13 mils each coat.
   c. Polyurethane Wrap

F. System E - Underground Ductile Iron Pipe and Appurtenances

1. General – Unless otherwise specified, all underground ductile iron pipe, fittings and appurtenances shall be coated with a factory bituminous coating and have a tubular polyethylene encasement and installed per manufacturer's recommendation per ANSI/AWWA C105/A21.5 and in accordance with Section 33 11 13 Subsection 2.05.
2. The polyethylene encasement shall be from Polywrap or an approved equivalent.

3.07 SURFACES NOT TO BE PAINTED

A. Unless otherwise specified, the following surfaces shall be left unpainted:

1. Stainless Steel
2. Bolt Threads
3. Aluminum
4. Butterfly Valve Actuator
5. Concrete
6. Glass
7. Machined Surfaces
8. Equipment Nameplates
9. Transducers
10. Copper

**** END OF SECTION ****

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SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes: Requirements for materials, fabrications and installation of all interior and exterior signs and plaques and associated accessory items as necessary to provide a complete and proper signage installation, as shown on Drawings.

B. Related Sections:

1. Section 09 91 00 – Architectural Painting, as may relate to touch up

1.02 SUBMITTALS

A. Comply with section 01 33 13 Submittals

1.03 QUALITY ASSURANCE

A. Signs as specified herein shall comply with CBC and CFC requirements

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Ensure timely delivery so products will be available at project site when required for installation so as not to delay job progress

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Kroy Sign Systems, LLC www.kroysignsystems.com

B. Best Manufacturing Sign Systems www.bestsigns.com

C. Or approved equal

2.02 MATERIALS

A. Colors shall be as specified herein or as selected by Owner or Engineer

B. Acrylic 1/4" minimum thickness signage, u.o.n. 8" shall be the minimum sign dimension. See Drawings and Schedules also

1. Electrical Room: ELECTRICAL CONTROL ROOM. 2" tall minimum white letters on contrasting background color to be selected
2. Chlorine Room Door: CFC / NFPA compliant signage per Floor Plan and Hazardous Material Schedule
3. No Smoking In This Building: 14" wide x 8" high minimum with white letters on red background; top line: NO SMOKING, bottom line: In This Building; Letters to be 3" tall minimum. Per CFC 5003.7.1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Install or apply all signs and plaques in locations indicated on Drawings.

2. All materials shall be installed level and plumb at 60” above finished walking surface to center of sign, unless noted otherwise.

3.02 ADJUST AND CLEAN

A. Clean and Touch-Up: Remove all packing and protection blemishes and thoroughly clean and polish all finish surfaces. Restore any marred or abraded surfaces to their original condition by touching up in accordance with the manufacturer’s recommendations. Touch-up shall not be obvious.

B. Defective Work: Remove and replace all defective work which cannot be properly repaired, cleaned or touched-up, as directed by Engineer, with no additional cost to Owner

C. Protect installed work during the construction period to prevent abuse and damage

3.03 CLEAN UP

A. Remove excess materials and debris and dispose of offsite in a legal manner

**** END OF SECTION ****

SECTION 10 44 16
FIRE EXTINGUISHER

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes details pertaining to the electrical room's fire extinguisher.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. National Fire Protection Association (NFPA):
   a. 10, Standard on Portable Fire Extinguishers
2. Underwriters Laboratories, Inc (UL):
   a. Building Materials Directory
3. Factory Mutual System (FM):
   a. Approval Guide - Latest Edition

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 13.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced
   b. Manufacturer's installation instructions

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver and install filled and charged extinguisher just prior to building occupancy

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable for fire extinguishers:

1. J L Industries
2. Larsen's Manufacturing Co
3. Muckle Manufacturing
4. Amerex Corporation
5. Ansul Fire Protection
6. Walter Kidde
7. Master Protection Enterprises
8. Potter - Roemer Inc

2.02 MANUFACTURED UNITS

A. Wall Brackets:

1. Bracket type to fit specified extinguisher with correct mounting accessories to fit substrate
2. Furnish bracket for each extinguisher not in cabinet

B. Fire Extinguisher:

1. Steel bodied, all metal top (head), and valves
2. Multi-purpose dry chemical, UL Rated, 20A-120BC
3. Provide hose and horn on each
4. Furnish one fire extinguisher at location directed by the Engineer
5. Finish: Red with epoxy finish coat
6. Provide "FIRE EXTINGUISHER" decal for each extinguisher
7. Meet NFPA 10

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with the manufacturer's instructions

B. Install units with extinguisher top not over 48-in above floor

C. Install FEC with top of unit at 60-in above floor

3.02 SCHEDULE

A. Electrical Room (1)

B. Chemical Room (1)

**** END OF SECTION ****

SECTION 11 00 02

VERTICAL HOLLOW SHAFT ELECTRIC MOTOR

1.01 GENERAL

A. This section specifies the vertical hollow shaft motor (motor) that will drive a deep well vertical turbine pump.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA) Standard for motors

B. Institute of Electrical and Electronics Engineers (IEEE) Standard for motors

C. Underwriters Laboratories (UL) Publication

1.03 SUBMITTALS

A. The following data shall be furnished in the shop drawing submittal for the driven equipment

1. Manufacturer's name
2. Manufacturer's type and frame designation
3. Horsepower output
4. Maximum ambient temperature rating
5. Insulation system designation
6. RPM at full load
7. Voltage, number of phases frequency and full load amperes
8. Code letter for locked rotor KBA
9. Service factor at 40°C ambient
10. NEMA design letter
11. Enclosure type
12. Lubrication requirements, including type and frequency
13. KW input power and power factor at 75% and 100% of rated horsepower output
14. Guaranteed minimum efficiency and nominal efficiency
15. Nominal efficiency

B. Provide installation, operation and maintenance instructions, and renewal parts list.

1.04 SPECIFIC REQUIREMENTS

A. The motor will be used to drive a deep well turbine pump operating with an 18-pulse variable frequency drive in an outdoor installation at Rio Linda, California.

PART 2 - PRODUCTS

2.01 GENERAL

A. Motors shall be rated in conformance with NEMA MG1

B. The motor shall be designed in accordance with the following:

1. 200 Horsepower, Premium efficiency. Manufacturer to verify motor sizing.
2. 4 Poles
3. RPM (Full Load): 1800
4. Three Phase
5. Frequency: 60 Hz
6. 460 Volt

7. 1.15 service factor in an ambient temperature of 40°C
8. Motors shall be suitable for six starts per hour (5 minutes on and 5 minutes off, continuously) when powering the specific driven equipment required for this project
9. Inverter duty complying with NEMA MG-1, Section IV, Part 31.
10. Self-releasing coupling
11. Non-reversing rachet
12. Motor space Heater
13. Thermal switches
14. The motor bearings shall withstand any momentary up thrust.

C. Approved Manufacturers: US Motor or an approved equal

2.02 NAMEPLATE

A. Provide stainless steel nameplate for the motor, attached with stainless steel screws or drive pins. Nameplates shall indicate clearly the information required by NEMA MG1, Part 10 and Part 12.

2.03 ENCLOSURE

A. The motor will be installed outside.

B. The motors shall be weather protected type 1.

2.04 INSULATION

A. Provide motor with Class B or F insulation, non-hygroscopic

B. Provide extra dip and bake of epoxy or polyester varnish to resist somewhat higher than normal moisture in the atmosphere.

2.05 EFFICIENCY

A. Provide a premium efficiency motor. Premium efficiency motors shall have nominal efficiencies at full load not less than 95%.

B. Guaranteed minimum efficiencies of premium efficiency motor shall correspond to nominal values as tabulated in NEMA MG-1, Table 12-8.

2.06 THERMAL PROTECTION

A. The motor will be operated with a Variable Frequency Drive (VFD) and shall include integral thermostats or other approved devices to protect the motor from overheating. Thermostats or other devices shall be normally closed and rated 125Vac, 1 amp.

2.07 SPACE HEATERS

A. Space heaters or solid-state motor winding heating systems for motors shall be used. Heaters shall be 120V or 240-volt rated single phase. Heater wattage and voltage ratings shall be indicated on motor nameplate.

2.08 CUSTOM SOUND ENCLOSURE

A. A custom sound enclosure shall be installed over the well pump motor to minimize sound. The enclosure shall have the following appurtenances:

1. Convection style self-cooling system with no fans
2. Lifting lugs integrated on the roof of the enclosure to support removal for pump maintenance

3. Two hinged openings on each side of the motor to allow access for routine maintenance of the motor
4. Heat resistant sound insulation inside of the steel panels
5. Anchoring system to the pump base that will allow for easy removal from the pump base for pump maintenance
6. Coated Interior and exterior per Section 09 91 00 Architectural Painting

B. Acceptable manufacturers:

1. U.S. Motors, Reliance or an approved equivalent

**** END OF SECTION ****

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SECTION 22 05 48

SEISMIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section is applicable to the following secondary structural system elements, non-structural components, and/or equipment:
   1. Mechanical, electrical, and plumbing equipment and appurtenances
   2. Conduit, piping, and similar systems
   3. Control Building
   4. Chlorine tank
   5. Storage racks, suspended ceilings, light fixtures, louvers, architectural features, and other non-structural components

1.02 REFERENCES

A. American Society of Civil Engineers Standard ASCE 7-10, Minimum Design Loads for Buildings and Other Structures, Chapters 11, 13, 15.

B. California Building Code, (Current Edition)

1.03 DEFINITIONS

A. Engineer – The Engineer responsible for the preparation of Contract Documents.

B. Specialty Engineer – Structural or Civil Engineer provided by the contractor licensed in the State of California responsible for specific elements of the primary structural system, the secondary structural system, non-structural elements and/or equipment supported by structures.

1.04 GENERAL DESIGN REQUIREMENTS

A. The Contractor is responsible for producing designs that resist the total seismic forces in accordance with the seismic design criteria. The Contractor is responsible for coordinating between the Engineer and the Specialty Engineer.

B. The seismic design for non-structural components and equipment shall be in accordance with the IBC Chapter 16, and the required coefficients and factors for determining the total design seismic forces are based on the U.S. Seismic Design Maps provided by the United States Geological Survey:

   1. Based on the average latitude and longitude of the site (38.705N, -121.436W)
   2. The mapped spectral response accelerations for the:
      a. 0.2 second period : S_s = 0.503
      b. 1 second period : S_1 = 0.238
   3. Site Class : D
   4. Site Coefficient : F_a = 1.398
   5. Design Spectral Acceleration : S_{DS} = 0.469g

C. Coordinate the layout so that adequate space is provided between items for relative motion. Provide additional supports and restraints between items of different systems when necessary to prevent seismic impacts or interaction.

D. Design anchorages of all elements of structures, non-structural components, equipment supported by structures, and non-building structures to resist static and

dynamic operational loads, plus total seismic loads specified in the IBC, ASCE 7-16 Section 13.3.1. For anchorage uplift, multiply dead load by 0.9 and subtract $0.2S_{DS}$ if used to reduce vertical seismic effects.

E. Design anchorages utilizing a Component Coefficient, $R_p = 1.5$, unless supporting documentation for embedment length, showing compliance with section 13.4.2 of ASCE 7, is provided for chemical anchors or cast-in-place anchors.

1.05 DESIGN REQUIREMENTS FOR PIPING AND CONDUITS

A. The Contractor is responsible for producing designs for support of piping, conduit, duct, or other systems to resist total seismic forces based on the seismic design criteria coefficients specified above unless shown on the Contract Documents. Except where the technical specifications give specific exemption from resistance of seismic forces, all supports shall be designed to meet seismic criteria.

B. Where possible, pipes, conduit, and their connections shall be constructed of ductile materials (e.g., copper, ductile iron, steel or aluminum and brazed, welded or screwed connections). Pipes, conduits, and their connections, constructed of non-ductile materials (e.g., cast iron, no-hub pipe and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for ductile material.

C. Seismic restraints may be omitted for the following conditions where flexible connections are provided between components and the associated piping and conduit:

1. Fuel piping less than 1 inch inside diameter.
2. All other exposed piping less than 2.5 inches inside diameter or electrical conduit less than 2.5 inches trade size.

D. As an alternative to designing the supports and anchorage where an approved national standard provides a basis for the earthquake-resistant design, submit standard, data, and details for piping, conduit, duct, or other systems:

1. For mechanical piping, process piping, and electrical conduits, follow Guidelines for Seismic Restraints of Mechanical Systems by SMACNA modified as follows:
   a. Seismically brace piping regardless of size or location. Provide transverse braces at all changes in direction and at the end of all pipe runs. Space transverse braces not more than 20 feet apart. Provide longitudinal braces at 40-foot centers.

1.06 SUBMITTALS

A. Submit in accordance with Section 01 33 13 Submittals.

B. Submit certification for equipment not listed in this specification but included in the contract documents that the equipment itself is designed to resist all internal seismic forces based on the seismic design criteria for the project.

C. Where required in the equipment specifications in or listed below, submit signed and sealed structural calculations and detailed drawings from a Specialty Engineer where the project is being built for the attachments and anchorage to the primary structure.

1. Required anchorage items include:
   a. Electrical Switchgear, Panels, and Equipment

D. Structural calculations and detailed drawings shall be prepared by a Specialty Engineer.

E. Structural calculations and detailed drawings shall clearly show the total design seismic forces which will be transferred from the elements of the structural system, non-structural components, and/or equipment and their attachments to the primary structure framing.

1.07 QUALITY ASSURANCE

A. The Contractor is responsible for submitting signed and sealed structural calculations and detailed drawings from a Specialty Engineer.

B. Comply with the California adopted and amended versions of the International Building Code (IBC) Section 1613, the referenced sections of ASCE 7.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

**** END OF SECTION ****

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SECTION 26 00 10
ELECTRICAL GENERAL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The following list of components and areas of work is a summary of the work required in the drawings and specifications. The list is not comprehensive of the total work required nor is it in any specific order. It is merely being provided as an aid to the bidder. Work not listed herein, but described in the plans or specifications, is also part of the overall scope of work.

1. Utility Metering with Main Disconnect and Generator Disconnect in NEMA 3R weatherproof wrap.

2. Switchboard with Automatic Transfer Switch (ATS), Power Distribution Section and low voltage transformer and panelboard.

3. Stand-alone Ultra Low Harmonic VFD

4. Propane (vapor) Generator with sound attenuating enclosure and remote fuel tank.

5. Control panel.

   a. Tesco L3000 PLC, programming, testing, and startup.

6. PLC Application Programming

   a. System application programming per control descriptions defined herein.

   b. Control Descriptions may be adjusted by Engineer during construction as needed and project circumstances dictate.

   c. System Integrator will make modifications to control descriptions (and associated PLC configurations) as needed during construction and start-up.

7. Communications system. Contractor to coordinate, configure, test, and place communications system(s) into operation.

8. Instrumentation

   a. Furnish NSF/ANSI 61 certified products that have undergone testing for any device, valve, instrument, or assembly that will come into contact with drinking water.

   b. Mounting supports or other accessories as detailed and as

recommended by the instrument manufacturer for the application.

c. Contractor shall calibrate, configure and test all instrumentation and document results.

9. Coordination and timely installation of critical path equipment and services such that construction may be facilitated. The Electrical Contractor and System Integrator should not assume that submittals, manufacturing, installation, start-up will be based on their own schedule. The Electrical Contractor and System Integrator scope of work is part of a much larger project and will need to be coordinated. Expect that additional cost in time and labor will be required beyond normal optimistic projections.

10. Conduit support systems, wire, and grounding system, for equipment interconnection, and operation.

11. Installation of Owner furnished instrumentation with mounting supports as detailed and as recommended by the instrument manufacturer. Contractor shall calibrate, configure and test all instrumentation and document results.

12. All necessary process piping, shut off, sample and calibration valves, drains, pressure reducers and calibration equipment for connection of instrumentation.

13. Trenching, backfilling, compaction and resurfacing for all new underground conduit routes, concrete pads, and pull boxes.

14. Coordination and equipment for connection of power utility and telephone services per utility drawings and standards.

15. Site electrical devices, lights and receptacles.

16. Seismic Anchorage Design Calculations and conforming installation.

17. System startup, calibration, testing and documentation.

    a. The Application Programmer (defined in Electrical Specifications [Electrical General].) and/or Construction Manager will be actively engaged in Operational Testing and Commissioning. These efforts shall be combined efforts of the Application-Programmer/Construction-Manager/Engineer and Contractor.

    b. The Contractor shall facilitate test as outlined herein such that hardware, software and application programming are tested completely and all applicable test documentation is completed.

    c. The Contractor shall assume that a minimum of 24 hours will be required to assist in this task.

d. Sufficient time shall be allocated in the construction schedule for troubleshooting, testing, startup, and verification of application programming in front of associated construction milestones. For instance, if a pump station is required to be operational prior to a date certain, then the schedule shall allocate time for these activities. The time necessary depends on the system to be started and shall be coordinated with the Owner Representative or Application Programmer during construction scheduling early in the project.

B. Electro-mechanical equipment to be installed in this project may be specified in other divisions but will interface to equipment provided under Electrical Specifications. Obtain submittals for those devices, review, coordinate and provide all interfacing equipment, software, communications, I/O, and testing to integrate the equipment to the extent possible and as intended.

C. Install electrical and control portion of electro-mechanical equipment specified in other sections. Reference those specifications, pertinent details, and follow all manufacturer instructions to erect, install and commission equipment. Furnish all electrical equipment, interconnecting wire, and make connections to place equipment in operation.

D. All electrical equipment and materials, and methods - including installation, calibration, and testing - shall conform to the applicable codes and standards listed in this and other Sections. All electrical materials and work shall conform to published standards of the National Electric Code (NEC) current issue, Institute of Electrical and Electronic Engineers (IEEE), and Underwriters Laboratories Inc (UL).

1.02 RELATED SPECIFICATIONS

A. The following specification sections are part of the [Electrical Specifications].

Section	Description
26 01 10	Conduit and Boxes
26 01 20	Low Voltage Wire and Data Cable
26 32 13	Engine Generator
26 36 23	Automatic Transfer Switch
26 44 50	Grounding
26 44 81	Variable Frequency Drive
26 66 00	Factory and Field Testing
26 66 30	Electrical System Analysis
26 79 05	Control Panels
26 79 10	PLC & OI Hardware
26 79 15	PLC & OI Applications Programming
26 79 25	SCADA Applications Programming
26 89 40	Instrumentation

B. Owner, Engineer, Construction Manager, Application Programmer, and City are used within Electrical Specifications and are interchangeable. They are all representatives of the Owner, in this case, the Rio Linda Elverta Community Water District.

1.03 QUALIFICATIONS AND REQURIED WORK SCOPE

A. Electrical Contractor

1. Management and installation of the entire electrical and control system (including stand-by generator) required for this project shall be by an Electrical Contractor meeting qualifications as defined herein.

a. Contractor shall be capable of looking at electrical equipment submittals, prior to installation, comparing hookup requirements to the drawings, and noting any deficiencies.

2. Electrical Contractor shall select, furnish, and install all commodity electrical materials (conduit, wire, supports, fittings, ductbanks, etc) that are generally not "custom" or uniquely manufactured for this project. Custom electrical panels, controls, and instrumentation shall be furnished by Systems Integrator.

3. Shall be competent in and familiar with management and subcontracting of specialty electrical and instrumentation supply and engineering work as requires of a Systems Integrator as described herein.

4. Electrical Contractor must be competent in performance, supervision and coordination of work required and performed by equipment suppliers and Systems Integrator (Subcontractors).

5. The Electrical Contractor (EC) shall meet the following minimum qualifications:

a. Has a current C10 Electrical Contractor's License issued by the State of California Department of Consumer Affairs.
b. EC shall be regularly engaged in similar industrial power and controls electrical contracting for the Water and Wastewater Industry.
c. EC shall have successfully performed work of similar or greater complexity (as measured in contract value on industrial power and controls projects) on at least three (3) previous projects.
d. EC shall carry all insurances as defined and required by the special provisions and as required by law.
e. EC shall be competent in methods and materials execution and selection associated in the type of electrical and instrumentation work specified in this Division.
1) EC shall be familiar with and understand codes and requirements from NFPA70, NFPA110, and all other governing national or local codes as required for work scope as described in the drawings and specifications.

2) EC shall know and understand common terms and abbreviations used in this Industry. Not all terms and abbreviations will be defined in the drawings and specifications.

f. EC shall comply with State law which requires that all personnel installing electrical components are certified by the State of California as "Electrician" or "Electrician Trainee." Apprentices may install electrical components only under direct supervision of a certified Electrician.

B. System Integrator

1. Systems Integrator shall be a supplier to the Electrical Contractor and must be competent in performance, supervision and coordination of work required in this contract.

2. This includes, but is not limited to, all work necessary to select, furnish, construct, supervise installation, configure, calibrate, test, and place into operation all transmitters, instruments, programmable controllers, control panels, motor controls, alarm equipment, communications, monitoring equipment, and accessories.

3. The System Integrator shall have on staff a Project Engineer with three years prior experience on similar sized projects. This Project Engineer shall coordinate the technical aspects of this project and prepare the submittals and drawings. The Project Engineer shall attend all coordination meetings when specifically requested by the Engineer.

4. The System Integrator (SI) shall meet the following minimum qualifications:

a. SI shall be regularly engaged providing electrical and control systems for the Municipal Water and Wastewater Industry.
b. SI shall have an Electrical Engineer on staff registered in the State of California as a Professional Engineer.
c. SI shall be capable of labeling all electrical panels as manufactured or customized by the System Integrator with appropriate Underwriters Laboratories (UL) label prior to factory testing or shipment to project site.
d. SI shall have successfully completed work of similar or greater complexity and on similar facilities on at least ten previous projects under the present company name.
e. SI shall be actively engaged in the following disciplines for the last 5 consecutive years.
    1) Design and manufacturing of custom Control Panels, Motor Controls Centers, and associated devices and equipment as specified in this division.
    2) Programming and commissioning of SCADA, PLC and Operator Interface hardware.
    3) Instrumentation - selection, purchase, calibration, start-up and commissioning.

4) Testing, calibration, start-up, and commissioning of control systems as applied to the Water and Wastewater industry.

f. SI shall employ personnel on this project who have successfully completed ISA or equal training courses on general purpose instrumentation.

g. SI shall have a permanent, fully staffed and equipped service facility within 200 miles of the project site for a minimum of 1 year prior to bid date with personnel and equipment required to maintain, repair and calibrate the instrumentation system.

1.04 CONTRACT DOCUMENTS

A. The resolution of conflicting information within the contract electrical documents shall put precedence on electrical drawings over that of electrical specifications.

B. The Drawings and specifications are intended to be descriptive of the type of electrical system to be provided with sufficient detail to construct. Minor omission of detail shall not relieve a qualified contractor from the obligation to provide a complete operational system if it can be determined that the particular detail is usual and customary for similar systems.

C. The following specifications may incorporate specific equipment or materials that do not have equal equipment listed. These items are standards because of their familiarity, serviceability, and/or spare parts inventory. However, equal alternate equipment or materials (noted in the submittal cover letter) will be considered for use on this project if submitted. The Engineer may reject said equipment for the purpose of adherence to standards.

D. Contract drawings are diagrammatic and indicate general arrangement of systems and equipment.

1. Exact locations and layouts of electrical products shall be defined during submittal, assembly, or field fit during construction. Field measurements take precedence over dimensioned drawings. Drawing intent is to show initial size, capacity, approximate location, orientation, and general relationship of equipment in area shown but may not show exact detail or arrangement.

2. However, when materials, locations, sizes, or methods are specifically dimensioned, detailed or noted, the drawings shall take precedence over electrical specifications in the event of conflict. In no case, is NEC, UL, or other applicable governing standards to be overridden.

E. The Contractor is encouraged to visit site and shall thoroughly examine existing conditions before submitting his bid proposal to perform any work. He shall compare site conditions with data given on the plans or in these Specifications. No allowance shall be made for any additional costs incurred by the Contractor due to his failure to examine each site or report any discrepancies to the Engineer.

F. The Contractor shall examine the architectural, mechanical, structural, and

electrical and instrumentation submittals and equipment furnished under other specifications divisions in order to determine conduit routing, stub-up locations, and final terminations for all conduits and cables. Conduits shall be stubbed up as near as possible to equipment electrical terminals. The exact locations and routing of cables and conduits shall be governed by structural conditions, physical interferences, and the physical location of wire terminations on equipment. If the Contractor installs equipment conflicting with the architectural, mechanical, structural, instrumentation or electrical equipment provided under this and other specifications sections, the Contractor shall replace without additional cost.

G. All equipment shall be installed and located so that it can be readily accessed for operation and maintenance. If accessibility appears to be compromised, the location of equipment or stub ups shall be modified to the extent possible.

H. Where conduits are shown on the Drawings, or stated to be furnished but not explicitly shown, as part of the scope of work; the Contractor shall provide all fittings, boxes, wiring, etc. as required for completion of the raceway system in compliance with the NEC and the applicable specifications in this Section.

I. No changes from the Drawings or specifications shall be made without written approval of the Engineer. Should there be a need to deviate from the Contract documents, submit written details and reasons for all changes to the Engineer for review.

J. The Contractor shall maintain a neatly and accurately marked full size set of Contract Drawings recording the as built locations and layout of all electrical and instrumentation equipment, routing of raceways, junction and pull boxes, and other diagram or drawing changes. Drawings shall be kept current weekly, with all "change orders", submittal modifications, and construction changes shown. Drawings shall be subject to the inspection by the Engineer at all times, progress payments or portions thereof may be withheld if drawings are not accurate or current.

K. When documents are changed, they shall be marked with erasable colored pencils using the following coloring scheme:

Additions - red
Deletions - green
Comments - blue
Dimensions - black

L. Prior to acceptance of the work, the Contractor shall deliver to the Engineer one set of record full size drawings neatly marked accurately showing the information required above.

1.05 UTILITY COORDINATION AND FEES

A. All fees and charges of the Power Utility, Pacific Gas & Electric (PG&E), for design and final connection will be paid by others.

B. Coordinate all work with the Utility for the work shown on Contract Drawings.

1. Unless already completed, apply for electric service within 10 working days from Notice to Proceed.

2. Coordinate and meet with the Utility's Representative at the project site(s) within 30 days after award of contract.

3. Discuss specific installation and comply with Utility requirements. Contact Engineer in the event that Utility requirements far exceed allowances in the plans and specifications. Provide an itemized list of deviations and potential costs or credits.

4. Coordinate and obtain required inspections prior to backfill. Make corrections to installation as required.

5. Coordinate connection and date of service with Utility. Utility back-charges due to mis-coordination or installation problems will be Contractor responsibility to pay and correct.

C. Furnish and install electric service in accordance with the serving Utility's requirements.

1. The contract plans show the preliminary design for the Utility installation. Slight changes required by the Utility do not constitute extra work unless cost impacts in material and labor exceed $5000. In that event, the agreed excess amount will be allowed as a contract change.

2. The Contractor shall provide and install service entrance equipment, all material, conduits, wiring, pull ropes, pole risers, transformer pads, bollards, etc. as shown on Utility design drawings and standards for new power service. Utility standards are available upon request from the Utility or for download from the Utility's website.

D. Following award of Contract, schedule all service installations and connections with utilities. Construction or start-up delays as a consequence to lack of documented effort by the Contractor which delay the project completion due to lack of Utility services will not be considered valid and Contract liquidated damages may be assessed.

1.06 PROJECT COORDINATION

A. Prior to submittal, the Electrical Contractor shall coordinate with equipment suppliers to verify sizes, mounting, connections, storage, and delivery of equipment. If there are any issues whereby the solution will be in conflict with plans and specifications, or that are undefined and need direction, they shall be brought to the attention of the Engineer or Construction Manager via the RFI process.

B. Where connections must be made to existing or new operational facilities, the Contractor shall schedule all the required work with Engineer, including the

power shutdown period. Carry out each shutdown so as to cause the least disruption to the operation of the installation.

1. The Contractor shall limit all unscheduled shutdown periods to less than 15 minutes and only with prior approval of the Station operator.

2. Carry out shut downs of durations greater than 15 minutes only after the time and date schedule and sequence of work proposed to be accomplished during shutdown has been favorably reviewed by the Engineer. Submit shutdown plans at least 2 days in advance of when the scheduled shutdown is to occur.

3. Provide temporary power to all existing facilities utilizing a portable generator. The generator shall be utilized for all shutdowns that exceed 15 minutes and run continuously for the duration of the primary power shutdown. All cost for operating the generator including equipment, fuel and labor shall be provided.

4. The Engineer reserves the right to delay, change, or modify any scheduled shutdown at any time, at no additional cost to the Owner, when the risk of such a shutdown would jeopardize the operation of the water distribution system and/or water plant operation.

1.07 SUPERVISION

A. The Contractor shall schedule all activities, manage all technical aspects of the project, coordinate submittals and drawings, and attend all project meetings associated with this Section. The Contractor shall coordinate and confirm that the project schedule is being adhered to and all work is being completed within the scheduled time frames.

B. The Contractor shall supervise all work in this Section, including the electrical system general construction work, from the beginning to completion and final acceptance.

C. The Contractor shall coordinate, obtain, prepare, and/or complete the documentation required within this division. All documentation shall be complete and delivered prior to final acceptance.

1.08 INSPECTIONS

A. General

1. Contract work or materials shall be subject to inspection at any time by the Engineer. If equipment, material, or installation method does not conform to the Contract documents, or does not have a favorably reviewed submittal status and has been determined to be unsatisfactory by the Engineer, then the Contractor shall remove said material from the premises; and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.

2. The Engineer may inspect and test the fabricated equipment at the factory before shipment to job site. See Electrical Specifications [Factory and Field Testing] for requirements.

3. Work shall not be closed in or covered over before inspection and approval by the Engineer. All costs associated with uncovering and making repairs where non-inspected work has been performed shall be borne by the Contractor.

4. The Contractor shall cooperate with the Engineer and provide assistance at all times for the inspection of the electrical system under this Contract. The Contractor shall remove covers, provide access, operate equipment, and perform other reasonable work which, in the opinion of the Engineer, will be necessary to determine the quality of the work.

B. Milestones requiring inspection and signoff.

1. Underground conduit and grounding system complete. Do not cover any portion of conduit prior to inspection. Conduits must be labeled with temporary tags per Electrical Specifications [Conduit and Boxes] and [Grounding].

2. Factory testing. Coordinate test date with Engineer 2 weeks prior to test scheduled date.

3. Installation of electrical equipment. Equipment is anchored in place, conduit connections are complete, no wire is yet pulled into conduit. Permanent conduit tags must be in place per Electrical Specifications [Conduit and Boxes] and [Grounding].

4. Wire termination complete. Do not energize equipment. All wire tags must be installed and wires terminated per Electrical Specifications [Low Voltage Wire and Data Cable]. Pre-energization testing to commence after inspection.

5. Testing per Electrical Specifications [Factory and Field Testing]. All testing per Electrical Specifications [Factory and Field Testing] shall be witnessed unless specifically declined by the Engineer. Schedule tests with Engineer 2 weeks prior to test date.

6. Start-up per Electrical Specifications [Factory and Field Testing]. Schedule tests with Engineer 2 weeks prior to test date.

7. Punch list final inspection. Schedule final walkthrough with Engineer one week prior to intended project completion date. All items on punchlist must be complete prior to scheduling walk-through.

1.09 JOB CONDITIONS

A. Construction Power and Telephone Service

1. The Contractor shall coordinate, furnish and install, temporary utility services required during construction of the project, such as temporary electrical power and telephone service. Temporary services shall be installed in accordance with the applicable codes and regulations of the serving utilities.

2. Upon completion of the project, remove temporary services. All equipment and material shall be the property of the Contractor.

B. Equipment Storage

1. The Contractor shall provide adequate protection for all equipment and materials during shipment, storage and construction.

2. Equipment and materials shall be completely and sufficiently sealed and covered and set on a pallet above grade so that they are protected from weather, wind, dust, water, or construction operations.

3. Equipment shall not be stored outdoors. Where equipment is stored or installed in an area with susceptibility to moisture, such as unheated buildings, untested piping, etc., provide an acceptable means to prevent moisture damage, such as plastic cover and a uniformly distributed heat source to prevent condensation.

C. The project site is located where outside temperatures vary between 10 deg F. to 110 deg F. Humidity in this area will range from 10% to 100%.

1.10 AREA CLASSIFICATIONS

A. Area classifications are shown on the site electrical plans. The area enclosed by walls or the entire drawing area shall be classified as shown unless otherwise described in notes.

B. All electrical equipment, enclosures, conduit, and supports shall be formally rated for or, at minimum, meet the intent of the rating as interpreted by Engineer.

C. If no area classification rating is shown on the drawings, classification shall default to a NEMA 12 rating for indoors, and NEMA 4 rating for outdoors (non corrosive) and NEMA 4X for corrosive areas both indoors and outdoors.

1.11 SUBMITTAL REQUIREMENTS

A. General

1. Requirements described herein are specific to electrical submittals and are secondary to those described in other general specifications sections. Any additional requirements described here that are beyond those described in those sections shall be provided as described. Conflicts shall be resolved by giving priority to general specifications.

2. The Contractor shall ensure that the System Integrator and/or equipment

suppliers provide the submittal documentation required in this section. Submittals shall be neat, orderly, complete (without un-needed parsing), and indexed.

a. Like equipment shall be submitted complete in a single submittal. For instance, all general electrical materials shall be in a single submittal. All instrumentation, all control panels, or all MCCs and so on shall be submitted complete where possible.

b. Submittals that are broken down without sufficient cause will be rejected for future inclusion into a combined submittal.

c. Do not separate submittals by area.

d. Do not separate submittals by specification division unless agreed to in advance.

e. Submittals for work scope covered in this contract are expected to be as follows. This list is intended to be a guideline and not to be specific of all submittals required. Project circumstances or leadtimes or availability will each impact the order and division of submittals.

1) General electrical materials conduit, wire, labels, etc.
2) Power Distribution and Motor Controls
3) PLC and Control Panels
4) Engine Generator
5) Seismic Calculations
6) Instrumentation
7) PLC Programming
8) SCADA Application Programming
9) Factory and Field Testing forms and procedures
10) Interconnection Diagrams
11) O&M Manuals

3. The Contractor shall coordinate submittals with the work so that project will not be delayed. This coordination shall include scheduling the different categories of submittals, so that one will not be delayed for lack of coordination with another. Time extensions will not be allowed due to failure to properly schedule submittals.

4. No material or equipment shall be delivered to the job site until the submittal for such items has been reviewed by the Engineer and marked "no exceptions noted" or "make corrections noted".

5. The equipment specifications have been prepared on the basis of the equipment first named in the Specifications. The Contractor shall note that the second named equipment, if given, is considered acceptable and equal equipment, but in some cases additional design, options, or modifications may be required to meet Specifications or functional installation.

6. Exceptions to the Specifications or Drawings or equipment or procedures

submitted as "equal" to specified equipment shall be clearly identified in a letter at the front of the submittal. Submittal data for "equal" equipment or procedures shall contain sufficient details so a proper evaluation may be made by the Engineer. The Contractor is responsible for verifying proper application/operation of substituted equipment.

7. The opinion of the Engineer will be the final determination whether a substitution request meets the design intent.

8. Deviations from the Contract documents shall **not** be incorporated into the work without prior written approval of the Engineer. A "Change Order" directive from the Engineer is required prior to incorporating any deviation from the Contract documents that has costs associated. The cost differential associated with this change order must be negotiated with the Owner to amend the Contract to reflect the costs or savings.

B. Submittal Procedures

1. Identify all submittals by submittal number on letter of transmittal. Submittals shall be numbered consecutively and resubmittals shall have a letter suffix. For example:

   a. 1st submittal: 1
   b. 1st resubmittal: 1A
   c. 2nd resubmittal: 1B, etc.

2. Within 30 calendar days after contract award, the Contractor shall furnish to the Engineer all submittals (electronic) required for this Division. Interconnection drawings, training documents test procedures, and O&M Manuals as applicable shall be submitted timely as to not delay the project.

   a. Submittals shall be delivered entirely electronically via email (no hard copy required). However, General Contractor supervision must not be circumvented by sending submittals direct to Engineer.

   b. Electronic Submittals shall be viewable using a PDF reader.

   c. Electronic (PDF) submittals must follow all applicable requirements for indexing, bookmarks, highlighting, selection indicators (box, highlight) etc. Use of native PDF files (not scans) are required if one exists on the World Wide Web (WWW).

3. Submittal Preparation

   a. Electronic submittals shall be assembled in accordance with the specifications with table of contents, bookmarks, tabs, subtabs, etc. utilizing the electronic bookmarks feature available in the PDF assembler. Only one PDF file is allowed for each submittal. Multiple (.PDF) files will not be acceptable.

b. Use of native PDF files (not scans) are required if one exists on the www. Ignoring this requirement is cause for submittal rejection.

c. Submittal shall be appropriately labeled with the project name, contract number, equipment supplier's name, specification section(s), and major material contained therein.

d. An index shall be provided. This index shall itemize the contents of each tab and subtab section.

e. Field equipment shop documents, panel equipment shop documents, drawings, and bill of materials shall be grouped under separate tabs. Shop documents shall be ordered in the same sequence as their corresponding Contract specification subsection.

f. All spare parts shall be listed separately at the end of the Bill of Materials list.

g. Data summary sheets shall be provided for each individual piece of instrumentation. The data summary sheets shall have the following information preceding their corresponding catalog data:

1) Instrumentation type and tag name.
2) Location/description.
3) The manufacturer's model and part number with all options.
4) Range, span, units, input and output signals.
5) Description of component.
6) Contract specification subsection number reference.

4. The reviewed submittals will be annotated "Make Corrections Noted", "No Exceptions Noted", "Revise and Resubmit Noted Items", or "Rejected without Review." The following actions shall then be taken by the Contractor:

a. "No Exceptions Noted" - The Contractor may proceed with the work covered in this submittal. No resubmission is necessary.

b. "Make Corrections Noted" - The Contractor may proceed with the work covered in this submittal incorporating the changes noted. However, the Contractor shall revise the submittal in accord with the changes noted and resubmit six (6) copies of drawings, bill of materials, and catalog data denoting changes within 14 calendar days when requested by the Engineer for record keeping purposes.

c. "Revise and Resubmit Noted Items" - The Contractor shall not proceed with the work covered in this submittal. The Contractor shall revise and correct the submittal in accordance with the

comments and resubmit six (6) copies within 14 calendar days for approval.

d. "Rejected without Review" submittal - The Contractor shall not proceed with the work covered in this submittal. The submittal did not address the work scope as defined by the submittal's title or the previous submittal comments have not been addressed in full. The Contractor shall revise and correct the submittal in accordance with the specifications, and resubmit six (6) copies within calendar 14 days for approval.

5. Resubmittals shall address all comments by the Engineer. A submittal response letter shall be submitted that addresses each comment by the Engineer with a standardized response of "revised" or with a written explanation. Partial re-submittals (that do not address all comments) may be returned without review at the discretion of the Engineer.

6. The Contractor shall be responsible for the Engineer's review cost for each resubmittal in excess of the second resubmittal. These costs will be back-charged to the Contractor and will be deducted from his progress payments.

C. Electrical Equipment -- Submittal data shall be grouped by equipment type. Each submittal shall be as complete as possible covering the entire project and scope of supply. Drawings or equipment submitted individually that are not on the critical path will not be accepted for individual review. The electrical submittals shall include (as a minimum):

1. Table of Contents

2. Comment Letter: The Project Engineer of the System Integrator shall note all deviations from Contract Documents and the reason(s) for the deviation. They may use this forum to inform the Engineer or installing Contractor of important information related to the project. RFIs must be submitted separately. Re-submittals shall include written responses to every comment provided by the Engineer during the previous review.

3. Bill of Materials: The Contractor and System Integrator each shall provide Bill of Material for electrical components formatted as shown below. Generic names or part numbers as defined by a distributor or Integrator are not acceptable. Only the originating manufacturer's name and part number shall be listed. Provide separate bill of materials for each panel, MCC, instrument list, etc.

Bill of Material

Item #	Qty	Tag#	Description	Manufacturer	Part #

4. Shop Drawings:

a. Equipment elevations with enclosure details drawn to scale or dimensioned with relative scale.
b. Electrical One-line, Elementary, and wiring diagrams
c. PLC I/O wiring diagrams

5. Catalog Data shall include the following: (features and options shall be highlighted, circled, or arrowed.)

a. Instrumentation data summary sheets (by Contractor)
b. Manufacturer's technical information brochure
c. Physical size and mounting details and illustrations
d. Calibration Range
e. Input/output signals
f. Electric power, air, and/or water supply requirements.
g. Options selected and available (Cross out items not included)
h. Materials of construction of components

6. Construction Sequence Plan: Include equipment delivery schedules and installation schedules for each piece of equipment. Include demolition and shutdown requirements during installation.

D. Shop Drawings - Shop drawings shall be furnished for each electrical panel even if one was not shown explicitly on the Drawings. Shop drawings shall be numbered in sequence. Blank drawings or drawings that contain no specific project data will not be accepted for review.

All drawings shall be generated with a computer utilizing AutoCAD or similar drafting program. Drawings shall be no smaller than 11" x 17". The lettering shall be legible and no smaller than 0.75 inch in height.

Drawings shall be custom prepared for this project and shall have borders and a title block identifying the project, manufacturer, system or location, drawing number, drawing title, AutoCAD file name, project engineer, date, revisions, and type of drawing. Diagrams shall carry a uniform and coordinated set of wire colors, wire numbers, and terminal block numbers. The shop drawings shall include the following as a minimum:

1. Electrical one-line diagrams detailing all devices associated with the power distribution system. The following applicable information or data shall be shown on the one- or three- line diagram: location, size and amperage rating of bus; size and amperage rating of wire or cable; breaker ratings, number of poles, and frame sizes; power fail and other protective devices; fuse size and type.

2. Detailed analog and digital I/O diagrams showing the wiring requirements for each instrument or device connection. Reference the Drawings for an example of each I/O card drawing requirements. If one is not included in the Drawings, then one may be obtained from the Engineer upon request.

3. Elementary (wiring) diagrams shall be provided for all relay logic, programmable logic controls, motor controls, power supplies, and other

wiring. All elementary (wiring) diagrams shall be drawn in JIC EMP/EGP format and standards showing ladder rung numbers and coil and contact cross referencing numbers.

4. Equipment exterior and interior scaled drawings of front, side, elevation, deadfront, front panel devices, and backpan components. Show fabrication methods and details; including material of construction, paint color, door latch and lock, and ventilation system. Show shipping split locations and offloading information. Submit base plan showing allowed conduit entrance areas and bolt hole locations.

5. Drawings shall show UL required information as needed to UL label the equipment in accordance with UL procedures for label applied.

6. Submit full size drawing of all nameplates and tags, as specified herein, to be used on project. Submittal to include the following:

   a. Dimensions of nameplate.
   b. Exact lettering and font for each nameplate.
   c. Color of nameplate.
   d. Color of lettering.
   e. Materials of construction.
   f. Method and materials for attachment.
   g. Drawing showing location of nameplates on each, panel and enclosure.

E. Seismic Anchor Design Calculations

1. All switchgear, motor controls centers, transformers, cabinets, raceways, supports, and electrical materials shall be so installed as to remain in a secure and captive position when subjected to a horizontal force in accordance with the current, applicable, and more stringent of California Building Code (CBC) or International Building Code (IBC) requirements. Method of securing shall constrain equipment against both vertical and horizontal forces and overturning forces.

2. Calculations as prepared by a structural engineer registered in the State of California shall be submitted in accordance with code requirements for earthquakes forces on all specified equipment. Calculations shall include wind loading forces for equipment installed outdoors.

1.12 OPERATING AND MAINTENANCE INFORMATION

A. Operational Training

1. At time of completion, the Contractor shall provide a period of not less than 6 hours training for instruction of operation and maintenance personnel in the use of systems. Instruct all personnel at one time in one session. Make necessary arrangements with manufacturer's representative. Provide product literature and application guides for user's reference during instruction.

B. Operations and Maintenance Manuals

1. Provide Operation and Maintenance manuals per specifications as described in "Submittal Requirements" in this section with the following additional requirements:

   a. A comprehensive index.

   b. A complete "Record" set of favorably reviewed electrical submittals as provided under subsection "Submittal Requirements" illustrating all components, piping, and electrical connections.

   c. A complete list of the equipment supplied, including serial numbers, ranges, catalog cuts, and pertinent data.

   d. Full specifications on each item.

   e. Detailed service, maintenance and operation instructions for each item supplied. Schematic diagrams of all electronic devices shall be included. A complete parts list with stock numbers shall be provided for the components that make up the assembly. All of these shall be originals, no copies.

   f. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

   g. PLC & OI applications programming and configurations (as applicable)

2. Submit electronic readable PDF file format (CD disk copies (2) or email with attachments or download links) of the proposed O&M manuals for review by the Engineer. Submittals shall be delivered timely to the Engineer to allow for review period, corrections, and re-submissions as necessary.

   a. General Contractor supervision must not be circumvented by sending submittals direct to Engineer.

   b. O&M Submittals shall be published 1st electronically and 2nd on hard copy paper stock.

   c. Electronic Submittals shall be transmitted with the hard copy submittals and be viewable using a PDF reader.

   d. Electronic submittals shall be assembled in accordance with the specifications for hard copy submittals with table of contents, bookmarks, tabs, subtabs, etc. utilizing the electronic bookmarks feature available in the PDF assembler.

   e. Electronic (PDF) submittals must follow all applicable requirements for hard copy submittals including indexing, item selection indication, bookmarks, etc.

3. Provide four (4) hard copy O&M manuals per specifications as described in SUBMITTALS REQUIREMENTS in this section.

   a. Deliver approved hard-copy O&M manuals to the project site and Owner prior to pre-operational testing or equipment start-up.

C. At the end of the project hard copy and soft copy electronic PDF files, shall be updated to "as-built" conditions.

D. Provide two (2) sets of compact disk (CD) containing all shop drawings, application programs, configurations, calculations, documents or other computer electronic files prepared for this project in native file format and updated to reflect as-built conditions.

PART 2: PRODUCTS

2.01 QUALITY

A. All equipment and materials shall be new, in current production, and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product.

B. Products specified that have become obsolete (out of current manufacturing, or have been superseded by another product) shall be cross-referenced to a replacement product(s) and provided in lieu of the specified product(s) for no additional cost. Under no conditions, shall products be submitted or furnished that are known (on manufacturer's list of obsolescence) and expected to be removed from current production within 12 months after project submittal. Products found to have been furnished this way will be removed and replaced at Contractor's expense.

C. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble free service. Light duty, fragile and competitive grade devices of questionable durability shall not be used.

D. The Contractor should expect that there will be occasional freezing conditions at the project site in outdoor locations. Instrument valves, tubing, instrumentation, and other components, etc. which are outdoors and susceptible to damage if frozen, must be provided with internal or external protection. Freeze protection can consist of internal or external active heaters with thermostats and/or passive insulation systems. Active systems can be powered from a nearby receptacle or via the conduit intended for the device.

E. Products that are specified and include a manufacturer, trade name or catalog number are intended to establish a standard of quality, performance, warranty and service. Products that are specified "or equal," do not prohibit the use of equal products of other manufacturers provided they are submitted, identified and promoted as equal, and favorably reviewed by the Engineer prior to procurement and installation.

F. Products submitted as "equal" to the named products will be reviewed for conformance with the specifications and in comparison with the first named product. If the equal product meets specifications, but does not have a feature or performance characteristic that is available with the first named product, and that feature or performance is required for this project, then the submitted equal product may be rejected on those grounds.

G. In the event that some claims of the manufacturer of submitted "equal" product are called into question by the Engineer, the Contractor, may be required to prove those claims either prior to installation or during startup of product. If the product does not meet the claims made or specifications, the product may be rejected by the Engineer and a replacement product must be submitted by the Contractor in its place. All cost for the rejected product, installation, testing, and removal will be the responsibility of the Contractor.

H. Underwriters Laboratories (UL) listing is required for all substituted equipment when such a listing is available for the first named equipment. Extra parts, labor, panel space, power supplies, circuit breakers, and/or GFIC devices shall be provided as necessary for incorporation of specified non-UL components.

I. When required herein or requested by the Engineer, the Contractor shall submit equipment or material samples for test or evaluation. The samples shall be furnished with information as to their source and prepared in such quantities and sizes as may be required for proper examination and tests, with all freight and charges prepaid. All samples shall be submitted before shipment of the equipment or material to the job site and in ample time to permit the making of proper tests, analyses, examinations, rejections, and resubmissions before incorporated into the work.

2.02 NAMEPLATES & TAGS

A. Equipment exterior nameplates - Nameplate material shall be rigid laminated black plastic with beveled edges and white lettering; except for caution, warning, and danger nameplates the color shall be red with white lettering. The size of the nameplate shall be as shown on the drawings. No letters are allowed smaller than 3/16". All nameplates located outdoors shall be UV resistant. Securely fasten nameplates in place using two stainless steel screws, type 316L, if the nameplate is not an integral part of the device. Epoxy cement or glued on nameplates will not be acceptable. Engrave the nameplates with the inscriptions as approved by the Engineer in the submittal.

1. For each major piece of electrical equipment provide a manufacturer's nameplate showing the Contract specified name and number designation, and pertinent ratings such as voltage, # of phases, ratings, etc.

2. For each device with a specific identity (pushbutton, indicator, instrument, etc.) mounted on the exterior or deadfront of a piece of equipment provide a nameplate with the inscription as shown on the Drawings and described herein.

3. Where no inscription is indicated on the Drawings or described herein, furnish nameplates with an appropriate inscription providing the name and number of device.

4. Install Safety Signs in accordance with the latest OSHA requirements.

   a. Entrances to electrical rooms and stations: Danger Sign requirements, ELECTRICAL ROOM, HIGH VOLTAGE (define voltage, example 480 VAC) KEEP OUT, AUTHORIZED PERSONNEL ONLY.

   b. Equipment enclosures, cable tray and wireway where 120 VAC or higher and 50 V DC and higher exist: Danger Sign requirements, HIGH VOLTAGE (define voltage, example 480 VAC) AUTHORIZED PERSONNEL ONLY.

   c. Equipment such as motor control centers, control panels, etc., where more than one source may be present in an enclosure or cubicle: Danger Sign requirements, VOLTAGE (define voltage, example 120 VAC control voltage or 480 VAC power) FROM MULTIPLE SOURCES IN THIS ENCLOSURE.

   d. Equipment such as switchboards, switchgear, panelboards and motor control centers: Warning Sign requirements, WARNING, SERVICE ENTRANCE DISCONNECT FOR 1 OF ___ (define quantity) SERVICES TO THIS BUILDING. OTHER SERVICE ENTRANCE DISCONNECTS ARE LOCATED AT (define locations).

5. Caution, warning and danger nameplates shall be red with white lettering

B. Equipment Interior Nameplates - Nameplate material shall be clear plastic with black machine printed lettering as produced by a KROY or similar machine; except caution, warning, and danger nameplates shall have red lettering. The size of the nameplate tape shall be no smaller than 1/2□in height with 3/8" lettering unless otherwise approved by the Engineer. Securely fasten nameplates in place on a clean surface using the adhesion of the tape. For each device with a specific identity (relay, module, power supply, fuse, terminal block, etc.) mounted in the interior of a piece of equipment provide a nameplate with the inscription as shown on the Drawings and described herein. Where no inscription is indicated on the Drawings or described herein, furnish nameplates with an appropriate inscription providing the name and number of device used on the submittal drawings. Stamp the nameplates with the inscriptions as approved by the Engineer in the submittal.

C. Equipment Tags - When there is no space or it is impractical to attach an

engraved plastic nameplate with screws, as is the case with most field devices and instruments, the Contractor shall attach a tag to the equipment with the same inscriptions as specified above in paragraph A. The tag shall be made from stainless steel material and the size of the nameplate shall be no smaller than 3/8"h x 2"w with 3/16" machine printed or engraved lettering unless otherwise approved by the Engineer. The tag shall be attached to the equipment with stainless steel wire of the type normally used for this purpose.

2.03 FASTENERS

A. Fasteners for securing equipment to walls, floors, or ceilings, shall be stainless steel. The minimum size fastener shall be 3/8 inch diameter.

2.04 COMPONENTS

A. Switches and Pushbuttons

1. Switches (HS) and pushbuttons (HC) for general purpose applications shall be water and oil tight as defined by NEMA 4X, corrosion resistant as defined by NEMA ICS 6-110.58, U.L. listed, standard 30 mm diameter, with plastic holding nut.

2. Switches and pushbuttons shall have contacts rated NEMA A600 or 10 amperes continuous and 600 VAC. Provide NO and NC contacts as required.

3. Engraved black legend plates shall be provided to define each switch and pushbutton function.

4. Selector switch handles and pushbutton caps shall be black unless otherwise noted on drawing. Lock-out stop caps shall be red.

5. Selector switches for hand-off-auto (HOA) applications shall have the hand position to the left, off in center, and auto in the right position.

6. Pushbuttons and selector switches in hazardous locations shall have hermetically sealed contacts or explosion proof enclosures.

7. Lockout stop pushbuttons shall include padlocking attachment. Pushbutton type shall be coordinated with padlock attachment type.

8. Switches and pushbuttons shall be Allen-Bradley 800H, or equal.

B. Indicating Lights

1. Indicating Lights for general purpose applications shall be NEMA 4X, corrosion resistant as defined by NEMA ICS 6-110.58, U.L. listed, 30 mm diameter, with plastic lens, plastic holding nut, and miniature bayonet lamp base.

2. Lamp shall be full voltage 120 VAC with 28 chip (min) High Intensity LED.

3. Indicating lights shall have contacts rated NEMA A600 or 10 amperes continuous and 600 VAC. Provide NO and NC contacts as required.

4. Engraved black legend plates shall be provided to define each lights function.

5. Indicating light type and color of lens shall as follows or as otherwise shown on the Drawings:

a.	Open/On	Green
b.	Closed/Off	Red
c.	Alarm	Amber or Blue
d.	Power On	White

6. Indicating lights designated "PTT" on wiring diagram or shown with push-to-test wiring shall be provided with a push-to-test switch and wiring.

7. Indication lights shall be Allen-Bradley 800H, or equal.

C. Relays and Timers

1. General: Relays and timers shall be provided with N.O. or N.C. contacts as shown on the Drawings. All spare contacts shown shall be provided. Contacts shall be rated 10 amps minimum at 120 VAC, 60 Hz unless otherwise shown on the Drawings. Coil voltage shall be 120 VAC unless otherwise described or shown on the Drawings. Relays and timers shall be designed for continuous duty. All relays shall be U.L. listed. All relays and sockets shall be the product of a single manufacturer. The following is a summary of abbreviations associated with relays and timers:

CR	□ Control relay
TR	□ Timing relay
TDOE	□ Time delay on energization
TDOD	□ Time delay on de-energization
PR	□ Power Relay
PFR	□ Phase Fail Relay
VR	□ Voltage Sensor Relay

2. Sockets for plug-in relays and timers shall be standard industrial type DIN rail mount with barrier type pressure plate screw terminals. Sockets shall be rated 300 VAC, 10 amps minimum.

   a. Blade 8 or 11 pin for coil voltage above 90 volts AC or DC.

   b. Octal 8 or 11 pin for coil voltage below 90 volts AC or DC.

3. Control relays (CR) shall be plug-in type with neon indicating lights and clear see-through sealed housing to exclude dust. Provide IDEC Type RR, or equal. Two form-C contacts (minimum) shall be provided on each relay.

4. Time delay relays on energization (TR-TDOE) shall be solid state plug-in relays with adjustable timer ranges from 1 second to 10 hours selectable unless other ranges are shown. Provide LED timer energized indicator lamp. Time delay relays shall be IDEC RTE, or equal.

5. Time Delay Relays (TR-TDOD)

   a. Time delay relays on de-energization (TR-TDOD) (continuous power control input) shall be solid state plug-in relays with a timer adjustable range from 1 second to 10 hours selectable unless other ranges are shown. Provide LED timer energized indicator lamp. Time delay relays shall be IDEC RTE, or equal.

   b. Time delay relays on de-energization (TR-TDOD) (true off) shall be solid state plug-in relays with a timer adjustable range from 1 second to 10 minutes unless other ranges are shown. True off time delay relays shall be IDEC GT3F-2, or equal.

6. Power relays (PR) shall be plug-in type and clear see-through sealed housing to exclude dust. Provide Magnecraft Type 389FXCXC-120A, or equal. 3PDT contacts rated 20A or 1 HP at 240 VAC (minimum) shall be provided on each relay. Furnish compatible blade type relay socket model 70-788EL11-1 or equal.

7. Voltage Sensor relay (VR) shall continuously monitor its input terminals nominally rated for 24 VDC. When nominal operating voltage with a value between the UPPER & LOWER setting is applied, the internal relay will energize (Pick-up). If the operating voltage falls outside the preset OVER trip point (adjustable 100-125% of nominal) or UNDER trip point (adjustable 75-100% of nominal) for a period longer than the drop-out time delay (T), the relay will de-energize (Drop-out). When the voltage returns to normal (within the preset OVER & UNDER trip points), the unit automatically resets and the relay energizes. The VR shall interface to the control circuit with to independent SPDT contacts rated for 10 Amps at 120 VAC. Set the trip points per contract drawings. Sensor Relay shall be Macromatic VWKP024D, or equal.

2.05 MOLDED CASE CIRCUIT BREAKERS

A. GENERAL

1. Circuit breakers and motor circuit protectors shall be manufactured by Eaton Cutler-Hammer, Square D, G.E., Siemens, or equal.

2. Circuit breakers shall be the bolt-on type.

3. Multiple-pole circuit breakers shall be designed so that an overload on one pole automatically causes all poles to open. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or spaces specified are not acceptable.

4. Molded case circuit breakers shall be operated by a single toggle-type handle and shall have a quick-make, quick-break switching mechanism.

An automatic trip of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and have flash reduction arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

5. Minimum interrupting capacity:

   a. 480 volt circuit breaker shall have a minimum interrupting capacity of 42,000 amperes.

   b. 120 or 208 or 240 volt breaker shall have a minimum interrupting capacity of 22,000 amperes

6. Circuit breakers shall be UL listed for series application.

7. Where indicated circuit breakers shall be current limiting.

8. Where indicated on Drawings, provide UL listed circuit breakers for continuous duty at 100% of their ampere rating in the intended enclosure.

9. Furnish add-on features such as auxilliary position status contacts, trip indication contacts, shunt trip coils, etc, as shown in the drawings.

B. TRIP UNIT Molded Case Circuit Breakers

1. Circuit Breakers less than 400 volt shall have thermal-magnetic (TM) trip units and inverse time-current characteristics. All other circuit breakers shall have trip units as Defined herein.

2. The trip unit shall be Eaton type Digitrip 310+ or equal.

3. Each molded case circuit breaker microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors, and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time-delay settings are reached.

4. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall non-adjustable. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.

5. Furnish 24VDC power supply with terminal blocks and 0.5A miniature circuit breakers to distribute power to each circuit breaker trip unit that requires it. Circuit breaker trip units shall be operable and adjustable with zero current flowing through the circuit breaker. The power supply shall be connected after the main breaker and above any feeder circuit breakers.

6. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

a. Adjustable long-time setting (set by adjusting the trip setting dial to an amount not to exceed rating plug)

b. Adjustable short-time setting and delay with selective flat or I^2t curve shaping,

c. Adjustable instantaneous setting

d. Adjustable ground fault setting and delay with selective flat or I^2t curve shaping.

7. The microprocessor-based trip unit shall have both powered and unpowered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.

8. Furnish internal ground fault protection with adjustable settings. Provide neutral ground fault sensor for four-wire loads.

9. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set.

2.06 MOTOR CONTROL ACCESSORIES

A. Control Power Transformer:

1. Control power transformer shall be epoxy encapsulated for dust and moisture protection. The internal wiring shall be copper and have 105 deg. C insulation rating. The unit shall feature barriered screw terminals for connection to electrical circuits. Provide with time-delay, slow-blow secondary fuse rated to protect the transformer and interrupt 10,000 amperes at 120VAC. Two primary fuses rated for 480 VAC and AIC as shown in the Drawings shall be provided. Transformer minimum size and voltage ratings shall be as shown on Contract drawings. Control power transformer shall be Micron Impervitran, Cutler Hammer MTE or equal.

2.07 DEVICES

A. Switches

1. General purpose commercial grade switches shall be manufactured in accordance with UL 20. Switches shall be one pole, brown, 20 amps at 277 VAC, 1HP at 120 VAC, 2 HP at 240 VAC. Switches shall have copper alloy contact arm with silver cadmium oxide contacts. Switches shall have slotted terminal screws and a separate green grounding screw. Provide Leviton 1221, or equal.

2. Wall mount commercial grade motion detector switches (denoted with M next to switch symbol in drawings) shall utilize passive infrared detection with 180 deg field of view to determine if the space is occupied by personnel. The device shall be capable of switching incandescent (800W at 120V) and fluorescent (1200VA at 120V) lamps with electronic ballasts.

The device shall feature a manual-off-auto switch. A delay off time adjustment shall be settable from 30 seconds to 30 minutes. The device shall incorporate a photocell with light intensity adjustment to keep the switch from activating when light levels are above setting. Provide Leviton ODS10, or equal.

3. Timer Switches (denoted with T next to switch symbol in drawings) shall provide a variable time range countdown of lighting circuit. Depressing touchplate turns lights on for the dial setting located behind the touchplate. Dial setting ranges of 1 minute to 18 hours shall be attainable. An illuminated LED indicates the load is on and blinking LED accompanied by annunciator sound indicates end of time cycle. Device shall be capable of switching incandescent (600W at 120V) and fluorescent (900W at 120V) lamps with electronic ballasts. Timer Switch shall be Leviton 6652, or equal.

4. Time Clock Switches (denoted with TC next to switch symbol in drawings) shall provide a programmable automatic time on/off of lighting circuit. Settings each 30 minutes for 24 hours shall be attainable by setting from front of switch. An illuminated LED indicates the load is on. Device shall be capable of switching incandescent (900W at 120V) and fluorescent (1200W at 120V) lamps with electronic ballasts. Timer Switch shall be Leviton 6124, or equal.

5. Thermostat Switches (T in circle on drawings) shall have a plastic NEMA 4X rated housing with stainless steel temperature sensing coil externally mounted. A face mounted dial shall allow temperature settings for heating and cooling from 40 to 104 deg F. The switch shall be rated for 120/240 volt at 10A inductive/16A resistive, SPDT. Temperature switch shall be Esapco TH15 or equal.

6. Special purpose switches shall be provided with the amperage, voltage, and configuration as shown on the Drawings. Switches used as motor disconnects for single phase motors shall be horsepower rated.

B. Receptacles

1. General purpose receptacles shall be commercial grade, duplex and rated 20 amps, 120 VAC, 2 pole, 3 wire grounding, NEMA 5-20R configuration, specification grade, and side wired to screw terminals. Face color shall be brown when paired with stainless steel covers. General purpose receptacles shall be specification grade Leviton 5362-B or equal.

2. Ground fault circuit interrupter receptacles shall be used where noted as GFI on plan or where in outdoor NEMA 3R locations. GFI receptacles shall be commercial grade, duplex, brown, 20A, 120V, back and side wired, with "test" and "reset" buttons. Daisy Chain connecting multiple receptacles from one GFI unit is not acceptable. GFI receptacles shall be Leviton 8898, Leviton MGNF2-B, Leviton 7899, or equal.

3. Boxes shown in NEMA 3R environments and outdoor locations shall be weatherproof while in-use. Furnish in-use weatherproof covers and weatherproof boxes for these areas.

4. Definite purpose receptacles and plugs in NEMA 4 or 4X environments where a receptacle is shown and a device is to be connected continuously, shall be listed as UL type 4, 4X, (Plug) and NEMA 3R (flip cover). Receptacles, plugs, and housings shall be fabricated of impact resistant plastic with o-rings and gaskets to prevent the entrance or water, vapors, and chemicals when unplugged or plugged. Circular plugs shall be retrofitted onto equipment so as to be compatible with the receptacles to maintain in-use ratings. Furnish Hubbel Watertight Wiring Devices and Accessories, or equal.

2.08 PANELBOARDS AND TRANSFORMERS

A. Panelboards:

1. General

a. The Contractor shall furnish panelboards of a type indicated on the one-line Contract drawings and specified herein.

b. Furnish and install padlock lock-off attachment for each circuit breaker.

c. Panelboards shall comply with the applicable sections of UL, NEC, and NEMA and shall be Cutler Hammer Pow-R-Line, Square D, ITT or equal.

d. A machine-typed circuit directory with clear plastic cover shall be supplied mounted on the inside of door in a frame when equipment is shipped. Circuit directory shall be as approved in the Submittal.

2. Interiors

a. Interiors shall be completely factory assembled with bolt-on devices.

b. Branch circuit breakers shall include padlock lockout provisions. Provide Cutler Hammer QLPB123PL or equal. Main breakers shall include padlock hasp suitable for frame size.

c. Full size insulated neutral bars shall be included. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

d. Main bus bars shall be plated copper seized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 50 degrees C above an ambient 40 degrees C

maximum.

e. A copper ground and neutral bus shall be included in all panelboards with terminal screws.

3. Boxes

a. Provide minimum gutter space in accordance with the National Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

4. Trims

a. Provide a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a catch, lock and trim.

b. Surfaces of the trim assembly shall be properly cleaned, primed and a finish coat of gray ANSI 61 or 49 or to match MCC if contained within.

c. Surface trims shall be same height and width as box for surface mount, and ¾□(min) beyond box on all sides for flush mount.

5. Panelboard Ratings

a. Panelboards shall have voltage, phase and short circuit (AIC) ratings as shown on the drawings.

b. Breakers shall be a minimum of 100 ampere frame. Breakers 15 through 100 amperes trip size shall take up the same pole spacing.

c. Panelboards shall be labeled with a UL short circuit rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the UL series ratings including:

1) Size and type of upstream device
2) Branch devices that can be used
3) UL series short circuit rating

B. Power Transformer:

1. The power transformer shall be ventilated dry type. Voltage and KVA ratings shall be as shown on the Contract Drawings. The transformer shall be as manufactured by Cutler Hammer, Jefferson, ACME, Square

D, G.E., or equal.

2. Transformer shall meet latest DOE 2016 minimum efficiency standards.

3. Coils shall be manufactured of electrical grade aluminum (if stand-alone) or copper (if within a MCC or Switchboard) and shall be adequately braced for short circuit ratings and defined in ANSI and NEMA standards.

4. Transformers rated 31KVA and above shall have two 2½ percent taps above and below normal full capacity (ANFC and BNFC).

5. The transformer shall carry full load continuously at rated voltage and frequency without exceeding the average temperature rise of 115°C above an ambient temperature of 40°C. Insulation shall be rated for 220°C (UL class 220°C).

6. Impedance (Z): 4.0% +/- 0.3% or above to keep downstream fault currents to a minimum.

7. Low noise. For transformers installed within electrical equipment, vibration isolators shall be installed between the transformer and its mounting surface to reduce case vibration and associated noise.

8. For stand alone transformers, the transformer housing shall be securely fastened to the mounting surface with bolted connections sized appropriately to withstand seismic zone 4 forces.

9. The transformer shall be finished with two coats of enamel to resist rust and corrosion.

10. Transformers located inside electrical structures or enclosures shall be provided with adequate ventilation for heat removal as required.

11. Transformer neutral shall be grounded in accordance with Article 250-26 and 450-10 of NEC and any applicable local ordinances. Installation and protection of the transformer grounding conductors and attachments shall be per NEC 250-24.

2.09 UTILITY METERING SWITCHBOARD PANEL

A. Metering Panel

1. Provide totally metal enclosed front accessible, self contained meter/main power utility metering panel. Voltage, phase, AIC and continuous amperage rating shall be as shown on Contract Drawings. Panel will include meter socket, factory installed main breaker(s) and test by-pass facility.

2. Design entrance features per NEC, local codes, and serving Utility requirements.

3. Metering enclosure shall be NEMA 3R construction for underground utility service. Enclosure shall be manufactured from galvanized 16 ga. (min) sheet steel. The enclosure shall be finished with ANSI 61 gray enamel paint. Provide pad mount, surface mount or flush mount cabinet per installation detail.

4. Utility metering switchboard shall be Cutler Hammer Pow-R-Line, Tesco Metering Switchboard or equal.

B. Switchboard

1. Switchboard shall be front accessible with group mounted, buss connected circuit protective devices. Where provisions for future circuit protective devices are required, space for the device, corresponding vertical buss, device connectors and the necessary mounting hardware shall be supplied.

2. Distribution section shall meet all requirements per NEC, local codes, and as defined in the drawings.

3. Power buss shall be copper, 3 phase, 4 wire, 480 volt, 42,000 AIC minimum (or as shown otherwise in the drawings).

4. Ground buss shall be copper and rated per NEC relative to the power bus amperage rating.

5. Switchboard enclosure shall be NEMA rated as shown in the drawings.

6. Utility metering switchboard shall be Cutler Hammer Pow-R-Line, or equal.

C. Surge Protective Device (SPD):

1. The surge protective device shall be rated for use on a 480 VAC, 3 phase WYE system or 240 VAC, 3 phase Delta system. The nominal line voltage of the device shall be 277V L-N with a maximum continuous line voltage of 320V L-N. The unit shall dissipate a minimum of 80,000 amps single pulse surge current over a 8x20 usec period. The device shall dissipate a minimum of 2560 joules transient energy per phase. Provide external fusing as required by the manufacturer for proper operation. Furnish Leviton 32277-DY3, or equal.

2.10 POWER MONITORING

A. Power Monitor

1. General:

a. Microprocessor based multifunction power and energy meter

b. Designed for multifunction electrical power, voltage, and current measurement on 3 phase power systems.

c. Measured parameters: voltage, current, frequency, unbalance,

kW, KVAR, KVA, power factor, kWh.

d. Support for 3-Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.

e. 200 ms update for power measurement, 100ms update for voltage, current, Hz.

f. Din rail mounting

g. 85 to 264 VAC control power, 5W.

2. Voltage Inputs

a. Configurable to potential transformer ratio.

b. Input impedance of 1 Mega Ohm, 0.014W at 120 Volts.

c. Direct voltage input range

1) 347 Volts Line to Neutral

2) 600 Volts Line to Line.

d. 2500V withstand.

3. Current Inputs:

a. Configurable to current transformer (CT) ratio 1A or 5A input.

b. Burden 0.05VA, Impedance 0.002 ohms

c. Meter shall have a maximum burden of 0.005VA per phase, at the maximum of 15 Amperes continuous input.

d. Fault current withstand shall be 200 Amps for 1/2 second.

4. Digital I/O:

a. Two status inputs 24VDC dry contact.

b. One KYZ output, 24VDC, 30mA

5. Accuracy

a. Revenue meter accuracy

b. +/- 1% or better for volts and amps

c. +/- 1% for power and energy functions.

d. True RMS measurements

6. Communications

a. Ethernet - 100BaseT Ethernet IP Allen Bradley protocol

b. Modbus TCP

7. Acceptable Products

a. Allen Bradley PM1000 1408-EM3A-ENT Ethernet

b. Or Equal

B. Current Transformers

1. Furnish mounted (preferable) or unmounted current transformers based on space allocated and installation requirements. The current transformer shall have wire leads or binding posts and ratio as shown on the drawings. The accuracy shall be metering accuracy class 0.6 at a minimum burden at 60 hz shall be 2.5 VA and as required to meet specified accuracy of device(s) fed.

2.11 RADIO SYSTEM

A. ANTENNA POLE

1. 35ft round tapered steel main section, hot dip galvanized, 11 ga steel thickness, min. Base plate diameter as required to meet performance criteria.

2. Welded top plate with tenon. The tenon is 2" diameter x 4" long pipe with plain end welded to plate and 2" MNPT threaded opposite end.

3. Provide 2□galvanized threaded Y adapter and threaded extension pipe and lighting rod per details.

4. Hand hole near base, 5□x 7□minimum. Ground lug accessible within.

5. Anchor Bolts: Galvanized 1□L□anchors with 2 hex nuts and 2 washers per bolt for leveling. Provide 2-piece base anchor cover and fasteners.

6. Design information

a. IBC 2012 (MOD W/AASHTO), Exposure category C, Risk Category II.

b. Wind Velocity: 100 MPH sustained with 130 MPH gust assuming effective panel area (EPA) and weight as required based on radios.

c. Pole Top Load: Assume 10 sq ft EPA, minimum.

d. One (1) degree of movement maximum at top of pole under wind gust conditions.

e. Designed and manufactured by Valmont Industries or equal.

B. RADIO MODEM

1. Unlicensed 900 Mhz spread spectrum radio for continuous communications to multiple addresses. The radio shall be system addressable to minimize interference from adjacent systems with different system addresses. The radio shall utilize a RJ45 port for Ethernet communications input and TNC connector for antenna lead connection output. The radio shall operate on 24 VDC radio with full performance over a temperature range of -30 deg C to +60 deg C. The radio shall be

MDS INET 900 or approved equal. Coordinate radio requirements with existing systems.

2. Bandpass filter shall pass 902~928 MHz with less than or equal to 1.5dB insertion loss and return loss of 20db or higher. The filter shall reject 850~894 MHz and 936~950 MHz greater than 45 dB. The unit shall be passive (unpowered). The dimensions of the filter shall be 5□x 2.5□x 2□ maximum and have N-female connectors. The filter shall be Anatech Microwave part number AB915B475 or equal.

C. ANTENNA

1. Each antenna system shall be furnished and installed complete and functional for the intended use. An antenna system shall include but not be limited to, antenna, antenna pole, mounting hardware, lightning arrestor, and coaxial cables with connectors.

2. Antenna system shall be meet the following specifications:

   a. Antenna shall be installed and supported as shown on the Drawings. Support members shall have sufficient strength to withstand local wind conditions and shall be protected from sun exposure and weather damage.

   b. Support hardware such as clamps, orientation mounts, and offset brackets shall be steel protected with a hot dip galvanized finish or stainless steel. Clamps and mounts shall be heavy duty in order to transfer the full antenna load to the support tower or mast. Bolts and screws shall be stainless steel.

   c. The radio antenna shall be 9 dB gain, 890-960 Mhz, aluminum, circumferential welded construction, black powder coat finish, directional type Yagi, VSWR 1.5:1, 50 ohm impedance, N-female connection, Maxrad Model BMOY 8905 or equal.

D. TRANSMISSION CABLE

1. Provide 50 Ohm, ½□weatherproof coaxial cable from lighting arrestor to antenna. The coax cable shall have a corrugated outer conductor of copper, copper-clad aluminum inner conductor with foam dielectric. The coax cable shall be jacketed for corrosive environment and ultra-violet exposure. The coax cable shall be capable of a minimum bending radius of 5 inches. The cable shall be installed as one continuous length from the antenna to the lighting arrestor. Antenna cable shall be Andrew Superflex FSJ4-50B, 1/2" coax cable or equal.

2. Cable end □N□connectors shall be furnished for field installation after the cable is run in conduit. Provide straight or right angle connectors as required for the installation as required.

3. Pigtail connector. Provide low loss connection cable for connecting the

Radio antenna connection to the lightning arrestor. Pigtail shall have compatible connectors for the radio and lightning arrestor.

4. Furnish an antenna lighting arrestor with "N" connector on the antenna coaxial transmission line. The lighting arrestor shall be grounded to the control panel ground buss by a #8 AWG or larger bonding wire. The lighting arrestor shall be insulated from the backpan. The lightning arrestor shall be a PolyPhaser IS-50NX-C2 or equal.

5. The cable shall be carefully installed to prevent damage to the jacket and routed with a minimum bending radius of 8 inches except where required at the conduit to free-air transition.

6. Provide connector weatherproofing kits for outdoor exposed connectors. All mating connectors that are exposed to weather shall be wrapped with a sealing material designed to protect against water and dirt entry into the connectors.

2.12 SPARE PARTS

A. The Contractor shall supply all spare parts prior to start of field tests. All parts shall be sealed in plastic bags and delivered to the site in a heavy duty plastic storage bag. Bag shall be clearly labeled with part name & number and the corresponding equipment tagname.

B. The Contractor shall make available any replacement parts that are not manufacturer's normal stock items for immediate service and repair of all the instrumentation equipment throughout the warranty period.

C. The following spare parts shall be provided as part of this Contract:

1. Ten fuses for each type of fuse below 31 amps, 3 of each type above
2. Ten lamps for each type of light, two lamps per color if LED type.
3. Two relays for each type of control, and time delay relay.
4. One voltage monitoring relay or power fail relay.

PART 3: EXECUTION

3.01 CONSTRUCTION METHODS

A. Equipment shall be assembled and wired by the manufacturer prior to shipment. Field modifications or changes are not allowed without a written "change order" to the Contract. Field changes, however large or small, shall be executed using the components, materials, wiring, labeling, and assembly methods identical to that of the original supplied equipment.

B. Electrical plugs, receptacles, cords, and connectors required to power or interface the equipment and panels shall be furnished and installed by the Contractor.

C. Factory as-built drawings for each custom manufactured control panel or MCC shall be shipped with the equipment and placed inside in waterproof envelopes.

3.02 EQUIPMENT FABRICATION

A. All electrical equipment, including custom manufactured equipment, shall meet the requirements of Underwriters Laboratories (UL) and bear the appropriate label. Panels shall be affixed with UL label prior to shipment and be built in accordance with the UL guidelines and procedure that corresponds to the UL label. Custom control panels shall bear a UL-508 label, minimum, with additional UL labels as required per intended service.

1. Design and furnish a Low Voltage Limited Energy Circuit for any device(s) not bearing a UL listing or registration that are required to be installed into a UL labeled panel.

2. Revise voltages for any electrical parts and equipment that are specified that do not bear the UL listing or registration.

B. Panel cutouts for devices (i.e. indicating lights, switches) shall be cut, punched, or drilled and smoothly finished with rounded edges. Exposed metal from cutouts that are made after the final paint finish has been applied shall be touched up with a matching paint prior to installing device.

C. Equipment doors shall swing freely and close and latch with proper alignment.

D. Component within the electrical equipment shall be securely mounted on an interior subpanel or backpan and arranged for easy servicing. Mounting bolts and screws shall be front mounted for device removal without special tools or removal of entire mounting panel.

E. A ground bus shall be provided in each enclosure or cabinet. It shall have provisions for connecting a minimum of ten grounding conductors. Screw type lugs shall be provided for connection of grounding conductors. All grounding conductors shall be sized as shown on plans or in accordance with NEC Table 250-95, whichever is larger.

F. Bolts and screws for mounting devices on doors shall have a flush head which blends into the device or door surface. No fastening devices shall project through the outer surfaces of equipment.

3.03 WORKMANSHIP

A. All work in this division shall conform to the codes and standards outlined herein.

B. Installation shall be performed by qualified personnel providing first class workmanship per Electrical Specifications [Electrical General, Qualifications].

C. Maintain equipment installed (or to be installed) in new condition. Protect equipment from damage while in Contractor care from dust, water, or mishaps that are typical to construction sites

D. Confirm that equipment and materials are correct for their intended duty and will be installed per manufacturer guidelines. Equipment and components found to

be installed inconsistent with manufacturer guidelines and/or these specifications will not be acceptable and subject to removal and replacement.

E. Upon completion of daily work, remove excess materials, scraps, and debris from the work area and from the inside of equipment.

F. Upon notification, stop work on any portion of the installation that is determined to be non-compliant with contract or being installed by unqualified personnel.

G. Perform all work to correct improper installations at no additional cost to the owner.

H. Equipment furnished under this contract or provided to Contractor for installation shall be installed in accordance with manufacturer's instructions, installation calculations, and contract documents.

3.04 EQUIPMENT SHIPMENT AND STORAGE

A. Shipment -- Any equipment whose destination (jobsite) is more than 25 miles from the factory shall be carefully protected for shipping. All openings shall be protected by plywood securely fastened to the framework of the equipment. Equipment shall be adequately covered during local delivery.

B. Storage -- From the time of receipt until the equipment is installed and energized, the equipment shall be considered in storage. While in storage, a 120V, 1 phase source of power shall be made available and connected to space heaters in all items of equipment so equipped. Equipment not provided with space heaters shall be provided with a light bulb or electric heater while in storage to prevent moisture condensation. Unless stored indoors, it shall be a least 1 foot above grade covered with at least 2 layers of heavy polyethylene plastic sheets and anchored to prevent damage by high winds. All equipment shall be protected from dust and moisture prior to and during construction.

3.05 DAMAGED PRODUCTS

A. Damaged products that cannot be repaired to new condition shall be replaced with new products. All equipment and materials shall be in like-new condition at start-up and commissioning.

B. Any equipment furnished outside of contract to the Contractor shall be repaired or replaced if damaged while in the Contractor's care. The Contractor shall pay for the parts and/or services of the original equipment manufacturer (OEM) to troubleshoot, asses, and repair damaged equipment.

C. Minor cosmetic damage shall be repaired by spray painting, after properly preparing the surface, all scratches or defects in the finish of the equipment. Only identical paint furnished by the equipment manufacturer shall be used for such purposes.

3.06 INSTALLATION

A. General

1. Install all products per manufacturer□s recommendations and the Drawings.

2. Provide all necessary hardware, conduit, wiring, fittings, and devices to connect the electrical equipment provided under other Sections.

3. Protect wiring insulation from wear by installing rubber cushions, bushings, or strip insulation, or by fastening the wiring to a rigid surface with zip ties and anchors.

4. Provide additional devices, wiring, conduits, relays, signal converters, isolators to complete interfaces of the electrical and instrumentation system.

5. Changing normally open contacts to normally closed contacts or vice versa

6. Adding additional relays to provide more contacts as necessary.

7. All programmable devices (not specifically excluded herein) shall be programmed, set-up and tested by the Contractor prior to startup. Programming and set-up parameters shall be adjusted or changed as directed by the Engineer during start-up and throughout the warranty period.

8. Coordinate with the Engineer and setup all alarm, process, and operation setpoints.

9. Keep a copy of the manufacturer's installation instructions on the jobsite available for review at all times prior to and during the installation of the associated equipment.

B. Panels and enclosures:

1. Install panels and enclosures at the location shown on the Plans or approved by the Engineer.

2. Install level and plumb.

3. Seal all enclosure openings to prevent entrance of insects and rodents.

4. Clearance about electrical equipment shall meet the minimum requirements of NEC 110.26

C. Conduits and Ducts:

1. Install all conduits and ducts per Electrical Specifications [Conduit and Boxes] and [Grounding].

2. Minimum wire bending space at terminals and minimum width of wiring

gutters shall comply with NEC tables 312-6 (a) & (b).

D. Wiring, Grounding, and Shielding:

1. Observe proper grounding and shielding practices as this application environment is generally noisy. The shield of shielded cables shall be terminated to ground at one end only, the origination end. The shield at the other end shall be encased in an insulated material to isolate it from ground.

E. Cutting and Patching:

1. The Contractor shall do all cutting and patching required for installing his work. Any cutting which may impair the structure shall require prior approval by the Engineer. Cutting and patching shall be done only by skilled labor of the respective trades. All surfaces shall be restored to their original condition after cutting and patching.

F. Cleaning and Touch up:

1. At the completion of the work, all parts of the installation, including all equipment, exposed conduit, and fittings, shall be thoroughly cleaned of grease and metal cuttings. Any discoloration or other damage to parts of the building, the finish, or the furnishings, due to the Contractor's failure to properly clean the system, shall be repaired by the Contractor.

2. The Contractor shall thoroughly clean any of his exposed work requiring same.

3. Vacuum and clean the inside of all electrical and instrumentation enclosures prior to applying power.

4. The Contractor shall paint scratched or blemished surfaces with the necessary coats of quick drying paint to match existing color, texture and thickness. This shall include all prime painted electrical equipment including but not limited to enclosures, poles, boxes, devices etc.

3.07 APPLICATION OF POWER

A. The Engineer will direct the energization and de-energization of all existing and new equipment. The Contractor is not authorized to energize or de-energize any equipment unless they have been given written permission to do so or while in the presence of the Engineer.

1. Any equipment that is under repair, demolition or installation shall be locked off and tagged out of service with Contractor supplied padlocks and tags.

2. The Contractor is required to comply with NFPA 70E and specifically in regards to safety when working on live equipment. Obtain work permits when needed to do live work.

B. The Contractor is responsible for grounding of high and medium voltage cabling and/or bus during installation and removal of equipment. The contractor is responsible for complying with all California Electrical Safety Orders (ESO) and Occupational Safety and Health Act (OSHA) safety requirements and procedures while working in or near medium voltage equipment.

3.08 WARRANTY

A. The Contractor shall warrant all electrical and instrumentation equipment & software for a period of 1 year from date of final acceptance. Standard published warranties of equipment which exceed the preceding specified length of time shall be honored by the manufacturer or supplier.

B. The Contractor shall have a staff of experienced personnel available to provide on-site warranty service on 2 working days notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing hardware & software and implementing corrective measures. If the Contractor "fails to respond" in 2 working days, the Owner, at his option, will proceed to have the warranty work completed by other resources. All cost for these other resources shall be reimbursed in full by the Contractor. "Fail to respond" shall be defined as: The Contractor has not shown a good faith effort and has not expended adequate resources to correct the problem. The use of other resources, as stated above, shall not change or relieve the Contractor from fulfilling the remainder of the warranty requirements.

3.09 FINAL ACCEPTANCE

A. Final acceptance will be given by the Engineer after the equipment testing is complete, each deficiency has been corrected, final documentation has been provided, and all the requirements of Contract documents have been fulfilled.

B. At the end of the project, following the completion of the field tests, and prior to final acceptance, the Contractor shall provide the following:

1. Each "operation and maintenance" manual shall be modified or supplemented to reflect all field changes and as-built conditions.

2. Two (2) disk copies of all final documentation to reflect as-built conditions.

C. Keys: Submit two sets of all keys for locks supplied on this project. Wire all keys for each lock securely together. Tag and plainly mark with lock number or equipment identification, and indicate physical location, such as panel or switch number.

END OF SECTION

SECTION 26 10 10
CONDUIT AND BOXES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Labor, materials, equipment, tools, safety gear, test equipment, incidentals, services, and transportation for a complete electro-mechanical installation as shown on the Drawings, included in these Specifications, or as can be reasonably implied from project descriptions.

B. The scope of work includes:

1. Furnish and install conduits, wireways, raceways, cable trays, junction boxes, pull boxes, and associated hardware. Provide conduit, fittings, hardware, hangars, mounting channel, and other parts for a complete raceway installation.

2. Furnish and install grounding system required by drawings, or if not shown or defined, as required by Article 250 of the NEC.

3. Installations shall be designed and installed with components meeting the NEMA area designation.

C. Work includes that specified in Electrical Specifications [Electrical General].

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Electrical Specifications [Low Voltage Wire & Data Cable]
C. Electrical Specifications [Grounding]
D. Project Drawings

1.03 QUALIFICATIONS

A. Material furnished under this specification shall be installed by qualified installers meeting requirements specified in Electrical Specifications [Electrical General, Qualifications].

1.04 SUBMITTAL REQUIREMENTS

A. Provide submittals and drawings as specified in Electrical Specifications [Electrical General, Submittal Requirements].

PART 2: PRODUCTS

2.01 CONDUIT, RACEWAYS AND WIREWAYS

A. GENERAL - Conduit, raceways, and wireways, wiring methods, materials,

installation shall meet all requirements of the NEC, be UL labeled for the application, and meet the minimum following specifications.

1. All wiring shall be installed in conduits, raceways, or wireways when interconnecting equipment and devices.

    a. The minimum size conduit shall be 3/4-inch unless indicated otherwise on the Drawings or for special connections to equipment.

    b. Provide cords and cord seals for devices or instrumentation requiring waterproof seal to maintain NEMA 4 or 4X ratings. Example devices include lighting and pipe mounted instruments that are located below grade.

2. Conduits may connect into junction boxes or wireways as shown in the drawings or as requested by Contractor and approved by Engineer. Junction boxes (circle with J in drawings) can be as simple as a condulet or JIC box, or larger box as determined by contractor and needed for the installation. Drawing may or may not depict junction box requirements that may be required by code. Wireways or junction boxes shall be rated for area (as noted in the Drawings), or furnish minimum NEMA 4 if not noted.

3. The Contractor shall use conduit material types (SPEC per conduit schedule) as defined below or as otherwise shown in the contract drawings or as specifically called out in the conduit schedule.

    a. Non-exposed underground portions of conduit run shall be PVC-40 for all signals and voltages unless otherwise shown in the conduit schedule.

b. Exposed conduit material (not underground and beyond transition) shall be per the following table unless specifically noted otherwise in the plan drawings. The conduit schedule denotes the conduit type for non-exposed (under-ground, in-concrete, etc.) and does not apply or coordinate with this table. Exposed condulets, elbows, fittings, device boxes, and hardware shall be of the same material and finish as the adjacent conduit.

Location	Material
NEMA 1 or 12	Galvanized rigid steel (GRS)
NEMA 3R	Galvanized rigid steel (GRS)
NEMA 4	PVC-Coated Steel (GRS-PVC)
NEMA4X	PVC-Coated Steel (GRS-PVC)
Class 1 Div 1 or 2 hazardous	PVC-Coated Steel (GRS-PVC)

4. Conduit stubs and transitions:

a. Conduit transitions shall be GRS-PVC for 6□on either side of the transition point (minimum) or as shown in drawing details. Conduit transition is defined as conduit sections emerging from or through concrete or earth or from below to above grade or through walls or vaults, non-exposed to exposed.

b. Beneath pad mounted electrical equipment, where not exposed, shall be installed or trimmed to 2□or less above slab and have bushing or end bell installed. Overall height of conduit entering into the base of equipment shall be enough for bushings/bells to be installed but be high enough for conduit tags to be installed.

c. Uniform in height for each panel or section. Conduits end bushings/bells shall not vary in height above slab more than ½□ from lowest to highest.

d. Conduits shall be spaced apart such that bushings and end bells may be installed without interfering with the adjacent conduits.

e. Transitions to PVC shall include PVC coated locknuts to shield exposed steel pipe threads.

f. Through walls □ shall protrude approximately 2□and include end bell or bushing. Pack space around conduit with non-shrink grout if the thru-hole was core drilled.

g. Conduits for future use shall be capped with coupling and plug. Identify each end with conduit labels.

h. Existing conduits that are no longer able to be used due to removal of a section or shown demolished and that protrude above graded shall be cut flush and filled with grout.

5. Conduit Tags

   a. All conduits listed in the "Conduit and Wire Routing Schedule" shall have conduit tags at both ends of each conduit run with tag number from schedule identified. This shall include ends within underground pull boxes.

   b. All conduits shall have temporary tags during construction. Temporary tags may be made from duct tape with hand written ink marking or suitable equivalent. Temporary tags shall be removed by Contractor at time of installation of permanent tags.

   c. Tag material shall be rigid laminated red plastic with white lettering. The size of the tag shall be ¼" thick by ¾" round or ¾" x 1" rectangle minimum.

   d. Letter height shall be ¼" minimum. Engrave the tags with the conduit number or acronym. Labeling shall be neatly installed for visibility and shall be clearly legible. Securely fasten tags in place using 20ga stainless steel tie wire through a pilot hole on the tag.

   e. Conduit tags shall be Custom manufactured per specification.

6. Supports

   a. Cross section of a single channel shall be 1-5/8" x 1-5/8" and cross-section of a double channel shall be 1-5/8" x 3-1/4". The channel wall thickness shall be 12 gauge as applicable.

   b. One-Hole clamps shall be intended for pipe mounting on support channels and equipped with clamp-backs. The clamps shall be Efcor, Thomas and Betts, Appleton or equal

   c. Spacers, provided to support underground conduits in concrete encasements, shall be plastic. The spacers shall be Carlon, Johns-Manville, Underground Products or equal

   d. Anchors shall be expansion type for securing equipment to concrete foundations, floors and walls. Anchors shall have length identification mark on the exposed end of the bolt. Provide Hilti Kwik Bolt 3, or equal.

   e. Stanchions shall be provided as needed to mount equipment and electrical components. Stanchions shall be shop fabricated from welded 4" c-channel, 12" x 12" x ¼" steel base plate, coated with a rust inhibiting primer and top coat of gray polyurethane gloss paint. Attach equipment to the stanchion direct or on a ¼" aluminum sheet sized for the equipment supported.

   f. Conduit Hangers shall be trapeze construction, with double channel, 3/8-inch rods and nuts. Suspend from suitable structural

support.

g. Support material and finish shall be per the following table unless otherwise noted in the drawings. Brackets, fittings and hardware shall be of the same material and finish.

Location	Material
Indoors NEMA 12	Galvanized steel
Outdoors NEMA 3R	Galvanized steel
Outdoors NEMA 4	Stainless Steel type 316
Corrosive areas NEMA4X	PVC bonded, 40 mil, factory applied

h. Equipment mounting racks shall be designed by installer for rigid equipment and conduit mounting. Racks shall be bolted or welded construction and sized for equipment or as shown on the drawings.

i. Strut channels shall be used for mounting equipment to walls and for supporting conduit runs. Double strut channel type shall be used for fabricating equipment mounting racks as required and/or as detailed on the drawings. Add additional supports to rigid mounting locations as needed to prevent wobbling and to meet seismic requirements. All field cut surfaces of the strut channels shall be deburred and coated to prevent rust.

B. Galvanized Rigid Steel Conduit - (GRS)

1. Manufactured from high-strength steel and hot dipped zinc galvanized inside and out. Conduit and fittings shall meet UL 514B, UL 6, and conform to NEMA RN 2. Conduit shall be capable of being used as an equipment grounding conductor per NEC 250.

2. Provide galvanized rigid steel factory sweeps and elbows for 90 degree transitions.

3. Cast fittings and device boxes shall be malleable iron or aluminum. Appleton type FS/FD or equal.

4. In hazardous locations, fittings shall meet and be listed UL 886.

5. All fittings, hubs, couplings, pulling elbows and connectors shall be threaded-type. Set-screw type and compression-type are not acceptable. All thread conduit is not allowed over 1/2□exposed length. Cover plates shall be cast iron with sealing gasket in NEMA 3R locations.

6. Conduits entering enclosures shall be fitted with insulated grounding bushing; O-Z "HBLG", Appleton "GIB", or approved equal. All grounding bushings shall be tied to the grounding system with properly sized bonding conductors per the NEC code.

7. Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type DX as manufactured by O.Z. Gedney Co.; Type DF as manufactured by Appleton Electric Co., or equal

C. Galvanized Rigid and Coated Steel Conduit (GRS-PVC)

1. Galvanized Rigid Steel conduit with a 40-mil thick polyvinylchloride exterior coating and a 2-mil urethane interior coating meeting NEMA RN-1, UL-6 and ETL PVC-001. The bond of the PVC to the zinc coated pipe must be stronger than the tensile strength of the PVC.

2. Provide PVC coated galvanized rigid steel factory sweeps and elbows for 90 degree transitions.

3. Cast fittings and device boxes shall be malleable iron or aluminum with a 40-mil thick PVC coating meeting the same

4. In hazardous locations, fittings shall meet and be listed UL 886.

5. Provide PVC coated threaded-type fittings, hubs, pulling elbows, couplings, and connectors; set-screw type and compression-type are not acceptable. Form 8 conduit fittings, ½□through 4□, must have a tongue-in-groove gasket to effectively seal out the corrosive elements. Covers shall be supplied with plastic encapsulated stainless steel cover screws. Form 8 fittings shall be UL and type 4X and IP69 listed.

6. A □PVC Coated Sealing Locknut□ shall be used on all exposed male threads transitioning into female NPT threads which do not have sealing sleeves, including transitions from PVC couplings/female adapters to PVC Coated GRC elbows in direct burial applications. □PVC Coated Sealing Locknuts□are not to be used in place of a myers hub

7. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.

8. All junction and metal pull boxes shall be galvanized with exterior surfaces PVC coated to 40 mils thickness.

9. Unistrut, strut clamps, pipe straps, and clamp back spacers, shall have 40 mil thick PVC coating. All mounting anchors shall be stainless steel.

10. Conduits entering enclosures shall be fitted with insulated grounding bushing. All grounding bushings shall be tied to the grounding system with properly sized bonding conductors per the NEC code.

11. Installers of PVC Coated Conduit must be certified by the manufacturer and be able to present a valid, unexpired certified installer card.

12. GRS-PVC conduit to be Robroy Plasti-bond, Perma-Cote, KorKap, T&B OCAL or equal.

D. PVC Conduit, Schedule 40 or 80 (PVC-40, PVC-80)

1. Shall be high impact schedule 40 or 80 polyvinylchloride suitable for use underground, direct burial and for use with 90 C wires, and shall conform to UL 651. Shall be UL listed and labeled for "direct" burial.

2. A copper bonding conductor shall be pulled in each raceway and bonded to equipment at each end with approved lugs.

3. Each underground run shall be placed in a trench with a five (5) inch sand bed evenly compacted on all sides, top and bottom unless otherwise noted.

4. Elbows, and risers shall be per exposed conduit transition detail. PVC conduit is not allowed above ground except where specifically called out on the Drawings.

5. PVC fittings shall have solvent-weld-type conduit connections. Fittings and device boxes shall be PVC with factory fabricated conduit connections. Provide Carlon or equal.

6. Conduits entering enclosures shall be fitted with a glued male adapter, lock ring and bushing to prevent wire chafing. Conduits entering panels through concrete to an open bottom or entering a pull box shall have a glued end bell fitting.

7. PVC conduit shall be stored on a flat surface and shielded from the sun.

E. Liquid Tight Flexible Non-metallic Conduit (up to 2□) - (FLEX)

1. Liquid tight flexible Nonmetallic Conduit shall be constructed of flexible PVC and have a smooth inner surface with integral crush resistant reinforcement within the conduit and be designated as a Type LFNC-B (for FNMC-B).

2. Liquid tight Flexible Nonmetallic Conduit shall be sunlight, oil, and flame resistant and approved for the installation of electrical conductors in indoor and outdoor applications.

3. Liquid tight Flexible Nonmetallic Conduit shall be listed to UL standard UL1660.

4. Liquid tight flexible non-metallic conduit shall be installed in accordance with Article 351, Part B of the National Electrical Code (NEC) and other applicable sections of the NEC and/or local electrical codes.

5. Liquid tight Fittings shall be listed for the use with Liquid tight Flexible Nonmetallic Conduit and shall be marked LFNC-B (FNMC-B).

6. Flexible Non-Metallic Conduit shall be Carlon Carflex or equal.

F. Liquid Tight Flexible Metal Conduit (above 2-1/2") - (FLEX)

1. Liquid Tight Flexible Metal conduit shall be moisture and oil-proof with PVC jacket extruded over a galvanized flexible steel conduit.

2. Liquid Tight Flexible Metallic Conduit shall be sunlight, oil, and flame resistant and approved for the installation of electrical conductors in indoor and outdoor applications.

3. Liquid Tight Flexible Nonmetallic Conduit shall be listed to UL standard UL 360.

4. Liquid Tight flexible metallic conduit shall be installed in accordance with Article 351, Part B of the National Electrical Code (NEC) and other applicable sections of the NEC and/or local electrical codes.

5. Liquid Tight Fittings shall be listed for the use with Liquid tight Flexible Metallic Conduit and conform to UL514B.

   a. Outdoors when extension of GRS-PVC: PVC coated galvanized steel with insulated bushings.

   b. Outdoors when extension of GRS: Galvanized steel with insulated bushings.

   c. Indoors or outdoors when extension of stainless steel: 316 stainless steel with sealing ring and insulated bushing.

   d. Indoors: Galvanized steel with insulated bushings.

6. Flexible Metallic Conduit shall be Amer-Tite type GP or equal.

G. EMT Conduit, Electrical Metallic Tubing

1. Thinwall electroplated galvanized steel suitable for indoor and outdoor use with 90 C wires, and conform to UL 797.

2. All fittings, hubs, couplings, pulling elbows and connectors shall be compression-type, set screw type are not acceptable.

H. Flexible Metal Clad Conduit (MC)

1. Flexible Metal Conduit (type MC) shall include stranded or solid copper THHN/THWN conductors with aluminum interlocking steel strip armor cover.

2. UL 1, UL 1479, File Reference E11831, CSA File Number 15035, CSA C22.2 No. 56 (trade size 3/8 only)

3. NEC 250.118(5), 300.22(C), 348, 430.223, 501.10(B)(2), 645.5

4. Cable Tray installations per NEC

5. UL Classified 1, 2 and 3-hour Through-Penetration Fire Systems UL File R14141

6. Fittings shall be listed for the use with Flexible Metallic Conduit and conform to UL514B.

    a. Steel Box Connectors are design coordinated with type MC Cable.

    b. No locknut required

    c. Positive grip clamp assures grounding continuity and holding power

    d. Tilt-in and tighten installation technique

    e. Wire protection provided by built-in insulated throat bushing

    f. UL Standard 514B, UL Listed File # E□164166

    g. CSA Certified File # LR□84516 for AFC□50, 75, and 5075 only

2.02 DEVICE BOXES

A. BOXES

1. Device boxes shall be of zinc-galvanized malleable iron or cast aluminum with shape and size best suited for the particular application, rated for the location installed, and shall be supported directly to structure by means of screws, anchors, or bolts.

2. Box dimensions shall be in accordance with size, quantity of conductors, and conduit clearances per NEC articles 314 requirements.

3. Boxes exposed to the weather or in moist locations shall be weatherproof (WP) by means of gasketing under a weatherproof cover.

4. Boxes connected to GRS-PVC conduit runs shall be PVC coated with 40 mil coating.

B. DEVICE PLATES and COVERS

1. Indoor general purpose device plates and covers shall be stainless steel. Plates or covers shall be attached with stainless steel screws. An engraved plastic label denoting circuit breaker number and panelboard name shall be affixed to each cover with #4 stainless steel screws.

2. Weatherproof switch, outlet, and receptacle boxes shall be fitted with gasketed covers rated for wet locations. Each access cover shall have a padlockable cover to maintain security and weatherproof integrity even when a plug is connected to the receptacle. Screws and hinge springs

shall be stainless steel. Weatherproof access covers shall be Leviton 5977-CL, Cooper 4966, or equal.

2.03 PULL BOXES

A. JUNCTION BOXES

1. Where required for best installation or where specifically called out in the Drawings, junction boxes shall have JIC type construction with hinged door, NEMA 4X rating, manufactured of type 304 stainless steel or as otherwise shown. Door shall be fastened with clamps and stainless steel screws. No devices, screws, rivets, or bolts shall protrude through the exterior surface unless specifically shown on the Drawings. Boxes shall be Hoffman, Circle AW, or equal.

B. UNDERGROUND BOXES

1. Underground pull boxes shall be prefabricated "Christy Box" size and type as noted in the Drawings or equal. Size shall be as shown or dimensioned on the Drawings. Provide larger boxes as needed to meet code or as determined in field to allow for adequate pull area at Contractor discretion. Extension sections shall be provided as necessary to reach the depth of underground conduits with maximum depth of 48". All boxes shall have galvanized steel hold down bolts and hardware. Boxes shall be H/20 loading rated and have traffic rated covers. Steel covers or lids shall be galvanized and grounded with bonding jumper to the local grounding circuit per NEC. Pull box covers shall be labeled electrical, signal, utility, and telephone, whichever applies. Pull boxes shall be Christy Concrete Products, Brooks or equal.

C. PULL BOX AND VAULT IDENTIFICATION

1. Engrave or bead weld box covers with minimum thickness of ¼" x 1" lettering with pullbox name (i.e. PBX-XXX) and purpose (electrical, signal, fiber, telephone, etc.). Provide an additional identifier "high voltage" for boxes with 600 volts or higher.

2. Utility pull boxes shall be labeled per Utility Company standards.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in Electrical Specifications [Electrical General, Workmanship].

3.02 INSTALLATION

A. System:

1. Install all products per Electrical Specifications [Electrical General, Installation].

B. Rigid Conduits and Ducts:

1. Exposed conduits shall be neatly arranged with runs perpendicular or level and parallel to walls. Bends shall be concentric.

2. Except as expressly indicated or approved, all conduits shall be surface mount on block walls, concealed behind gypsum walls, and buried to required depth below floor slabs.

3. Pipe threads shall be treated with conductive thread compound.

4. Installation of the GRS-PVC conduits must be in accordance with the manufacturer's installation procedures using recommended tools.

   a. Apply touch up compound at each fitting sealing sleeve edge to improve watertight seal.

   b. To ensure compliance, the installer(s) must be manufacturer certified before installation can proceed.

   c. Certification available by contacting manufacturer's representative and attending a brief instructional course. Valid and unexpired certification card shall be available for review per installer.

5. Repair GRS-PVC coating utilizing a touch-up compound as provided by the manufacturer of the conduit of the same material as the coating. Overlap beyond the damaged area to cover the PVC coating. Contact from touchup compound to PVC is required to maintain integrity. The entire conduit shall be replaced if the repair exceeds 1 combined length.

6. A maximum of three equivalent 90 degree elbows are allowed in any continuous run. Install pull boxes where required to limit bends in conduit runs to not more than 270 degrees or where pulling tension would exceed the maximum allowable for the cable.

7. Route all above grade conduits parallel or perpendicular to structure lines and/or piping. Conduits installed above grade shall be braced in place with stanchions. Expansion joints shall be installed every 100 feet. Bends shall be concentric.

   a. Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type DX as manufactured by O.Z. Gedney Co.; Type DF as manufactured by Appleton Electric Co., or equal

8. Care shall be exercised to avoid interference with the work of other trades. This work shall be planned and coordinated with the other trades to prevent such interference. Process Pipe, mechanical and HVAC shall

have precedence over conduits for routing and space requirements.

9. Seal each bottom entrance conduit into the MCC and other electrical enclosures with plugging compound sealant to prevent the entrance of gasses, insects and rodents. Plugging compound sealant shall be Gardner Bender Duct Seal or equal.

10. Exposed conduit stubs for future use shall be capped with coupling and plugged. Drill hole in plug for pull rope as necessary.

11. Explosion proof seal-off fittings shall be provided on all conduits that enter or leave hazardous areas per requirements of the National Electrical Code, Chapter 5 and UL 886. The seal-off fitting shall prevent hazardous gases and/or flames from passing from one type area to another through the conduit system. Ceramic or other non-asbestos fiber material and sealing compound shall be placed in the fitting to complete the seal.

12. Hazardous location conduit outlet boxes shall be used in hazardous locations for change in direction, access to conductors and as pull and splice boxes.

13. All spare conduits shall have 1/8" nylon pull ropes installed.

C. Flexible Conduit and Cords

1. Final connections to vibrating equipment such as motors, heaters and fans shall be made with liquid tight flexible conduit.

2. Flexible conduit lengths shall not be greater than 36 inches for sizes up to 2 ½□and 48 inches for 3□and larger conduit.

3. Flexible conduit shall include a ground conductor for equipment bonding in circuits over 30 VDC or as shown in the conduit schedule.

4. Flexible conduit shall only be installed in exposed or accessible locations.

5. Where equipment is cord connected, submersible rated, and conduit connections are not possible without modification, devices and equipment may be free-air cord connected in lieu of flexible conduit. Connection to adjacent rigid conduit shall be through liquid-tight cord connector fitting specifically designed for the purpose and sized appropriately for the cord. Cord connectors shall be rated similar to the adjacent conduit they are connected to: Stainless steel, galvanized or plastic.

D. Excavation and Back Filling:

1. Trenches for conduit below floor slabs and other underground electrical conduit shall be excavated to the required depths per utility requirements or specific detail. Conduits under floor slabs shall have minimum trench depth to contain bends without any portion of the radius visible at finished grade.

2. Underground conduits outside of structures, excluding utility conduits, shall have a minimum cover of 24 inches except under roadways where minimum cover shall be 30 inches or as otherwise shown in the Contract Drawings. Back filling shall be done only after conduits have been inspected. Excavation and back fill of conduits shall conform to the requirements of other applicable Specifications sections unless modified on plans, and to other entities (Utilities, etc.) as required.

3. Install spacers to support underground conduits. Horizontal and vertical separation shall be maintained by plastic spacers set every four feet. Spacers shall be Carlon Snap-Loc or equal.

4. At all times during the installation of the electrical system, the Contractor shall provide barricades, fences, guard rails, etc., to safeguard all personnel, including small children, from excavated trenches.

E. Underground pullboxes:

1. Pullboxes shall be located in areas that will experience the least traffic loading and in the general vicinity as shown in the Drawings. Boxes in pavement shall be set at final grade and boxes in planter areas shall be set 1□ above final grade. Boxes shall not be buried by landscape material.

2. Steel pull box lids shall be grounded per NEC 250.4(A)(5) and 314.4.

3. Boxes shall be set on compacted base and base rock to minimize settling of the box over time. If the box is located in a paved traffic area, a 6□x 6□ concrete ring shall be poured around the box below the pavement.

F. Device Mounting Heights:

1. Mounting heights of fixtures and devices shall be as follows unless otherwise indicated or when height has to be adjusted to be over or under counter tops.

Wall switches	=>	48 inches
Convenience outlets	=>	18 inches
Telephone outlets	=>	18 inches
Bracket fixtures	=>	7 feet 6 inches

G. Cutting, Coring, Patching and Repairing:

1. The Contractor shall do all cutting and patching required to install his work. Any cutting which may impair the structure will require prior approval. Cutting and patching shall be done only by skilled labor of the respective trades. Where it is becomes necessary to cut into existing work for the purpose of making electrical installations, locate existing post tension cables, rebar and electrical services prior to core drilling using ground penetrating radar or similar technologies. All surfaces shall be restored to their original condition after cutting and patching.

3.03 FIELD ASSISTANCE

A. General: Provide all equipment and supplies necessary to perform all testing. The Owner Representative shall have the option to witness and participate in the on-site tests performed by the installer.

B. Per Electrical Specifications [Factory and Field Testing].

3.04 WARRANTY

A. Provide warranty as specified in Electrical Specifications [Electrical General, Warranty].

END OF SECTION

SECTION 26 01 20
LOW VOLTAGE WIRE & DATA CABLE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Labor, materials, equipment, tools, safety gear, test equipment, incidentals, services, and transportation for a complete electro-mechanical installation as shown on the Drawings, included in these Specifications, or as can be reasonably implied from project descriptions.

B. The scope of work includes:

1. Furnish and install wire, splices, lugs, or other miscellaneous devices as defined in this specification.

2. End to end wiring and terminations for each system, device, instrument, and piece of equipment shown in the Drawings as new, or rehabilitated, or reconnected.

3. Testing of conductors and completed wired systems.

4. Installations shall be designed and installed with components meeting the NEMA area designation.

C. Work includes that specified in Electrical Specifications [Electrical General].

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Electrical Specifications [Conduit and Boxes]
C. Electrical Specifications [Grounding]
D. Project Drawings

1.03 QUALIFICATIONS

A. Material furnished under this specification shall be installed by qualified installers meeting requirements specified in Electrical Specifications [Electrical General, Qualifications].

1.04 SUBMITTALS AND DRAWINGS

A. Provide submittals and drawings as specified in Electrical Specifications [Electrical General, Submittal Requirements].

PART 2: PRODUCTS

2.01 WIRING AND ELECTRICAL DEVICES

A. GENERAL

1. General

a. Provide wiring and electrical devices specified herein and install field and internal panel wiring as shown on the Contract Drawings.

b. This section applies to all wires or conductors used internal (non-field) to electrical equipment or external for field wiring.

c. Field wire quantity and size shall be per "Conduit and Wire Routing Schedule."

2. Analog Signals

a. Analog signal transmission between electric or electronic instruments shall be 4-20 milliamperes and shall operate at 24 volts DC unless otherwise specified. Milliampere signals shall be current regulated and shall not be affected by changes in load resistance within the unit's rating.

b. Provide powered current isolators wherever the loops' load resistance exceeds the originating current signal transmitter's rating. Associated shunt resistors shall be located on rail-mounted terminal blocks. Exposed resistor leads shall be insulated with heat-shrink tubing.

B. LOW VOLTAGE WIRE AND CABLE (through 600V except instrument signals)

1. General: Low voltage conductors shall be used for power, control, lighting and miscellaneous circuits. This Section applies to all wires or conductors used internal for all electrical equipment or external for field wiring. Wire shall be new, plainly marked with UL label, gauge, voltage, type of insulation, and manufacturer's name.

a. Conductors shall be copper with a minimum of 98% conductivity.

b. Class C stranding. Solid conductors may be used for lighting and receptacle circuits.

c. Wire shall be rated 600 volt (min).

d. Size all conductors per NEC minimum or as shown on the drawings.

1) Minimum #12 AWG for wires used in power transmission circuits or as defined on the drawings.

2) Minimum #14 AWG for wires used in signal transmission circuits or as defined on the drawings.

2. Wire colors and sizes shall not change within the circuit.

3. Wire shall be properly fused or breaker protected at or below the maximum amperage rating allowed by the NEC.

4. Control and Power Wiring:

a. Field wire in conduit:

1) Type XHHW-2, XLPE insulation, rated 90 °C in wet or dry locations, oil resistant.

i Use for power circuits carrying voltages higher than 200 volts phase to ground.

2) Type THHN / THWN, PVC with nylon jacket insulation, rated 90 °C in dry locations and 75 °C in wet locations, oil resistant, UL83.

i Use for power circuits with voltages below 200 volts phase to ground, or control circuits.

3) Minimum #12 AWG for wires used in power transmission circuits or as defined on the drawings.

4) Minimum #14 AWG for wires used in signal transmission circuits or as defined on the drawings.

b. Field wire in tray (Tray Cable type TC):

1) Individual cables - Insulation type THHN/THWN, rated 90 °C in dry locations and 75 °C in wet locations, oil resistant, UL83.

2) 3 or more conductor plus ground wire in a single cable.

3) UL Listed as sunlight resistant, direct burial, and open wiring.

4) Conductor sizing per ICEA Publication P-54-440 for cable tray and ICEA P-46-426 for conduit

5) Minimum #12 AWG for wires used in power transmission circuits or as defined on the drawings.

6) Minimum #14 AWG for wires used in signal or conrol transmission circuits or as defined on the drawings.

c. Power cord

1) Flexible wire cord shall be type SOW, SOOW, or G and be provided in 2, 3, or 4 conductor plus ground as required for connected load.

2) EPR insulation, 90 deg C rating, oil and abrasion resistant., overall jacket plus individual conductor jackets. 600V rated

3) Conductors shall be stranded copper.

4) Cord shall be installed with cord grips on each end where it enters termination enclosures.

d. VFD Motor Supply Cable

1) VFD motor supply cable shall be shielded and designed for use with AC variable frequency drives. The cable shall be used to interconnect a variable frequency drive to the controlled motor.

2) The VFD cable insulation shall disperse voltage spikes, harmonics, and power distortions associated with variable frequency drives. Cable shall be plainly marked with UL label, gauge, voltage, type of insulation, and manufacturer's name.

3) Conduits requiring VFD supply cable shall be specifically listed in the conduit schedule in "NOTES" column designation defined as VFD CABLE.

4) Power conductor size shall be as listed in the conduit schedule. Length shall be as required to extend from VFD to motor connection terminals. Conductor stranding shall be fine wire, three black conductors with white numbers and one green/yellow ground. Conductor stranding shall be class C or finer.

5) Insulation for conductors shall be rated for 1000 volts (min). Insulation shall be oil and UV resistant rated -25°C to 90°C.

6) For Cable sizes 12 AWG to 2 AWG the cable construction shall be tinned copper with XLPE insulation under dual shielding of foil tape and copper braid construction, and outer PVC jacket. The VFD motor supply cable shall be Olflex/Lapp USA Wire and Cable Inc. OLFLEX Slim series, Belden 295xx or equal.

7) For cable sizes above 2AWG to 500MCM the cable construction shall utilize 3 symmetrical grounds next to 3 power conductors with XLPE insulation and foil and braid shield. The VFD motor supply cable shall be Olflex/Lapp

USA Wire and Cable Inc. OLFLEX VFD Symmetrical series or equal.

e. Nonfield control panel or factory installed equipment internal wiring:

1) Insulation - Type MTW, NFPA standard 79, UL 1063 with tinned copper.

2) Minimum #16 AWG for wires used for individual conductor circuits 100 volts and above.

3) Minimum #18 AWG for wires used for individual conductor circuits below 100 volts.

5. Instrument wiring:

a. Field: Instrument cables shall have 600V tray cable rated insulation and 100% individual shielded twisted pair #16 conductors with drain wire. Single twisted shielded pair (TSPR) cables shall be Belden 9342, or approved equal. Three wire twisted shielded cables (#18 TS3W) shall be Belden 1119A or equal.

b. Non-Field: Instrument cables shall have 300V rated insulation and 100% individual shielded twisted pair #18 conductors with drain wire. Single twisted shielded pair (TSPR.) cables shall be Belden 8760, or approved equal. Three wire shielded cable shall be Belden 8770 or equal.

c. Field multi-pair instrument cable as required per conduit schedule shall have 300V rated insulation and 100% individual shielded twisted pair #18 conductors with drain wire. Multiple twisted shielded pair (T.S.PR.) cables shall be Belden 9773 thru 9777, or equal.

d. Multi-pair cable is not allowed (unless specifically called out in conduit schedule or on plans) for use in field or non-field applications. One T.S.PR cable is required for each signal.

6. Manufacturer Supplied Cables

a. Cables and wiring for special systems provided by the manufacturer with the equipment shall be installed per the manufacturer□s recommendations.

7. Data Cable

a. Data network category 6 cable (indoor) shall consist of 4 pair unshielded twisted pair #24 awg solid copper conductors. The cable shall be rated by IEEE for service intended □ plenum and

dry.

1) Cable: IEEE Category 6, various manufacturers.

2) Connectors: Standard RJ-45 with boot.

b. Data network cable (outdoor) shall consist of 4 pair foil and braid shielded twisted pair #24 awg solid copper conductors with anti-crosstalk divider, and drain wire. Rated Level 2 Category 5e Outdoor Carrier by IEEE for use in plenum, conduit, wet or dry.

1) Cable: IEEE Category 5e, Ubiquiti Tough Carrier, Belden, or equal

2) Connectors: Grounded RJ-45 with drain wire crimp.

8. Temporary motor or panel hook-up

a. Temporary cable may be cord without conduit or PVC conduit with wiring. In either case, the cabling must be protected from damage during construction. Sections may be located out of harms way, buried, or sleeved in steel conduit as needed.

b. Power Circuits: Provide 2, 3, or 4 conductor plus ground power supply cable(s) for temporary pump connections or electrical power circuits. Cables shall be sized for breaker rating amperage, (minimum).

c. Provide multi-conductor (TC) cables for digital control circuits. Provide quantity of conductors as needed.

d. Provide instrument wiring for 4-20 ma instrumentation.

e. Voltage drop in power circuits shall not exceed 15% during motor start and 5% during operation.

C. COLOR CODE

1. All wires #8 and below shall have wire insulation the color specified. Wires #6 and larger may be black with color electrical tape at termination points.

2. No other colors shall be used without prior approval.

3. Color code - color code of all wire shall conform with the following table:

WIRE COLOR CODE TABLE

Description	**Phase/Cod**	**Field wire or tape color**	**Non-Field Wire Color**

	e Letter		
480V, 3 Ph	A	Brown	Brown
	B	Orange	Orange
	C	Yellow	Yellow
240V or 208V, 3 Ph	A	Black	-
	B	Red (Orange if high leg)	-
	C	Blue	-
	Neutral	White	White
240 / 120 V, 1 Ph	L1	Black	Black
	L2	Red	-
24V Positive	24+	Blue	Pink
24V Negative	24-	Gray	Gray
12V Positive	12+	Blue	Red
12V Negative	12-	Black	Black
AC Control		Red	Red (Yellow for foreign circuits)
DC Control		Blue	Blue
Ground	G	Green	Green
Shielded Pair	+	Red, Clear, or White	Clear or White
	-	Black	Black

2.02 WIRE MARKING

A. All panel, enclosure and field wiring shall have wire labels on both ends of each wire. Labeling shall be neatly installed for visibility and shall be clearly legible. Each conductor of instrument shielded signal wiring shall be labeled. Wire labels shall be machine printed with on white heat shrinkable tubing. Each label shall fit a minimum 23 characters, 3/16□ in height before shrink. Tubing shall be oversized for the wire and shrunk into place using an electric heat gun. The □shrunk□label shall have just enough give to allow the label to be rotated. Hand lettered wire labels are not acceptable and shall be replaced at the Contractor□s expense. Provide Brady □PermaSleeve□or equal.

1. **Node Style Wire Identification** - All wires that are electrically the same (connected to common termination points) and do not pass through a contact or other switching device shall have the same wire identification. The wire labeling code for each end of the same wire shall be identical.

a. The wire identification code for **internal panel** wiring shall be the number/letter as designated on the Contract elementary and/or approved shop drawings.

b. Wire labeling for **field** wiring shall contain the panel/equipment name as a prefix and the termination point name. (I.E. PLC50-A103 or P10-124). The hierarchy of label names is 1) PLC panel name, 2) MCC equipment name, and 3) Equipment name. Therefore, wires from PLC50 to the MCC50 P10 cubicle will be labeled PLC50-XXX. Wires from MCC50 P10 to field pressure switch PSH10 will be labeled P10-XXX.

c. Wire labels shall be exactly per interconnection submittal and/or control panel drawings -- abbreviations determined in the field are not allowed. Abbreviations may be used in the wire label as submitted and approved in the interconnection drawings submittal.

d. Wire labels for lighting and receptacle circuits shall consist of the panel board and circuit number and a unique node number. (I.E. LP#3-A, LP#3-B, LP#3-N)

e. Wire labels may be omitted on □neutral jumpers□ less than 8□in length.

2.03 ELECTRICAL TAPE / SHRINKABLE INSULATORS

A. Vinyl tape shall be 7 mil, 600 volt rated, flame retardant, hot and cold weather resistant conforming to UL510. Provide 3M Scotch Super 33+ vinyl tape or equal

1. Vinyl tape for color coding shall be 7 mil, ¾□width, vinyl tape conforming to UL 510. Provide 3M Scotch 35 vinyl tape or equal.

B. Rubber Tape: EPR rubber, 90 deg C continuous rated. Provide 3M 130C rubber tape or equal.

C. Varnished Cambric Tape: Adhesive backed, 7 mil, bias cut cotton tape, coated with yellow insulating varnish. Provide 3M Scotch 2510 or equal.

D. Shrinkable insulators shall be heat shrinkable, polyolefin thick wall sleeves, end caps and cable repair sleeves are designed for use in splicing, sealing and re-jacketing of direct bury secondary cables. The insulators shall comply with UL 486D and be rated up to 1000 Volts. They shall provide long-term reliable performance overhead, underground or submerged with mechanical and environmental protection. Shrinkable insulators shall be 3M ITCSN or 3M IMCSN per manufacturer instructions for the application or equal.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in Electrical Specifications [Electrical General, Workmanship].

B. Perform work to remedy non-compliant installations after inspection.

C. Upon notification, stop work on any portion of the installation that is determined to be substandard or being installed by unqualified personnel.

3.02 FABRICATION AND INSTALLATION

A. System:

1. Install all products specified in Electrical Specifications [Electrical General, Installation].

2. Panels shall be completely factory wired and tested before shipment.

3. All spare PLC input / output points shall be wired to terminal blocks.

4. A minimum of 20% spare unwired terminals shall be provided in each panel.

B. Wiring Methods:

1. Wiring Separation: Wires carrying 100 volts and above shall be physically separated from lower voltage wiring by using separate bundles or wire ways with sufficient distance to minimize the introduction of noise, crossing only at 90 degree angles.

2. Harness: All wiring shall be neatly bundled and laced with plastic tie-wraps, anchored in place by screw attached retainer. Where space is available, wiring shall be run in slotted plastic wireways with dust covers. Wireways shall be sized such that the wire fill does not exceed 60%. Tie-wraps shall be T&B TY-RAP or equal.

3. Retainers: Wireways, retainers, and other devices shall be screw mounted with round-head 316 stainless steel screws or mechanically mounted by push-in or snap-in attachments. Glue or sticky back attachment of any type or style shall not be used. Retainers shall be T&B TC series or equal.

4. Hinge Loops: Where wiring crosses hinged surfaces, provide a "U" shaped hinge loop protected by clear nylon spiral wrap. The hinge loop shall be of sufficient length to permit opening and closing the door without stressing any of the terminations or connections. Spiral wrap shall be Graybar T25N or equal.

5. Routing: Wires and cable shall be routed such as to maintain separation between 100 Volt or higher from 100 volt or lower wiring being run in the same duct or bundle. Wires and cables shall have sufficient length to allow slack and to avoid any strain or tension in the wire or cable.

a. Wires shall be routed in slotted plastic wireways with snap covers. Wires carrying 120 VAC shall be separated as much as possible from other wires and signal cables, and shall be routed only in ducts for 120 VAC. If the power wiring has to cross the signal wiring, the crossing shall be as close to a right angle as possible. Wireways for 24 VDC wiring shall be used for all other wires and

cables. Routing of 120 VAC in combined wireways shall be minimized. Wires and cables shall be placed in the wireways in a straight, neat and organized fashion and shall not be kinked, tangled or twisted together. Additional wire ducting shall be provided for use by the electrical subcontractor for routing field wires to their landing points in the each electrical and instrumentation panel.

b. Provide 2□ minimum separation between wireway and terminal blocks.

c. Wiring not routed in wireways shall be neatly bundled, treed, and laced with plastic ties.

C. Wire Terminations

1. Single wire and cable conductors shall be terminated according to the requirements of the terminal device as follows:

a. Crimp-on terminals: shall be UL listed, self-insulating sleeve type, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.

b. Terminal Blocks: Remove the last +/- 0.25 inches insulation from of the conductor and insert it under the pressure plate to full length of the bare portion of the conductor. Tighten the screw to close the pressure plate onto the conductor. No more than two conductors shall be installed in a single terminal. All strands of the conductor shall be captured under the pressure plate.

c. Screw-less terminals: wire shall be stripped back and inserted per the terminal manufacturer□s instructions.

d. Motors with pigtail leads: Install terminal connectors on the motor pigtails and the cable to be connected. Terminals shall be non-insulated crimp-on type applied with a rachet-type crimping tool. The terminals shall be bolted together with a nut, bolt and lock washer combination. The connection shall be wrapped with four (4) layers varnished cambric tape, six (6) layers of rubber tape and six (6) layers of vinyl electrical tape, each half lapped.

2. When stripping insulation from conductors, do not score or damage conductor.

3. The drain wire and stripped end of outer jacket of shielded cables shall be covered with heat shrink insulating tubing. The drain wire shall be covered along its full bare length between the cable jacket cover and the terminal lug and placed on end outer jacket to cover foil.

4. Condulets with wire nut connections shall be supplied for wire termination

to devices with leads instead of terminals (i.e. solenoid valves, level probe, etc.).

D. Wire Splicing

1. No wires shall be spliced without prior approval.

2. Where splices are allowed or approved they shall conform to the following:

a. Wire splicing devices shall be sized according to manufacturer's recommendations.

b. Splices of #10 and smaller, including fixture taps, shall be made with nylon self-insulated twist on wire nuts; T & B "Piggys", Ideal "Wing-Nut" or equal.

c. Splices of #8 and larger shall be hex key screw, two way connectors, insulated with molded high-dielectric strength plastic; NSI Polaris IPL or IPLD Series terminal blocks or equal.

d. Non-Motor Splices #6 and smaller in underground pullboxes shall have wire-nut connections which are sealed with non-hardening silicone based sealant that protects the connection from moisture and corrosion. The wire nuts shall be factory filled with sealant and UL listed for waterproof connections. Provide Ideal Model 60 or equal.

e. Non-Motor Splices #4 and larger in underground pullboxes shall have double hex crimp barrel connections applied with adhesive/sealant filled heat shrinkable rubber insulation applied over the exposed connection. The cross-linked polyolefin shrink tube shall extend 4" on each side of the exposed connection minimum. Heat shrink tubing shall be 3M ITCSN or equal.

f. Motor lead Splices in underground pullboxes shall have terminal connectors on the motor leads and the cable to be connected. Terminals shall be non-insulated crimp-on type applied with a ratchet-type crimping tool. The terminals shall be bolted together with a nut, bolt and lock washer combination. The connection shall be wrapped with four (4) layers varnished cambric tape, six (6) layers of rubber tape and six (6) layers of vinyl electrical tape, each half lapped. Seal the connection with epoxy resin coating.

E. Wire Installation

1. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, stressing the cables, or damaging the insulation. Use a UL listed pulling compound for lubrication within conduits as necessary. The raceway construction shall be complete and protected from weather before cable is pulled in. Swab conduits before installing cables and

exercise care in pulling, to avoid damage to the insulation or conductors.

2. All wire and cables (with the exception of coaxial antenna cable) shall be installed within UL listed raceways or enclosures. Install all wires and cables in one continuous length unless splices are per Contract Drawings, required to connect equipment or submitted and favorably reviewed.

3. Bundle incoming wire and cables in panels. Zip-tie at intervals of 2□and neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Do not bundle, tape or tie wires within conduits.

3.03 WARRANTY

A. Provide warranty as specified in Electrical Specifications [Electrical General, Warranty].

END OF SECTION

SECTION 26 32 13
ENGINE GENERATOR

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Because of potentially long permit applications processes and manufacturing lead times for the generator equipment, the Contractor is required to submit the complete generator submittal within 14 days of notice-to-proceed and/or contract award.

B. These specifications describe the minimum requirements for a STANDBY duty three phase engine driven generator. The "Generator Data Sheet" at the end of this specification lists the minimum sizing for the generator and accessories. A larger generator shall be supplied when necessary to meet the requirements of this section. The Contractor shall complete this form with proposed generator values and include it with the generator submittal.

C. The generator shall be provided as described in the following specification and as shown on the Contract drawings, herein designated as the design documents. The generator shall comply with all applicable sections of NFPA 30, 37, 70, 72 and 110, California Fire Code Articles 79 and 80 as well as State Statues.

D. The equipment furnished under these specifications shall meet the requirements of NEC Article 702, "Optional Standby Systems" and any other applicable articles of the NEC.

E. The system shall meet the requirements of NFPA 704 Hazard Identification System Diamond indicating the hazards associated with the fuel being stored.

F. The generator shall be delivered as a skid mounted unit, completely assembled to the extent possible and factory tested.

G. Only new models in current production by a U.S. firm that meet the requirements of these specifications and which are cataloged by the manufacturer and for which manufacturer's published literature and printed specifications are currently available, will be considered. Special options may be included only when recommended by the manufacturer of the unit approved.

H. All equipment/options are to be factory installed. If the equipment/options are not available factory installed, dealer installed equipment/accessories may be acceptable. The bidder is to specify those items which will be dealer installed in the submitted bid document.

I. The manufacturer's local representative shall be an authorized distributor who maintains a stock of spare parts for the supplied generator and has a service facility with factory-trained service personnel. The manufacturer's local representative shall be located within a radius of 200 miles of the project.

J. The Contractor shall perform complete startup, training and testing services for the generator per Electrical Specifications [Factory and Field Testing] and as detailed herein.

K. Generator system shall be EPA Certified and meet all current Local, State and Federal air emissions requirements at time and location of installation.

L. Generator system shall be coordinated and compliant with all current Local and State building and Fire Protection codes and requirements at time and location of installation. Furnish alarms, signage, fuel containment, shutdowns, and other devices and systems as required.

M. The Contractor shall supply the generator, labor, testing and associated documentation as specified herein. This document describes the materials and intended operation, but does not necessarily describe all devices necessary for a functional system. All components and devices shall be furnished and installed as required to provide a complete, operable and reliable system for accomplishing the functions and meeting the performance set forth hereinafter.

N. The generator scope of work includes:

1. Engine driven electric generator
2. Remote fuel tank.
   a. Generator supplier has fuel system responsibility for safe and functional system.
   b. Fuel line piping meeting local code requirements and drawings.
3. Battery charger (120 VAC operated) mounted to generator frame.
4. Weatherproof sound attenuating housing.
5. All auxiliary apparatus and accessories shall be provided as required for a fully functional generator and to meet local code requirements.
6. Install a steel reinforced concrete pad, adequately sized to support the specified generator and fuel tank.
7. All piping associated with exhaust system.
8. Trenching, back filling, compaction and paving of each underground conduit route and fuel line piping.
9. Field installation, startup, testing and training for the generator and associated equipment as part of this scope of work.
10. Fuel for use during testing and full tank top off upon testing acceptance.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]

B. Project Drawings

C. The following manufacturing and installation standards apply to this section:

1. ASTM International (ASTM): A335/A335M, Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service.

2. Best Available Control Technology Standards (BACT)

3. Code of Federal Regulations (CRF): Title 40 Volume 18, Control of Emissions from New and In-Use Non-road Compression-Ignition Engines.

4. National Fire Protection Association (NFPA):

   a. 37, Installation and Use of Stationary Combustion Engines and Gas Turbines.

   b. 70, National Electric Code.

   c. 110, Emergency and Standby Power Systems.

5. SAE International (SAE): J1074, Engine Sound Level Measurement.

6. Underwriters Laboratories, Inc. (UL):

   a. 142, Steel Aboveground Tanks for Flammable and Combustible Liquids.

   b. 2085, Protected Aboveground Tanks for Flammable and Combustible Liquids.

   c. 508, Industrial Control Equipment.

   d. 1236, Battery Chargers for Charging Engine-Starter Batteries.

   e. 2200, Stationary Engine Generator.

D. The bidder shall carefully examine the plans and specifications, and be familiar with the conditions of the location of installation.

1.03 QUALIFICATIONS

A. Equipment manufacturers shall be represented by a company capable of servicing and testing the generator unit from a mobile service vehicle dispatched from within a 200 mile radius.

1.04 SUBMITTAL REQUIREMENTS

A. Submit shop documents and drawings for approval in accordance with this subsection and as specified in Electrical Specifications [Electrical General, Submittal Requirements]. All non-relevant items not provided on this project shall be crossed-off or deleted from all submitted documents and drawings.

B. Submit a specification compliance statement, describing differences between specified and proposed equipment. Note equipment provided specifically to meet local agency or authority having jurisdiction requirements.

C. Complete "Generator Data Sheet" at the end of this section and submit this form with the generator submittal.

D. Submit data sheets and catalog information detailing:

1. Engine:

a. Make and model.
b. Fuel type.
c. Number of cylinders and cylinder arrangement.
d. Bore and stroke.
e. Compression ratio.
f. Piston speed, Feet per Minute, at rated RPM.
g. Cylinder head, piston, valve, and block material.
h. Crankshaft material.
i. Main bearings, quantity and type.
j. Rated RPM and HP at rated RPM.
k. Governor type.

2. Generator:

a. Make and model.
b. Generator full load electrical rating, KVA, KW, Voltage, Amperage, Frequency (Hz), # of Phases, # of Wires, Power Factor.
c. Generator and Exciter type.
d. Insulation material, class, and temperature rise.
e. Bearings, quantity and type.
f. Peak motor starting, KVA.
g. Voltage regulator type and regulation % from no load to full load.
h. Frequency regulator type and regulation %, from no-load to full load.
i. One step load acceptance.
j. Unbalanced load capability.
k. Number of leads.
l. Generator transient (x□d) and subtransient (x"d) reactance in per unit.
m. Ambient temperature range.

3. Electrical

a. Control and instrument panel.
b. Generator main breaker.
c. Batteries and battery charger.

4. Cooling System

a. Maximum ambient temperature.
b. Capacity (gallons).
c. Coolant flow (gpm).
d. Fan diameter (in).
e. Fan HP requirement at rated RPM.

5. Accessories:

a. Exhaust silencer, stack, and piping system.
b. Fuel tank and piping system.
c. Vibration isolation system.
d. Block Heater system.

e. Weatherproof/Soundproof Housing as specified herein.
f. Noise Attenuation System.
g. Paint Finish.

E. Submit electrical schematics and wiring diagrams for:

1. Generator control panel.
2. Battery charging system.
3. Main generator.
4. Voltage regulator.
5. Governing system.
6. Generator main breaker.

F. Submit dimension drawings for:

1. Engine generator side, front, and top.
2. Pad construction (minimum) size, anchor details.
3. Enclosure (if required).
4. Fuel tank.
5. Exhaust muffler and air intake baffle.
6. Conduit stub-up areas under generator frame and/or sub-base fuel tank.

G. Submit reports, calculations, and curves for:

1. Generator sizing calculation (computer generated report acceptable) showing that the unit is sized adequately to start all loads as shown on Contract Drawings "Load Calculation" without exceeding the maximum voltage dip specified.

2. Generator air emissions data, prototype or actual, suitable for submission to governing air quality management agency where generator is to be installed. Emissions data shall be for fuel type as required by local air quality agency.

3. Sound level data showing that the complete generator package meets the sound level requirements stated herein.

4. Engine generator fuel consumption data at 25%, 50%, 75% and 100% electrical loading.

5. Proposed concrete pad dimensions, reinforcement method and isolation material (as necessary) for submitted generator.

6. Seismic calculations for bolt down anchorage for seismic site class D. Calculation shall be signed by a California Registered Professional Structural Engineer. Generator installation shall meet applicable CBC or IBC requirements for stand-by power systems.

   a. Calculations shall include calculations for wind loading on equipment to be mounted outdoors.

b. The Contractor shall submit a copy of the current ICBO anchor evaluation report for each type of anchor submitted.

c. The Contractor shall submit a copy of the concrete mix design to include the concrete design strength.

d. The Contractor shall submit Near Fault Vicinity and Location maps.

7. Battery sizing calculations showing all anticipated DC "black start" loads, and performance requirements including battery charger sizing and maximum recharge time.

H. Air Quality Management Applications and Permits

1. The Contractor shall obtain the correct ATC application from the AQMD and preliminarily complete the application by inserting the project specific generator technical information. Submit preliminary partially completed application to the Engineer for use by the Owner in preparation of the final completed ATC application.

2. The Contractor shall submit all generator specific information required to complete the ATC permit application. The Owner will not submit the application until all the information is received and the submittal receives a status of "make corrections noted" or "approved." Submit information in sufficient time for application processing and submittal review as to not delay project completion. The generator will not be considered approved until the ATC permit is obtained.

3. The Owner shall complete and apply for the "Authority to Construct" (ATC) permit from the Air Quality Management District or Board with jurisdiction for this generator system. Fees for permit and application will be paid by the Owner. The Owner will submit the permit application within 14 days of submittal approval. Allocate 12 weeks for Owner to obtain ATC permit once application has been submitted.

4. The Contractor shall confirm that the submitted generator meets all AQMD guidelines prior to submittal of the generator unit or preliminary application. Failure to do so will delay the ATC permitting and submittal approval.

I. Descriptive literature shall be provided that describes the generator and all accessories. This literature shall provide sufficient detail to determine that the generator has all the accessories, options, features, and characteristics specified herein. Items that are not provided shall be neatly lined out.

J. Deviations from the Contract documents shall not be incorporated into the work without prior written approval. A "Change Order" directive is required prior to incorporating any deviation from the Contract documents that has costs associated. The cost differential associated with this change order must be negotiated to amend the Contract to reflect the costs or savings.

K. Exceptions to the Specifications or Drawings or equipment or procedures submitted as "equal" to specified equipment shall be clearly identified by the equipment supplier in a letter at the front of the submittal. Submittal data for "equal" equipment or procedures shall contain sufficient details so a proper evaluation may be made. The Contractor is responsible for verifying proper application/operation of substituted equipment.

L. The Owner will not accept any ownership for material or equipment until the corresponding submittals have been reviewed by the Owner and approved.

M. Submit complete and specific information with regard to equipment representatives and service facilities.

1.05 OPERATION AND MAINTENANCE INFORMATION

A. Provide six (6) sets of operating, maintenance & parts instructions in original manuals (no copies allowed).

PART 2: PRODUCTS

2.01 QUALITY

A. The generator shall be as manufactured by Kohler, Caterpillar, Cummins, Generac or equal with accessories as defined herein.

B. The equipment supplied and installed shall meet the requirements of the National Fire Protection Association (NFPA 70 and NFPA 110) and all applicable local codes and regulations.

C. The generator system shall be designed as a "black start" unit capable of starting and operating without any external power.

D. Provide all of the features, options, and accessories specified herein and shown on the design drawings. Finished equipment shall be complete and site tested as an installed unit with all accessories functioning.

E. All rotating parts shall have guards to protect against accidental contact in accordance with Federal OSHA and Cal-OSHA requirements.

2.02 RATING

A. The engine generator shall have a minimum continuous standby rating as listed in "Generator Data Sheet" at the end of this section. Standby rated shall mean that generator starts within 60 seconds upon being called and operates continuously for the total duration of the generator call or fuel supply. Rating of the generator shall be based on operation when equipped with all necessary operating accessories such as radiator, fan, air cleaners, lubricating oil pump, governor, exhaust silencer, etc.

B. No derating from the ratings specified shall occur for ambient temperatures below 122°F or installation elevation below 1,000 feet.

C. The generator will be installed at approximately 200 feet above sea level. The generator shall operate as specified at ambient temperatures between 0 degrees Fahrenheit and 122 degrees Fahrenheit.

D. The engine/generator shall accept 100% of its nameplate rating at 0.8 PF in one step, in compliance with NFPA 110, Paragraph 5-13.2.6.

E. The generator shall be capable of successfully providing three phase, four wire, 60 hertz power to start and continuously operate at the specified KW rating and below for loads shown in the drawing and/or with power factors between 0.5 lag to 0.9 lead. It shall be capable of operating in noisy electrical environments that are typical of variable frequency drive motor loads. The nominal voltage and maximum step voltage dip shall be per the "Generator Data Sheet," as measured line to line at the generator terminals, during start of any of the station loads.

F. Generator set mean time between failures shall be a minimum of 5,000 hours.

2.03 ENGINE

A. The engine shall be a rich burn LP Gas (vapor) engine type, water cooled, four cycle, with vertical inline or V-type cylinders and an overhead valve configuration.

B. The engine shall have sufficient power to produce the specified ratings when operating with all accessories including exhaust, fuel, cooling, and battery charging systems, etc.

C. The engine shall be equipped with:

1. Electrical governor; consisting of a magnetic pickup speed sensor, adjustable electronic control, and an electrical actuator mounted integrally with the fuel pump. The governor shall provide automatic engine generator set frequency regulation adjustable from isochronous to 5% droop. Governors using external throttle linkages are not acceptable.

2. An electric starting system complete with batteries, battery charger, battery rack, connector cables, and any other equipment required to start the standby generator. The starting system shall not require an auxiliary AC power supply to start, fully load, and operate the standby generator. The batteries shall be sized to provide five starts with 30 seconds cranking for each start attempt. The battery charger shall be sized to fully recharge the batteries within 12 hours. If required to maintain the above criteria, an electrical heat pad for the batteries shall be provided to keep the batteries in a ready state at the specified minimum ambient temperature. The charger shall be furnished with charger trouble alarm and an automatic equalize timer for fast recharge. The charger shall alarm on loss of power and cause a generator common alarm output.

3. Positive engagement solenoid shift-starting electric starter with DC voltage as listed in "Generator Data Sheet."

4. Battery charging alternator with a minimum ampere output as listed in

"Generator Data Sheet."

5. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain. The oil pump shall be capable of supplying adequate lubricating oil under pressure to the main bearings, crankshaft bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism. The cartridge oil filters shall be full flow type, conveniently located for servicing. Filters shall be equipped with a spring loaded bypass valve to ensure oil circulation if filters are clogged.

6. An electric DC motor-driven pre-lube oil pump shall be provided if required by the engine manufacturer's design for "black start" of the standby generator.

7. Dry type replaceable air cleaner elements. The dry-type air cleaner shall be equipped with a self-cleaning dust and water evacuator and a vacuum restriction gauge to indicate maximum allowable restriction of the air cleaner system according to the engine manufacturer's recommendations. The air cleaner elements shall be conveniently located for servicing. The air filters shall be supplied with automatic swing open louvers to allow inlet air flow during engine operation.

8. Unit mounted radiator, blower fan, water pump, and thermostat. The radiator with blower type fan shall be sized to maintain safe operation at 122° F ambient temperature. The engine cooling system shall be filled with a solution of 50/50 ethylene glycol/water antifreeze or equivalent as recommended by the manufacturer.

9. Replaceable type cylinder liners.

10. Replaceable insert main bearings.

2.04 GENERATOR

A. The generator shall be a synchronous wye-connected generator designed for direct connection to the engine. It shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated, drip-proof construction, with amortisseur rotor or damper windings and skewed stator for smooth voltage waveform. The unit shall conform to the applicable standards for synchronous generators, salient pole type.

B. The generator shall have the following features:

1. Temperature rise of the rotor and stator shall be limited to 125° C for the specified KW and KVA ratings.

2. Steady state voltage regulation from no load to full load within +/- 0.25% for electronic governors, +/- 0.8% for mechanical governors.

3. Steady state regulation from no load to full load within +/- 0.25%.

4. The insulation material shall meet the NEMA standard (MG1-22.40 and 16.40) for class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL I-24092.

5. The excitation system shall be of brushless construction controlled by a solid state voltage regulator with adjustable volts-per-hertz operation capable of maintaining voltage within +/- 2% at any constant load from 0 to 100% of rating. The regulator isolated from the load to prevent tracking when connected to SCR loads. The regulator shall be protected from the environment by conformal coating and provide individual adjustments for voltage range, stability and volts-per-hertz operations. Provide permanent magnet (PM) excitation for generators above 150KW or AREP excitation for generators smaller than 150KW.

6. The generator shall have a single maintenance-free bearing and be connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

7. Radio interference suppression to meet the BS.800 and VDE Class G and N standards.

8. Telephone interference factor of less than 50 per NEMA MG1-22.43.

9. AC voltage waveform total harmonic distortion of less than 5% total from no load to full load. Any individual harmonic shall have less than 3% THD.

C. The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.

D. On starting each listed load, the instantaneous voltage dip shall not exceed that listed in "Generator Data Sheet" and shall recover to +/- 1% of rated voltage within one second.

2.05 CONTROLLER & INSTRUMENT PANEL

A. Provide a generator-set mounted controller & instrument panel. The controller top shall be mounted no higher than 6 feet above finished grade. Controller mounting shall be vibration isolated from the rest of the engine / generator set.

B. Emergency stop maintained pushbutton located at maximum 6 feet above grade .

C. Remote mounted emergency stop glass covered pull switch located as shown in the drawings at maximum 54 inches above grade.

D. Controller Features

1. All solid state construction, except for interface relays. The controller shall utilize a microcomputer based logic with a ROM based control algorithm. Circuit boards shall be coated to protect from environmental

damage.

2. Graphical display with preconfigured screens for parameter and alarm viewing and setpoint changes.

3. Voltage, current and power metering, engine and generator parameter viewing.

4. Real time clock for time stamping of diagnostic events and maintenance reminders.

5. Non-volitile memory for setpoint storage through power failures.

6. Security through password access.

7. Communications to SCADA systems through included Ethernet Modbus TCP port.

E. Control circuitry shall be of plug-in design for quick replacement. The controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall be capable of operation from □40°C to 85°C.

F. Control must meet NFPA-110 Level 1 requirements (2005 version) and meet NFPA-70.

G. The panel display shall include as a minimum:

1. AC voltmeter.
2. AC ammeter.
3. Frequency meter.
4. Water temperature gauge.
5. Oil pressure gauge.
6. Battery voltmeter gauge.
7. Engine running time meter (non-resettable)
8. Voltage adjustment.
9. Pre-alarms:

    a. Auxiliary fault.
    b. Battery Charger Fault.
    c. Fuel low level/pressure.
    d. Low oil pressure.
    e. Low engine temperature
    f. High engine temperature.
    g. High battery voltage
    h. Low battery voltage
    i. Fuel leak alarm

10. Engine shutdowns:

    a. Auxiliary Shutdown.

b. Emergency Stop.
c. Low coolant level
d. Overcrank.
e. Overspeed.
f. Low oil pressure.
g. Low fuel level.
h. High engine temperature.

11. Audible Alarm:

a. Generator switch not-in-auto.

12. Functions:

a. Three position (RUN-OFF-AUTO) function: In the RUN position the engine shall start and run regardless of the position of the remote starting contact. In the AUTO position, the engine shall start when contacts in the remote control circuit close and stop five minutes after those contacts open following the engine cooldown sequence. In the OFF position the engine shall not start even though the remote start contact closes. This position shall also shutdown engine immediately.

H. Wiring The manufacturer shall furnish, install at the factory, and test all wiring required between devices mounted within or on the standby generator unit base. All wiring shall be neatly and carefully installed in wiring gutters, wire looms, or raceway. All power supply circuits shall be provided with suitable isolation/electrical protection means consisting of either fuses or circuit breakers. All internal wiring shall be marked at both ends of the conductor.

I. Operation:

1. Two-wire generator start/stop control from an automatic transfer switch (normal start and stop with cooldown) and from a remote emergency stop (immediate stop with fuel shutoff).

2. Engine starter control for:

a. Cranking cycler with 15 second ON and OFF cranking periods or as recommended by the manufacturer. Cranking shall cease upon engine starting and running.

b. Two methods of cranking termination shall be provided:

1) After three 15 second cranking cycles.
2) After 75 seconds if the engine fails to start or as recommended by the manufacturer
3) Each condition shall lockout the engine, and visually indicate an overcrank alarm.

c. Starting system shall be designed for restarting in event of a false

engine start. It shall permit the engine to completely stop rotating before reengaging the starter.

3. Provide wiring circuitry and sensing devices as required for emergency shutdown of the engine on any occurrence of the following conditions.

   a. Low coolant level.
   b. Over speed.
   c. Over-crank.
   d. High engine temperature.
   e. Low oil pressure.
   f. Low fuel
   g. Emergency stop
   h. Auxiliary shutdown

4. Engine cool down timer factory set at five (5) minutes to permit unloaded running of the generator set after the call to operate is dropped.

5. Programmable I/O contacts to be provided and brought out to terminals for connection to remote monitoring equipment:

   a. A common alarm dry contact, normally open which closes on any alarm condition.
   b. A generator running dry contact, normally open which closes when the engine is running.
   c. A generator in cool-down dry contact, normally open which closes when the engine is running but opens when the engine enters cool-down.
   d. Low fuel level dry contact, normally open which closes on low fuel alarm condition.
   e. Auto switch position dry contact that closes when the three position (RUN-OFF-AUTO) selector switch is in the "AUTO" switch position.
   f. Remote emergency shutdown from normally closed switch.

2.06 ACCESSORIES

A. Engine block heater. Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1. Wattage and voltage shall be per Generator Data Sheet.

B. Exhaust System:

1. The complete exhaust system (silencer, stack, and exhaust piping) shall be sized to ensure that exhaust back pressure falls within the manufacturer's minimum and maximum limitations under all operating conditions.

2. Exhaust Silencer: Provide exhaust silencer including flexible piping & fittings properly sized and installed according to the manufacturer's

requirements. The silencer shall be critical type (30dB attenuation minimum) and coated to be temperature and rust resistant. The flexible connector section(s) shall be seamless, stainless steel and the ends shall be pipe thread (2□ maximum) or SAE flanged. Support for exhaust silencer shall be from overhead or side supports or as shown and shall not be carried by the exhaust manifold.

3. Exhaust Stack and Piping: Provide thin-gauge steel pipes with flange connections, high temperature gaskets, elbows and straight runs to complete the exhaust system. The exhaust system shall extend vertically above roof to direct exhaust and heat away from building or enclosure or as shown on the drawings. Provide wall thimble and roof penetrations designed for high heat applications and a gravity actuated steel rain cap at end of exhaust pipe. Exhaust system shall be supported from side or above utilizing galvanized steel channel trapeze hangars, gusseted wall brackets or custom welded brackets per manufacturer's recommendations to meet the specified seismic design conditions. Design system to accommodate engine vibration and not loosen or break exhaust system mounts.

4. Insulation system: The non-outdoor portion of the exhaust pipe, stack and silencer shall be covered with fiberglass insulation and soft outer cover. The outer cover shall be constructed of heat and fire resistant canvas material with snap buttons.

C. Vibration Isolation

1. Engine Generator: Vibration isolation dampeners between the engine and steel mounting skid.

2. Exhaust Silencer: Mount with vibration isolators and/or flexible exhaust piping.

3. Enclosures shall be mounted with vibration isolators and/or steel structural stiffeners to minimize added noise due to vibration.

4. The generator shall have provisions for shipping/transit such that expected shocks will not damage the vibration isolators or generator.

D. Remote Fuel Tank:

1. Fuel tanks shall be sized to provide fuel for a minimum run time in hour at full load or gallons as listed in □Generator Data Sheet.□

2. The fuel tank shall meet all local safety and code requirements for installation and leak monitoring. Provide any required information to aid in the permitting process. All necessary information shall be included in the submittal to avoid delays in project completion.

E. Batteries: Support tray with plastic battery enclosure, tie downs, battery cables, and 12-volt batteries all mounted to the engine/generator skid. The batteries shall

be capable of delivering the cold-cranking amps required at zero degrees Fahrenheit per SAE Standard J-537.

F. Signage:

1. Signage shall be posted on the sides of the generator enclosure facing the main approaches to the system.

2. Provide an engraved placard with fuel filling procedure, tank capacity, fuel type, and maximum fill guidelines.

3. Provide signage 0.08□thick white painted/silk-screened aluminum with 1-1/2□red lettering to read □No Smoking□. Signs shall be posted on all sides of generator enclosure.

4. Provide signage 4□x 6□x 0.08□white painted aluminum with red lettering to read □Generator Emergency Stop□ for installation at a remote emergency stop switch as shown on the drawings.

G. Automatic Battery Charger suitable for continuous operation to maintain the battery charge voltage with no manual intervention. Battery charger features shall be as follows:

1. Solid state circuitry with charging modes as described to automatically recharge the starting batteries. When battery voltage drops below the specified value the battery charger shall operate at the high rate constant current mode until the battery voltage rises to the preset equalize level. The equalize mode will continue until the current required to maintain this voltage drops to 50% of the high rate level.

2. A current limiting circuitry to prevent charger overload under low battery voltage conditions. Provide minimum DC voltage and amp ratings (minimum) as listed in □Generator Data Sheet.□

3. The battery charger shall provide temperature compensation of -2 mv/°C per cell over the ambient temperature of □40°C up to 60°C. This shall automatically adjust the "float" and "equalize" voltage settings to prevent the batteries from overcharging at high temperature and under charging at low ambient temperatures.

4. The complete charger unit shall be U.L. listed.

5. The charger shall be mounted to the engine/ generator skid. The charger shall be operational through an ambient temperature range of □40°F to 140°F. It shall include the following features:

   a. Fused AC input and DC output overload & short circuit protection.

   b. DC ammeter and voltmeter, 5% full scale accuracy, to indicate battery charging amps and volts.

   c. "Power on" lamp to indicate when the charger is operating.

d. DC voltage regulation +/- 1% from no load to full load and over AC input line variations of +/- 10%.

e. Reverse polarity protection to prevent the charger from energizing outputs if improperly connected.

f. Current limiting. Current limiting circuitry shall be provided to prevent damage to the charger from being overloaded at low battery voltage such as occurs during short circuit conditions or during engine starter cranking.

g. The battery charger shall be powered from 120 VAC.

H. Sound Attenuating Weatherproof Housing for the generator shall be as follows:

1. Manufactured from heavy-gauge aluminum or galvanized sheet steel and painted with the manufacturer's standard finish. Paint color shall be submitted to Owner for approval. Color choices shall include but not be limited to autumn white and beige. All surfaces shall be painted inside and out.

2. The interior of housing shall have a heat resistant thermo-acoustic insulation system designed to meet sound attenuation requirements for the life of the generator. The placement, type, thickness and weight of the attenuator panels shall provide sound dampening to the specified level of allowable noise outside the generator. The air intake and exhaust shall have similar dampening and allow ample air flow for proper engine cooling, without having to remove side panels. The insulation shall be mechanically held against walls, ceiling and doors behind full sheets of perforated galvanized sheet steel. All insulation shall be covered with the exception of the exhaust piping.

3. The enclosure shall house the engine, generator, control & instrument panel, battery charger, generator breaker, and all accessories.

4. All exterior panels shall have lockable latches to prevent unauthorized entry.

5. The specified exhaust silencer shall be mounted in or on the roof of the enclosure with vibration isolators.

6. Pressure drops through the enclosure openings shall not exceed limits set by the manufacturer of the generator.

7. The enclosure shall be free standing and anchored to the concrete pad (or trailer) supporting the engine generator. The enclosure may be mounted to the generator skid only if a skid mounted enclosure can meet the sound attenuation requirements specified.

8. The enclosure shall be designed so that sound levels measured at a 25 feet radius from any side of the enclosure (free field) and 5 feet above ground level, noise levels shall not exceed (Generator Data Sheet) dB with the engine generator running at full load and full speed inclusive of

exhaust noise.

2.07 MOLDED CASE CIRCUIT BREAKERS

A. GENERAL

1. Circuit breakers and motor circuit protectors shall be manufactured by Eaton Cutler-Hammer, Square D, G.E., Siemens, or equal.
2. Circuit breakers shall be the bolt-on type.
3. Multiple-pole circuit breakers shall be designed so that an overload on one pole automatically causes all poles to open. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or spaces specified are not acceptable.
4. Molded case circuit breakers shall be operated by a single toggle-type handle and shall have a quick-make, quick-break switching mechanism. An automatic trip of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and have flash reduction arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
5. Minimum interrupting capacity:
   a. 480 volt circuit breaker shall have a minimum interrupting capacity of 42,000 amperes.
   b. 120 or 208 or 240 volt breaker shall have a minimum interrupting capacity of 22,000 amperes
6. Circuit breakers shall be UL listed for series application.
7. Where indicated circuit breakers shall be current limiting.
8. Where indicated on Drawings, provide UL listed circuit breakers for continuous duty at 100% of their ampere rating in the intended enclosure.
9. Furnish add-on features such as auxilliary position status contacts, trip indication contacts, shunt trip coils, etc, as shown in the drawings.

B. TRIP UNIT Molded Case Circuit Breakers

1. Circuit Breakers less than 400 volt shall have thermal-magnetic (TM) trip units and inverse time-current characteristics. All other circuit breakers shall have trip units as Defined herein.
2. The trip unit shall be Eaton type Digitrip 310+ or equal.
3. Each molded case circuit breaker microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors, and

initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time-delay settings are reached.

4. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall non-adjustable. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.

5. Furnish 24VDC power supply with terminal blocks and 0.5A miniature circuit breakers to distribute power to each circuit breaker trip unit that requires it. Circuit breaker trip units shall be operable and adjustable with zero current flowing through the circuit breaker. The power supply shall be connected after the main breaker and above any feeder circuit breakers.

6. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

   a. Adjustable long-time setting (set by adjusting the trip setting dial to an amount not to exceed rating plug)

   b. Adjustable short-time setting and delay with selective flat or I^2t curve shaping,

   c. Adjustable instantaneous setting

   d. Adjustable ground fault setting and delay with selective flat or I^2t curve shaping.

7. The microprocessor-based trip unit shall have both powered and unpowered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.

8. Furnish internal ground fault protection with adjustable settings. Provide neutral ground fault sensor for four-wire loads.

9. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. The construction methods specified herein shall be followed by the manufacturer of the generator. If the manufacturer fails to comply, the Contractor shall pay all costs required to make the changes to the equipment to conform to these construction methods.

B. Screw type solderless terminals or lugs shall be provided for all field connected power cables, control and instrument wiring. All connections shall be accessible from a designated connection panel without removal of internal components.

C. A terminal strip shall be provided for control and instrument wiring. Number all terminals with machine printed lettering.

D. All internal and external control and instrument wiring shall have permanent identification at each point of connection. Wire identification shall be by machine printed numbered "shrink-tube" wiring sleeves. Internal wire numbers shall be per generator manufacturer's wiring diagram. External wire numbers shall be determined by the connected control panel(s).

E. Control and instrument wiring shall be neatly bundled and secured in place with screw down anchors and plastic cable ties. Wiring shall be protected with plastic spiral wrap where it is subject to mechanical damage or crosses over to a hinged door.

F. The generator and any accessories shall be a product of excellent workmanship and shall be free from any defects or imperfections that will affect their appearance or serviceability.

G. The generator's neutral shall be grounded per generator manufacturer's installation instructions for 3 wire distribution systems.

3.02 INSTALLATION

A. The generator shall not be delivered to the job site until the manufacturer's certified factory test report has been submitted, reviewed and accepted. A non-existent or non-reviewed certified factory test report shall be sufficient cause for the unit to be rejected.

B. The Contractor shall remove rejected equipment immediately from the jobsite at his expense until the generator submittal and/or factory test report is approved.

C. Fuel tank shall be installed per manufacturer's instructions, NFPA, and local codes. Provide and install all necessary options, traffic bollards, regulators, vent piping, restraint, etc. to satisfy governing agencies and performance requirements of generator.

1. List exact installed tank location with manufacturer and provide confirming documentation and related warranty information.

2. All electrical devices within 20 feet of the tank must conform to NFPA 70 Hazardous Locations. All electric conduits and wiring connected to the tank shall be explosion proof and in strict accordance with NEC Class-1, Division 1 or local standards whichever is more stringent.

3. Grounding per NFPA 780.

4. Provide necessary installation information to aid in the permitting process. Compile installation specific information as necessary for the Owner to obtain the proper permits.

3.03 FACTORY INSPECTION AND TESTS

A. Factory or Factory Authorized Dealer shall be considered one in the same for the purposes of inspection, testing, service facility and herein after may be referred to as "factory" or "manufacturer."

B. Factory Tests: Each generator to be supplied shall be tested by the manufacturer prior to shipment. All tests shall be made with all accessories installed. The factory tests shall be made under varying loads (30% to 100%) for a minimum of one hour total.

The factory testing shall include the following tests:

1. Single step load pickup.
2. Transient and steady state governing.
3. Safety shutdown device testing.
4. Voltage regulation.
5. Rated power.
6. Maximum power.
7. Test all generator control panel alarms, status lights & indicators.
8. Test all remote connection status and alarm points (dry contacts).
9. Simulate remote ATS start/stop of generator utilizing a wire jumper.

C. A typewritten factory test report shall be provided which lists the factory tests performed. The results of the each test, name & phone number of person who performed the tests, date(s) when tests were performed, serial & part number of equipment tested, setting values, failures encountered, and repairs made during testing.

3.04 FIELD ASSISTANCE

A. The Contractor shall take all precautions necessary to ensure the safety of all personnel during the tests. Absolutely no tests shall be run that could potentially cause injury or jeopardize personnel safety.

B. The initial setup of each generator shall be performed by a factory-trained service person of the manufacturer's local representative. Fill the engine fuel, lubricants, and cooling system and make all preliminary tests and checks required before engine start-up the day prior to witness field testing.

C. The Contractor shall be responsible for and pay the costs for the necessary fuel to fill each generator tank prior to the start of the field tests. The fuel shall include a fuel conditioner as recommended by the manufacturer.

D. The Contractor shall pay for a factory-trained service representative to perform one (1) 8-hour day of field tests for each generator, beginning at 8:00 a.m. any weekday, except Friday.

1. Each failure mode, alarm, and control function shall be demonstrated to Owner by the Contractor's factory-trained service representative prior to performing any other field tests.

2. The generator manufacturer representative shall furnish a temporary 1.0 PF load bank and connection cabling rated for a load equal to no less than 100 percent of the generator nameplate KW. The load bank shall be connected to the generator output terminals for a four (4) hour, full-load test. The Owner Representative shall be allowed to change loads during the tests to simulate normal operating conditions. The factory-trained service person shall be responsible for running the generator during the load tests. Any defects or failures discovered during these tests shall be corrected or adjusted by the factory-trained service person. The engine generator load test shall be restarted after each repair or adjustment that requires shutdown of the generator. The test shall be restarted as many times as necessary until the generator runs for four (4) continuous hours without shutdown or failure.

3. Under no circumstances shall the testing be allowed to extend beyond 5:30 p.m.

4. All field tests shall be witnessed by Owner. Written notice shall be provided to the Owner Representative seven (7) days prior to the date for the field test.

E. The Generator Field Checklist (GCL per Electrical Specifications [Factory and Field Testing] shall be completed by the generator manufacturer representative prior to beginning of operational testing. The checklist shall be signed by the representative submitted prior to the start of operational load bank testing.

F. The Generator Performance Test Report (GPT per Electrical Specifications [Factory and Field Testing].) shall be completed by the generator manufacturer representative during operational testing. The forms shall be signed by the representative and given to the Owner Representative prior to completion of operational load bank testing.

G. The Generator Sound Level Data Form (GSLD Electrical Specifications [Factory and Field Testing] shall be completed by the generator manufacturer representative during operational testing. The forms shall be signed by the representative and given to the Owner Representative prior to completion of operational load bank testing.

H. Training

1. The local representative's factory-trained service person shall instruct in the proper operating and maintenance procedures for all components of the generator. This instruction shall be given for a minimum length of two (2) hours. The training shall cover "operation" and "maintenance". Training shall not begin until Operation and Maintenance manuals are approved and field tests have been completed.

3.05 WARRANTY

A. The Generator System Supplier shall have a staff of experienced personnel available to provide service on two (2) working days notice during the warranty

period. Such personnel shall be capable of fully testing and diagnosing the equipment delivered; and of implementing corrective measures.

B. If the Generator System Supplier fails to respond in two (2) working days, the Owner at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor from fulfilling the remainder of the warranty requirements.

C. Prior to final acceptance, the Contractor shall furnish a listing of warranty information for all manufacturers of materials and equipment supplied under the scope of work covered in these design documents. The listing shall include the following:

1. Manufacturer's name, service contact person, phone number, and address.
2. Material and equipment description, equipment number, part number, serial number, and model number.
3. Warranty expiration date.

D. Hardware support:

1. The Contractor shall provide warranty of all equipment for a period of one (1) year from date of final acceptance. Standard published warranties of equipment which exceed the preceding specified length of time shall be honored by the manufacturer.

2. The Contractor shall provide all labor and material to replace or repair any hardware that fails during the warranty period, at no additional cost to the Owner.

3.06 FINAL ACCEPTANCE

A. Final acceptance will be given by the Owner after the equipment has been field tested satisfactorily, each deficiency has been corrected, documentation has been provided, and all the requirements of design documents have been fulfilled.

B. At the end of the project, following the completion of the field tests, and prior to final acceptance, the Contractor shall provide the following to the Owner:

1. Fuel tank top off. The Contractor shall supply up to one entire tank of fuel at the end of the project.
2. Each "operation, maintenance and parts" manual shall be modified or supplemented by the Contractor to reflect all field changes and as-built conditions.
3. Two sets of keys for all locks.

GENERATOR DATA SHEET

The following data sheet is a summary of generator required specifications. Not all specification requirements are listed below. The Contractor/Supplier shall return this page with the Submitted Value column completed. If submitted values are less than those listed in the Specification Minimum column, then the supplier shall explain reasons for the exception in cover letter.

Description	Specification Minimum	Units	Submitted Value	Units
Generator Continuous Output Power	**295**	KW		KW
	369	KVA		KVA
Three phase voltage (Nominal)	**480**	Volts AC		Volts AC
Continuous amperage at 0.8 power factor	**444**	Amps AC		Amps AC
Power Frequency	**60**	Hz		Hz
Max voltage dip with specified motors	**12**	%		%
Reactance – Subtransient (X''d)	**	%		%
Reactance – Transient (X'd)	**	%		%
Reactance – Synchronous (Xd)	**	%		%
Engine horse power at rated KW	**	HP		HP
Engine RPM at rated power	**1800**	RPM		RPM
Engine Fuel Type	**Propane**	-		-
Engine aspiration (Normal/Turbo)	**Turbo**	-		-
System Voltage	**	Volts DC		Volts DC
Alternator output (at system voltage)	**	Amps DC		Amps DC
Battery charger output	**10**	Amps DC		Amps DC
Engine block heater power	**	W		W
Alternator condensation strip heater	**	W		W
Heater(s) voltage (1 phase)	**240**	Voltage		Voltage
Fuel tank capacity (hrs @ 100% load)	**24**	Hours		Hours
Type (Sub-base/Remote)	**Remote**	-		-
Main Breaker Maximum Rating	**400**	Amps		Amps
Trip Features Per Spec	**LSIG**	-		-
Interrupt Rating	**42**	KAIC		KAIC
Load Bank (Radiator Mounted, None) Load Bank Rating Percentage	**None** FLA			
Enclosure type (Sound Atten., Weatherproof, None)	**75 dB Sound Attenuating**			

** Sized per manufacturer recommendations to meet intent of plans and specifications, codes, and environmental conditions at location of installation. Please highlight any deviations from drawings and specifications.

END OF SECTION

SECTION 26 36 23
AUTOMATIC TRANSFER SWITCH

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall supply the automatic transfer switch (ATS) as specified herein.

B. The ATS scope of work includes:

1. Providing and installing one automatic transfer switch of rating shown on Contract Drawings.
2. Submittal data and drawings.
3. Startup assistance.
4. Factory and field testing.
5. Operation and maintenance manuals.
6. Warranty of all components.

C. Startup and configuration of ATS with installed voltages and loads.

D. As required under Electrical Specifications [Factory and Field Testing], furnish all required labor, materials, safety equipment, transportation, test equipment, incidentals and services to perform factory and/or field testing.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Electrical Specifications [Factory and Field Testing]
C. Project Drawings

1.03 SUBMITTALS REQUIREMENTS

A. Provide Submittals as specified in Electrical Specifications [Electrical General, Submittal Requirements].

B. Include a record of each parameter available to be changed by the user. The list shall include factory defaults and space for entered values.

1.04 OPERATION AND MAINTENANCE INFORMATION

A. Provide operation and maintenance information as specified in Electrical Specifications [Electrical General, Operating and Maintenance Information].

B. Include a record of each ATS parameter setup during startup and testing and place a copy of setting in each O & M manual.

PART 2: PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. General:

1. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard for 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

2. The ATS shall be rated to close on and withstand 42,000 RMS symmetrical short circuit amperes at the ATS terminals or otherwise shown. Provide overcurrent protection as shown on the Contract drawings.

3. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

4. ATS types utilizing components of molded-case circuit breakers, contactors, or parts thereof, are not acceptable.

5. The switch assembly shall be installed in a NEMA enclosure located as shown on Contract drawings.

6. The automatic transfer switch shall be an ASCO Model 7000, Zenith ZTSD, each with options to meet specified requirements, or equal.

B. Switch Unit:

1. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be solenoid operated and only momentarily energized to minimize power consumption and heat generation.

2. The transfer switch shall feature a delayed transition mode. The switch shall remain in the neutral position (neither emergency nor normal) until the associated time delays have expired and allow the switch to complete the transfer.

3. The transfer switch shall be a conventional 2 position transfer configuration. The switch may only remain in transition for a fraction of a second.

4. The switch shall be 3 pole double-throw with inherently interlocked construction. A solid neutral shall be provided for all systems.

5. Wide contact gaps shall be provided to insure positive isolation of the normal and emergency power sources.

6. The switch shall be fully rated for amperage shown on Contract Drawings, for switching all types of loads including induction motors. The ratings shall apply to the voltage and mounting arrangement as shown in the drawings.

7. The main power contacts shall have silver alloy contact construction featuring a wiping action each time the switch is operated. Arc chutes shall be utilized to contain the inherent spark created when switching under load.

8. The main contact design shall allow repeated making and breaking of rated full load current, with a combination of motor and other loads and without damage or undue wear to the contacts.

9. All main power contacts and auxiliary contacts shall be mechanically driven from a common actuator shaft.

10. The bus shall be constructed of silver plated copper.

11. Inspection of all contacts, linkages and moving parts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

12. All switch and relay contacts, coils, mechanical linkages, and control elements shall be serviceable or removable from the front of the mounted switch or accessory assembly without removal of the switch or assembly from the compartment and without disconnection of the power cables or control wiring.

13. The switch shall have a manual operating handle for maintenance purposes.

14. Compression screw type solder-less terminals or lugs shall be provided for connecting all external line & load power cables and control wiring. All connections shall be accessible from the front without removal of internal components.

15. A terminal strip shall be provided for terminating all control wiring. All terminals shall be numbered with machine printed lettering matching the wire number of the terminated wire.

16. All control wiring shall have permanent identification at each point of connection. Wire identification shall be by machine printed numbered wiring sleeves. Electrically common wires shall have the same wire number. Electrically different wiring shall have unique wire numbers.

17. Control wiring shall be neatly bundled and secured in place by plastic cable ties. Wiring shall be protected with plastic spiral wrap where it crosses over a hinge to the door.

C. ATS CONTROL PANEL

1. A control panel shall be provided to direct the operation of the transfer switch. The modules sensing and logic shall be a controlled by a built-in microprocessor. Control panels that do not utilize microprocessor electronics to control the operation of the switch are not acceptable.

2. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port.

3. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

    a. Sensing and control logic shall be provided on multi-layer printed circuit boards.
    b. The panel shall be enclosed with a protective cover and be outer door or deadfront mounted such that it may be operated with the door closed for safety and ease of maintenance.

4. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to $\pm$ 1% of nominal voltage. Frequency sensing shall be accurate to $\pm$ 0.2%.

    a. The under-voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal and the dropout adjustable from 75% to 98% of pickup setting, both in increments of 1%. These adjustments shall be factory set at 85% dropout, and 90% pickup.
    b. The voltage of each phase of the emergency source shall be monitored, with pickup adjustable from 85% to 100% of nominal. This adjustment shall be factory set at 95% pickup.
    c. Frequency sensing of the emergency source shall be provided, with pickup adjustable from 90% to 100% of nominal. This adjustment shall be factory set at 97% pickup.
    d. The control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard 472-1974 (ANSI C37.90a 1974) and the withstand voltage test in accordance with the proposed NEMA Standard ICS1-109.21.

5. The transfer switch control panel shall be capable of operating over a temperature range of -20 to +60 degrees C.

6. The transfer switch shall be provided with advanced inphase algorithm which measures the frequency difference between the two sources and initiates transfer at appropriate phase angels to minimize disturbances from transferring motor loads.

7. The control panel shall include the following field adjustable time delays:

    a. Time delay to override momentary normal source outages, adjustable from 0 to 5 minutes. This adjustment shall be field set to place emergency generator on-line in 1 minute.
    b. Transfer to emergency time delay for controlled timing of load transfer to emergency, adjustable from 0 to 5 minutes. This adjustment shall be field set switch position in 5 seconds after power has stabilized.
    c. Emergency source failure time delay to ignore momentary transients during initial generator set loading, adjustable from 0 to 6 seconds. Set at 2 seconds.
    d. Retransfer to normal time delay, adjustable 0 to 60 minutes. This adjustment shall be factory set at 5 minutes. The time delay is automatically bypassed if the emergency source fails and normal source is acceptable.
    e. Unloaded running time delay for emergency engine generator cooldown, adjustable from 0 to 60 minutes. This adjustment shall be factory set at 5 minutes.
    f. Delayed transition time delay for setting the dead time when all power is removed from the load side of ATS, adjustable 0 to 5 minutes. Set at 1 minute.
    g. Generator Exercise Timer: Timer provided for operator adjustment of day of week, time of day and run duration for exercising the generator under operating loads by activating the automatic transfer switch. . Timer shall be mounted on the ATS outer deadfront door.
    h. The controller shall provide an integral engine exerciser. The timer shall be field set by the Contractor with date and time during training. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

        1) Enable or disable the routine.
        2) Enable or disable transfer of the load during routine.
        3) Set the start time of day, day of week, week of month, alternate or every time start, duration of run.
        4) At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

8. The controller shall commit-to-start engine which requires the engine to reach proper output and run at least the duration of the cooldown setting, regardless of whether the load is transferred.

9. Provide interface relays or main switch follower contacts to comply with I/O interface requirements as defined in the P&ID diagram. Interfacing relays shall be industrial grade plug-in type with dust covers. Interface connections shall be wired to backpan terminal blocks. At minimum, the

switch shall have the following unused I/O contacts available:

a. Switch in Normal □ SPDT rated 10 amps, 120 VAC
b. Switch in Emergency □ SPDT rated 10 amps, 120 VAC
c. Engine starting contact -- DPDT gold-flashed contacts rated 10 amps, 32 VDC
d. Emergency Power available □ SPDT rated 10 amps, 120 VAC
e. Normal Power available □ SPDT rated 10 amps, 120 VAC

10. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.

11. Provide separate LED signal lights with nameplates indicating the following:

a. Utility power is available (green)
b. Generator power is available (red)
c. ATS is connected to Utility source (green)
d. ATS is connected to the Generator source (red)
e. ATS in neutral position (wht)

12. A three position momentary-type test switch shall be provided for the test / automatic / reset modes:

a. Test: simulate normal source failure
b. Automatic: normal operation
c. Reset: bypass the time delays on either transfer to emergency or retransfer to normal.

13. All adjustments shall be field adjustable without the use of tools, meters, power supplies, or special test equipment and can be made safely without personal exposure to live parts

14. Each adjustment resolution shall be settable within minimum increments of 1%.

15. Repetitive accuracy of timer, voltage and frequency settings over a temperature range of □20° C to 70° C shall be within +/-2%.

16. The control panel programming shall be lockable via password protection.

17. The wire harness for connection of the control panel to the transfer switch shall have sufficient length to reach between the mounting locations shown on the Contract drawings.

18. Provide the following displays on the controller:

a. Event log to display 99 logged events with the time and date of the event, event type and event reason.
b. Total number of ATS transfers.

c. Number of ATS transfers caused by power source failures.
d. Total number of days ATS has been in operation.
e. Total number of hours that the normal and emergency sources have been available.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in Electrical Specifications [Electrical General, Workmanship].

3.02 FIELD ASSISTANCE

A. Testing, checkout and start-up of the ATS equipment shall be performed under the technical direction of a factory trained authorized manufacturer representative.

1. The setup and programming of the ATS shall be provided by a factory-trained representative who is authorized by the ATS manufacturer to perform the startup. This setup and programming shall be done prior to and during the first application of power.

2. Provide testing as specified in Electrical Specifications [Factory and Field Testing].

B. Provide 1 hour of "ATS Setup" Training on operating and maintenance procedures.

3.03 WARRANTY

A. Provide warranty as specified in Electrical Specifications [Electrical General, Warranty].

END OF SECTION

SECTION 26 44 50
GROUNDING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Labor, materials, equipment, tools, safety gear, test equipment, incidentals, services, and transportation for a complete electro-mechanical installation as shown on the Drawings, included in these Specifications, or as can be reasonably implied from project descriptions.

B. The scope of work includes:

1. Furnish and install grounding system required by Drawings, or if not shown or defined, as required by Article 250 of the NEC. Ground conductors shall be sized for the protective device, minimum.

2. Furnish and install conduits, junction boxes, underground boxes, and associated hardware. Provide hardware, conduit, fittings, and other parts for a complete grounding installation.

3. Installations shall be designed and installed with components meeting the NEMA area designation.

C. Work includes that specified in Electrical Specifications [Electrical General].

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Electrical Specifications [Low Voltage Wire & Data Cable]
C. Project Drawings

1.03 QUALIFICATIONS

A. Material furnished under this specification shall be installed by qualified installers meeting requirements specified in Electrical Specifications [Electrical General, Qualifications].

1.04 SUBMITTAL REQUIREMENTS

A. Provide submittals and Drawings as specified in Electrical Specifications [Electrical General, Submittal Requirements].

B. Submit manufacturer□s product information for connections, clamps, rods, terminals, and grounding system components.

PART 2: PRODUCTS

2.01 GROUNDING SYSTEM

A. General

1. Grounding conductors shall be sized as shown on the Drawings or in accordance with NEC table 250, whichever is larger.

2. Components of the grounding electrode system shall be manufactured in accordance with UL 467 - Standard for Safety Grounding and Bonding Equipment.

B. Grounding System

1. The utility service ground shall be tied to a building ground grid consisting of a "UFER" and/or ground rod type grounding system.

2. The UFER shall consist of minimum 25 feet minimum of code sized bare copper wire conductor laid at 3 foot nominal depth encased with of concrete or ground or as detailed on the Contract Drawings. UFER ground shall be located where soil moisture content will be maximized.

3. Ground enhancement material shall be permanent and be designed to lower earth resistance in all soil conditions. Once set, material shall have resistivity of not more than 20 ohm-cm resistance. Material shall be set by mixing it with water to form a slurry and shall not dissolve or decompose once cured. Ground enhancement material shall be Erico Ground Enhancement Material (GEM), Lyncole XIT, or equal.

4. The main ground bonding wire from the ground rod shall extend up into the utility service panel with readily visible UL approved "ground clamp" attached to the ground bus.

5. Install bare copper ground bond wires from the UFER ground to the various locations shown on the Drawings.

C. Raceway Grounds

1. Metallic conduits shall be assembled to provide a continuous ground path. Metallic conduits shall be bonded using insulated grounding bushings.

D. Equipment and Enclosure Grounds

1. Electrical and distribution equipment shall be connected to the grounding system. Cables shall be sized as specified.

E. Components

1. Ground rod shall be copper-clad steel, ¾□x 10 ft length. Rods shall have minimum copper thickness of 10-mils. Provide threaded, sectional type with coupling and driving stud so that extension rods of same diameter and length may be added where necessary to obtain necessary ground resistance improvements. Couplings and driving studs shall be by the

same manufacturer as the rod. Rods shall be Joslyn; Thomas & Betts; or equal.

2. Provide ground well enclosures for all outdoor ground rods. Furnish Christy type F8 or equal unless otherwise shown on the Drawings.

3. Ground rod clamps shall be bolt-on type as manufactured by O-Z Gedney type GRC, or equal.

4. Grounding and bonding wires shall be installed in all PVC conduits and nonmetallic raceways and connected to the ground bus and all equipment.

5. Each electrical enclosure shall have a copper ground bus. Screw type fasteners shall be provided on all ground busses for connection of grounding conductors. Ground bus shall be a Challenger GB series, ILSCO CAN series or equal.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in specified in Electrical Specifications [Electrical General, Workmanship].

3.02 INSTALLATION

A. Grounding System:

1. Install all products per Electrical Specifications [Electrical General, Installation].

2. Each nonmetallic conduit shall contain a code sized grounding conductor.

3. The system neutral conductor and all equipment and devices required to be grounded by the National Electrical Code shall be grounded in a manner that satisfies the requirements of the National Code.

4. The system neutral (grounded conductor) shall be connected to the system's grounding conductor at only a single point in the system. This connection shall be made by a removable bonding jumper sized in accordance with the applicable provisions of the National Electrical Code if the size is not shown on the Drawings. The grounding of the system neutral shall be in the enclosure that houses the service entrance main overcurrent protection.

5. Utilize mechanical connections in accessible locations and exothermic connections in non-accessible or buried locations.

6. The secondary on all transformers shall be grounded.

7. All raceway systems, supports, enclosures, panels, motor frames, and

equipment housings shall be permanently and effectively grounded.

8. Install insulated grounding conductor with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards and distribution panels with 12ga. conductor to grounding bus

9. All receptacles shall have their grounding contact connected to a grounding conductor.

10. Branch circuit grounding conductors for receptacles or other electrical loads shall be arranged such that the removal of a lighting fixture, receptacle, or other load does not interrupt the ground continuity to any other part of the circuit.

11. Attachment of the grounding conductor to equipment or enclosures shall be by connectors specifically provided for grounding. Mounting, support, or bracing bolts shall not be used as an attachment point for ground conductors.

12. Install grounding electrode conductor and connect to reinforcing steel in foundation footing. Electrically bond building steel to ground system. Bond metal siding not attached to grounded structure.

B. Ductbanks

1. Provide #4/0 AWG bare, stranded ground conductor in approximately the center of the ductbank where shown on plans and for all ductbanks containing cables rated 2kV or greater

2. Ground wire, where required, shall be strapped to a conduit every 5 feet.

3.03 FIELD QUALITY CONTROL

A. Inspections:

1. Engineer shall inspect ground system prior to cover.

B. Testing:

1. Complete applicable test forms if provided in testing specifications [Factory and Field Testing]. If form is not provided, furnish results on a vendor standard form.

2. Test each grounding connection to determine the ground resistance. The grounding test shall be IEEE 81.2 and NETA 7.13. The current reference rod shall be driven at least 100 feet from the ground rod or grid under test. The measurements shall be made at 10-foot intervals beginning 20

feet from the test electrode and ending 80 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

END OF SECTION

SECTION 26 44 81
VARIABLE FREQUENCY DRIVE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Provide each variable frequency drive as shown on elementary and one-line Drawings. Variable frequency drive shall be provided with full speed bypass, harmonic conditioner, line and/or load reactor, RFI filter and/or other accessories where shown on The Drawings. All VFDs shall be of the same manufacturer.

1. The System Integrator shall perform and be responsible for procurement, submittals, shop drawings, testing, and all control wiring for the VFD. System Integrator is defined in Electrical Specifications [Electrical General].

B. Provide enclosure (and side mounted wire chase as required) for top or bottom feed conduit connection as shown in the Drawings. Enclosure size shall not exceed the space allocated in the Drawings for such use.

C. Provide cooling/ventilation system, mounting hardware, associated components, devices, and field control stations. Some components may be specified in other Electrical Specifications such as terminal blocks, wire, buttons, etc.

D. Installation of the VFD with components as specified in Electrical Specifications [Electrical General]. The VFD scope of work includes:

1. Providing and installing VFD(s) of rating shown on The Drawings.
2. Submittal data and drawings.
3. Startup assistance.
4. Factory and field testing.
5. Operation and maintenance manuals.
6. Warranty of all components.

E. Startup and configuration of VFD with actual motor load.

F. Electrical Specifications [Factory and Field Testing]. Furnish all required labor, materials, safety equipment, transportation, test equipment, incidentals and services to perform factory and/or field testing.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Electrical Specifications [Low Voltage Wire & Data Cable]
C. Electrical Specifications [Factory and Field Testing]

1.03 SUBMITTALS REQUIREMENTS

A. Provide Submittals as specified in Electrical Specifications [Electrical General,

Submittal Requirements].

B. Include a record of each VFD parameter available to be changed by the user. The list shall include factory defaults and space for entered values.

1.04 OPERATING AND MAINTENANCE INFORMATION

A. Provide operation and maintenance instructions as specified in Electrical Specifications [Electrical General].

B. Include a record of each VFD parameter setup during startup and testing and place a copy of setting in each O & M manual.

PART 2: PRODUCTS

2.01 GENERAL

A. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed and braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be industrial grade and shall be of sturdy and durable construction suitable for long, trouble-free service. Light duty, fragile, and competitive grade devices of questionable durability shall not be used.

B. The VFD is inclusive of the input stage, buss, output stage, input filters, output filters, and all other assemblies, boards, or conditioning equipment, that make up the entire VFD system. The VFD system is herein referred to simply as "VFD" and is not to be parsed in any way to meet a specification as a specific part or assembly where it cannot be met as a system.

C. Products that are specified by manufacturer, trade name, or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are favorably reviewed by the Owner and/or Engineer prior to installation.

D. Underwriter's Laboratories (UL) listing is required for all substituted equipment when such a listing is available for the first named equipment.

2.02 QUALITY

A. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product.

B. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed and braced and anchored and shall be

installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light duty, fragile, and competitive grade devices of questionable durability shall not be used.

C. Products that are specified by manufacturer, trade name, or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are favorably reviewed by the Owner and/or Engineer prior to installation.

D. Underwriter's Laboratories (UL) listing is required for all substituted equipment when such a listing is available for the first named equipment.

2.03 VARIABLE FREQUENCY DRIVE

A. This specification is based on ABB ACS (Ultra Low Harmonic ACS-800) or meeting efficiency requirements herein.

B. The VFD shall be of the latest technology used to control and maintain a process variable (level, flow, pressure, speed, etc.) by varying the motor speed. The VFD shall be available from a single manufacturer in the horsepower range of 1 to 500 HP.

C. Performance Requirements

1. Harmonic Attenuation (applies to Ultra Low Harmonic (ULH) as shown in Drawings)

a. The VFD shall have an active filter line supply unit which controls the low order harmonic current or 18 pulse rectifiers to reduce the harmonic current impressed on the incoming power feeder.

b. The input current to the VFD shall limit the total harmonic content to less than 5% of the VFD's rated input on any power system and under all operating conditions.

c. The VFD shall comply with IEEE 519 requirements.

2. Open loop static speed regulation shall be 0.5 % to 1% of rated motor speed. When motor speed feedback is provided from a suitable encoder, closed loop speed regulation shall be 0.1% of motor nominal speed. Dynamic speed accuracy shall be less than 1%-sec with 100% torque step open loop and 0.5%-sec closed loop with 100% torque step. 2. Torque control response time shall be less than 10 ms with nominal torque. In the torque regulating mode, torque regulating accuracy open loop shall be +/- 5%; torque regulating accuracy closed loop shall be +/- 2%;

D. Ratings

1. The VFD shall employ a full wave rectifier to prevent input line notching and operate at a fundamental (displacement) input power factor of 0.98 at all speeds and nominal load.

2. The VFD efficiency shall be 97.5% or better at full speed and load. Efficiency is defined as the output power divided by the input power in terms of percentage. All internal system losses recognized.

3. Load - The VFD shall be designed to continuously operate the following motor/pump load:

    a. Motor NEMA design B, squirrel-cage induction or specialty specific use motor per Mechanical Division Specification as shown in Drawings.
    b. Horsepower at full speed R.P.M. of submitted/approved motor.
    c. Voltage, 230/460 VAC, three phase, 60 Hz.
    d. Service factor, 1.15 S.F.

4. Input Power - The VFD shall be rated to continuously operate under the following input power conditions:

    a. The Drive shall be rated to operate from 3-phase power at nominal voltage (208VAC to 600VAC, +10% /-15% as shown in Drawings), 48Hz to 63Hz.
    b. The overvoltage trip level shall be a minimum of 30% over nominal, and the undervoltage trip level shall be a minimum 35% under the nominal voltage.
    c. Three phase, phase rotation insensitive.
    d. Displacement power factor, 0.95 lagging at all loads and speeds above 10% rated load.

5. Output Power - The VFD shall be rated to continuously operate while providing the following output power conditions:

    a. Voltage, 0 to 500 VAC.
    b. Frequency, 3 to 60 Hz.
    c. Continuous motor horsepower.
    d. VFD amp output (minimum).
    e. Continuous current - as shown in Drawings or 115% of rated motor nameplate amps, whichever is higher.
    f. Short term normal current, 110% of continuous rated current for a minimum duration of 1 minute per every 10 minutes running.
    g. Short term heavy duty overload current, 150% of continuous rated current for a minimum duration of 1 minute per every 10 minutes running.
    h. Waveform - sine coded PWM.
    i. The drive's switching pattern shall be continually adjusted to provide optimum motor flux and avoid the high-pitched audible noise.
    j. Diodes and transistors shall have a minimum withstand of 1,200 peak inverse voltage (PIV).

6. Environmental - The VFD shall be rated to continuously operate under the following environmental conditions:

   a. Ambient temperature, 5°F to 122°F (-15°C to 50°C).
   b. Altitude, no derating below 3,300 ft.
   c. Relative humidity, 95% non-condensing.
   d. The drive shall be protected from atmospheric contamination by chemical gasses and solid particles pre IEC 60721-3-3, chemical gasses Class 3C2 and solid particles Class 3S2.
   e. The drive shall be protected from vibration per IEC 60721-3-3 Class 3M4 (sinusoidal displacement 3.0 mm, 2Hz to 9Hz; acceleration 10m/s^2, 9Hz to 200Hz).

E. Protection - The VFD shall be provided with the following protection:

1. For each programmed warning and fault protection function, the Drive shall display a message in complete English words or Standard English abbreviations. The three (3) most recent fault messages along with time, current, speed, voltage, frequency and DI Status shall be stored in the Drive's fault history. The last ten (10) fault names shall be stored in Drive memory.

2. The Drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.

3. Output short circuit withstand rating and ground fault protection rated for 100,000 AIC shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.

4. The Drive shall provide electronic motor overload protection qualified per UL508C.

5. Protection shall be provided for AC line or DC bus overvoltage at 130% of max. rated or undervoltage at 65% of min. rated and input phase loss.

6. A power loss ride through feature will allow the Drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

7. Stall protection shall be programmable to provide a warning or stop the Drive after the motor has operated above a programmed torque level for a programmed time limit.

8. Underload protection shall be programmable to provide a warning or stop the Drive after the motor has operated below a selected underload curve for a programmed time limit.

9. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.

10. The VFD shall constantly monitor the load current with an electronic

thermal overload relay and trip the drive on motor overload. The electronic overload relay shall be adjustable and compensate for the reduced cooling of the motor at reduced speeds. This protection provides an orderly shutdown should the motor's thermal capabilities be exceeded and eliminates the requirement for conventional motor overload relays.

F. Digital programmer/controller – The VFD shall be equipped with a front mounted operator control panel (keypad) consisting of a backlit, alphanumeric, graphic display and a keypad with keys for Start/Stop, Local/Remote, Up/Down and Help. Two (2) Softkeys will be provided which change functionality depending upon the position within the parameter hierarchy or state of panel.

1. All parameter names, fault messages, warnings and other information shall be displayed in complete English words or standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.

2. The Display shall have contrast adjustment provisions to optimize viewing at any angle.

3. The control panel shall provide a real time clock for time stamping events and fault conditions.

4. The control panel shall include a feature for uploading parameter settings to control panel memory and downloading from the control panel to the same Drive or to another Drive.

5. All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.

6. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus.

7. The keypad shall be removable and insertable under Drive power, capable of remote mounting, and shall have its own non-volatile memory.

8. Digital Programmer/Controller (HIM) shall be capable of remote door mounting. Cable for remote digital programmer/controller shall be supplied as shown in the Drawings. The HIM shall be mounted and housed to maintain the NEMA 12 door rating.

9. The standard operator panel shall provide a start-up, maintenance and diagnostic assistants that guides a new user through initial start-up and commissioning of the Drive as well as provide indications for maintenance and help to diagnose a fault. In addition, a PID assistant, Real-time Clock assistant, Serial Communications assistant, and Drive Optimizer assistant shall be included. A Drive Optimizer assistant permits the user to choose Drive set-up for low nose, drive & motor efficiency or motor control accuracy.

10. The door mounted human interface module (HIM) display shall be capable to view and adjust the following diagnostic and status indicators:

    a. VFD Speed % or Frequency
    b. Instantaneous overcurrent.
    c. Ground fault.
    d. Overtemperature.
    e. Overvoltage.
    f. Undervoltage.
    g. Overload.
    h. Overfrequency.
    i. Amps.
    j. Voltage.
    k. Temperature.
    l. Auxiliary Fault.
    m. Phase loss.
    n. Current limit.
    o. Power and kilowatt hours
    p. Power up delay.
    q. Status of discrete inputs and outputs.
    r. Values of analog input and output signals
    s. Values of PID controller reference, feedback and error signals.

11. Adjustments - The following setting ranges shall be provided and made independently accessible for operator adjustment:

12. Speed/Torque control functions shall include:

    a. Minimum speed/torque limits.
    b. Maximum speed/torque limits.
    c. Selection of up to seven (7) preset speed settings or external speed control
    d. Two (2) independent built-in PID controllers to control a process variable such as pressure, flow or fluid level.
    e. Two (2) analog inputs shall be programmable to form a reference by addition, subtraction, multiplication, minimum selection or maximum selection.

13. Output control functions shall include:

    a. Current and torque limit adjustments to limit the maximum Drive output current and the maximum torque produced by the motor. These limits shall govern the inner loop torque regulator to provide tight conformance with the limits with minimum overshoot.
    b. A torque regulated operating mode with adjustable torque ramp up/down and speed/torque limits.

G. Input and Output Terminations - The VFD shall have terminals for input and output cabling as defined in the Conduit and Wire Schedule as shown on the Contract Electrical Drawings.

1. Provide power terminal blocks for motor lead connections where drive terminals are hard to reach or require drive cabinet disassembly to connect.

2. Five (5) digital inputs, all independently programmable with at least twenty-five (25) input function selections. Inputs shall be designed for 120 volts AC input or as otherwise shown in the Drawings. Input functions must include time delay start and hand and auto (Ethernet) control.

3. Two (2) form C relay contact digital outputs, all independently programmable with at least thirty (30) output function selections. Relay contacts shall be rated to switch a maximum two (2) Amps rms continuous current at a maximum switching voltage of 30VDC or 250VAC. Function selections shall include indications that the drive is ready (no faults and in remote), running, and are addressable from Ethernet as users choice.

4. Two (2) analog inputs, each selectable for 0VAC - 10VAC or 4mA - 20mA, and independently programmable with at least ten (10) input function selections. Analog input signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion. If the input reference (4-20mA or 0-10V) is lost, the VFD shall give the user the option of the following: (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The Drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus.

5. Two (2) analog outputs providing 0 (4) to 20mA signals. Outputs shall be independently programmable to provide signals proportional to at least twelve (12) output function selections including output speed, frequency, voltage, current and power.

6. Provide I/O input and relay output expansion card(s) as needed to accommodate the I/O wiring as shown in the Drawings. The option card shall be integrally mounted to the drive.

H. Communications The VFD shall include communications module for interface to the PLC. All settable parameters and instantaneous operational registers shall be accessible from the communications port.

1. Type

a. Ethernet TCP/IP

I. Features - The VFD shall have the following features:

1. Connection of the three incoming line leads and three-motor leads shall be the only connections necessary for manual operation of the VFD unit. All other wiring shall be prewired at the factory and self-contained within the VFD unit. A 120 VAC control power transformer and other auxiliary

power supplies shall be provided with the VFD for power to pilot lights, meters, relays, and miscellaneous devices specified to be supplied with the VFD. Lugs shall be provided for connection of all power leads; terminal blocks shall be provided for all other wiring. Relay logic, wiring and enclosure layout shall be equivalent to that shown on the Drawings.

2. The VFD shall be protected by a circuit breaker disconnect unless otherwise shown in the Drawings. The disconnect shall be externally operated and shall have an operator mechanism that is an integral part of the enclosure. An operator mechanism shall be provided to allow padlocking the disconnect in the "off" position with up to two padlocks.

3. AC input fuses shall be provided on the line and/or load side of the VFD (if required by the manufacturer) to isolate the VFD power circuitry upon a fault condition.

4. The VFD shall be capable of sensing load outside of normal range. A User Load Curve with range settings shall be available to be configured. If the motor horsepower as a function of speed is not within a predefined range, then an alarm shall be set within a setpoint delay. The alarm may be configured to shut down the drive and/or set a digital output for connection to a indicating light or PLC. The intent of this alarm is to protect the machine or pump from operating with a broken shaft, or clog, or flow restriction, or similar condition.

5. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

6. Transient and surge voltage power line input protection shall be provided for the VFD through use of metal oxide varistors (MOVs), surge protective module, or other approved equal methods. Transient protection integral to the VFD shall be provided to a minimum of 10,000 volts, 50 joules without failure. The transient protection shall meet or exceed ANSI C7, 90-1971 and IEEE 472-1974 Standards without failure. Failure is defined as loss of components in the VFD including power semiconductors and fuses. The VFD shall be protected from the following, as a minimum, power line transients and recover to automatically restart and resume normal operation without posting a fault:

    a. Switching the primary of a power transformer.
    b. Switching power factor correction capacitors "ON" and "OFF" line.
    c. De-energization or energization of contactors, relays, and other power equipment from the power line.
    d. Starting and stopping of other motors when powered from Utility.

7. The VFD shall not be affected by or generate excessive electro-magnetic interference (EMI). The VFD shall be provided with a radio interference filter (RIF) to meet the following requirements:

    a. The use of a 4 Watt hand-held VHF/UHF transceiver within three feet of the VFD with its doors closed shall not cause erratic

operation, loss of configuration, or any other deviation from normal operation.

b. The worst case conducted and radiated EMI generated by the VFD shall not be enough to prevent the use of hand held VHF-UHF transceivers within three feet of the VFD with its doors closed.

8. Opening of the VFDs input switches, circuit breakers, or output contactors while the VFD is operating under load shall not result in damage to the VFD power or control circuit components.

9. The VFD shall be capable of starting and operating without a motor load connected.

10. Phase loss protection shall be provided to prevent single phasing of the motor load.

11. The VFD shall have an instantaneous electronic trip circuit to protect the VFD from output line-to-line and line-to-ground short circuits. Output line-to-line and line-to-ground short circuits shall not damage the VFD.

12. The VFD shall be protected from excessive regeneration by a full function regeneration limit circuit which avoids nuisance tripping when overhauling loads occur. The full function regeneration limit circuit reduces the negative current limit of the drive during periods of excessive regeneration allowing the drive to remain fully operational without exceeding the level of regenerated energy which can be safely accepted and dissipated by the inverter. The following performance characteristics shall be provided:

    a. The regeneration circuit automatically adjusts the negative current limit, allowing the load to decelerate at the fastest rate possible without excessive regenerated energy. Deceleration torque is automatically limited to its maximum safe level.

    b. If the load tends to overhaul the drive motor, the negative current limit is automatically adjusted to prevent excessive regeneration. The inverter hold back torque decreases and allows the motor to follow the load while maintaining hold back torque at its maximum safe level.

13. Automatic fault reset to automatically restart the drive after any type of fault condition. This automatic restart shall repeat up to three attempts. This automatic reset shall be provided to prevent a drive fault from completely locking out on isolated nuisance fluctuations. When the drive is locked out after its automatic reset attempts the operator shall be able to reset the VFD by a local or remote manual reset pushbutton. Fault lockout shall be indicated on the door mounted drive fail pilot light.

14. The VFD shall be capable of continued operation during an intermittent

loss of incoming line power up to five cycles.

15. The VFD shall automatically restart upon reapplication of power after a loss of line power. Momentary or sustained power failures shall not fault trip out the VFD or blow any fuses.

16. Any configuration of adjustments or controls not set by a switch or potentiometer shall be stored in nonvolatile memory. No configuration information shall be lost due to power failures of any duration.

17. The VFD shall be capable of starting into a rotating motor without tripping out on a fault.

18. The drive shall have an adjustable voltage boost control capable of providing additional starting torque to the motor at start. This control shall provide the additional voltage only at the frequency range required to start the motor thus reducing the additional motor heating excess voltage would cause at normal operating speeds.

19. The drive shall be equipped with critical frequency jump circuitry which allows the VFD to be setup to skip two bands of frequencies which cause excessive vibration or noise.

J. Enclosure - The enclosure type shall be as shown in the Drawings - freestanding, wall mount, motor control center full section, or MCC cubicle mount construction. All components shall be accessible from the front of the enclosure. Rear or side access shall not be required in order to remove or service any component. The enclosure shall include the following in its construction:

1. The VFD shall incorporate thermostat/run controlled fans for cooling. The air flow through the VFD compartment shall provide proper cooling of the operating VFD at an (external cabinet) ambient temperature of 104°F. Fan mounting shall include reusable air filters on suction. Provide fans for suction and discharge vents as required maintaining air flow and forcing circulation.

2. Provide specific use fans located within the enclosure to cool, directly, specific components such as line filters or DV/DT filters.

3. Thermostat shall have bi-metallic adjustable set point range of 30° to 140°F. Thermostat shall have a switching capacity of 10A at 120 VAC. Provide Hoffman A-TEMNO temperature switch or approved equal to operate fans. Thermostat shall operate fans in parallel with motor running output of VFD.

4. The VFD, including the enclosure and input protection, shall be UL listed for a minimum of 42,000 RMS symmetrical ampere fault withstand capability. VFDs consisting of the VFD, enclosure, and all accessories, that are not UL listed will not be approved.

2.04 SINGLE TURN POTENTIOMETER

A. Provide manual single turn potentiometer. Potentiometer shall be compatible with the VFD input for manual speed control. Potentiometers shall be Allen-Bradley 800H, Cutler Hammer or equal.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in Electrical Specifications [Electrical General, Workmanship].

B. Requirements of Related Electrical Sections apply to design, documentation construction and assembly of Variable Frequency Drives.

C. Perform work to remedy non-compliant installations after inspection.

3.02 FIELD ASSISTANCE

A. Testing, checkout and start-up of the variable frequency drive equipment shall be performed under the technical direction of a factory trained authorized manufacturer representative.

1. The setup and programming of the VFD shall be provided by a factory-trained representative who is authorized by the VFD manufacturer to perform the startup. This setup and programming shall be done prior to and during the first application of power to the motor. The VFD electronic motor overload protection shall be set to meet the motor nameplate and NEC Code requirements.

2. Provide testing as specified in Electrical Specifications [Factory and Field Testing].

B. Provide 1 hour of "VFD Setup" Training on operating and maintenance procedures.

3.03 WARRANTY

A. Provide warranty as specified in Electrical Specifications [Electrical General; Warranty].

END OF SECTION

SECTION 26 66 00
FACTORY AND FIELD TESTING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This Section defines factory and field testing requirements of electrical and instrumentation equipment and as specified in this section and in Electrical Specifications. All equipment provided under Electrical Specifications and electrical equipment provided under other sections shall be tested as specified herein.

B. The Electrical Contractor shall coordinate at no additional cost to the Owner, the services of an approved qualified third party independent testing company for the purpose of performing specific tests as outlined in EXECUTION, Field Test of this section.

C. The System Integrator, Testing Company and/or Electrical Contractor shall provide all labor, tools, material, power, and technical supervision to perform the specified tests and inspections.

D. The Electrical Contractor shall be present during field testing and assist the System Integrator and/or Testing Company in testing all equipment. The Electrical Contractor shall be ready to correct any wiring problems found during testing.

E. The Application Programmer (defined in Electrical Specifications [Electrical General].) and/or Construction Manager will be actively engaged in Operational Testing and Commissioning. These efforts shall be combined efforts of the Application-Programmer/Construction-Manager/Engineer and Contractor. The Contractor shall facilitate test as outlined herein such that hardware, software and application programming are tested completely and all applicable test documentation is completed.

F. It is the intent of these tests to ensure that all equipment is operational within industry and manufacturer□s tolerances and is assembled in accordance with design plans and Specifications.

G. The Owner and/or Construction Manager may witness testing in effort to insure quality and verify results. The Contractor is required to provide notification 2 weeks prior to any test that are intended to be documented and submitted for approval or are final tests. The Owner and Construction Manager must specifically decline witness of each test to be performed, and the test must be successful, and it must be documented on the day of test, in order for it to not have to be repeated in the presence of an authorized witness. Only the Owner or Construction Manager may assign an authorized witness.

H. All tests shall be documented in writing by the person performing the test on the test forms submitted (and similar to those shown at the end of this section) and

signed by the Engineer as satisfactorily completed. The Testing Company, Electrical Contractor or System Integrator performing tests shall keep a detailed log of all tests that failed or did not meet Specifications, including date of occurrence and correction.

I. The Contractor shall perform all applicable testing of Owner supplied or existing equipment as a unit and as part of a system. Testing shall include documentation and witness sign-off.

J. The radio and communications equipment shall be completely configured by the Contractor for permanent operation. Radio diagnostics, addresses, and configuration shall be recorded and provided with testing submittals. Provide data in tabular format on Excel spreadsheet. Contractor is required to test every path, link, repeater until optimum results are obtained. Test form example is not provided for this purpose and must be generated by the Contractor.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Project Drawings
C. Additional testing may be specified in other Electrical Specifications.

1.03 FACTORY AND FIELD GENERAL REQUIREMENTS

A. Testing General

1. Prior to any field testing Operation & Maintenance Manuals shall have been submitted and approved.

2. The test forms shall be completed by the contractor during testing and calibration of all equipment. All tests shall be witnessed by the Owner's Representative. Completed test forms shall be given to the Owner's Representative the day of the test. Complete two sets of test forms if Contractor wants to keep a copy.

3. The Contractor shall give the Engineer 10 working days notice of the dates and time for inspections and testing.

4. Include test results in the Maintenance and Operational Manual.

5. As a minimum, all the tests indicated/specified on the test forms shall be performed and test forms filled out by the Contractor.

6. Prepare and submit formal test procedures and forms at least two weeks prior to the start of testing. Testing shall not commence until the test procedures have been reviewed and approved. Submit a combined test procedure submittal with separate sections for factory and field tests.

7. If the results of any of tests are unacceptable, the Contractor shall make corrections and perform the tests again until they are acceptable; these tests shall be done at no additional cost.

B. Failure to Meet Test

1. Any system, material or workmanship which is found defective on the basis of these tests shall be reported immediately following the test. The Contractor shall replace the defective material or equipment and have tests repeated.

C. Safety

1. Testing shall conform to the respective manufacturer□s recommendations. All manufacturers' safety precautions shall be followed.

2. Safety, as shown herein and in other divisions, shall be a combination of all methods and practices described. Safety practices may not be determined based on the least restrictive requirement, but instead, on the most restrictive requirement. Obtain clarification if there is any question prior to performing tests.

3. The procedures stated herein are guidelines for the intended tests, the Contractor shall be responsible to modify these tests to fit the particular application and ensure personnel safety. Absolutely no tests shall be performed in such a fashion that personnel safety is jeopardized.

4. The Contractor shall have two or more personnel present at all tests.

5. Two non-licensed portable radios shall be provided by the Contractor for use during testing.

6. Contractor shall comply with California Electrical Safety Orders (ESO) and Occupational Safety and Health Act (OSHA): All test and procedures shall comply with ESO and OSHA as to safety, protective clothing, clearances, padlocks and barriers around electrical equipment energized during testing.

7. The first set of tests to be performed (**pre-energization**) shall determine the suitability for energization and shall be completed with all power turned off.

1.04 QUALIFICATIONS

A. Testing Company

1. Testing company shall have been actively engaged in the type of electrical testing specified in this Division for the past three years (minimum). The Testing Company representative shall have two years experience in field testing of equipment working for the Testing Company or equivalent. The following Electrical Testing Companies are pre-approved.

a. EETS (916) 339-9691
b. Industrial Test (888)-809-8550

c. Emerson Electrical Reliability Services
d. Apparatus Testing and Engineering (916) 853-6280
e. Apparatus Testing and Engineering (925) 454-1363
f. Power Systems Testing (925) 583-2361

2. Testing Companies not listed are required to submit company and individual representative resumes for review and approval.

B. System Integrator Representative

1. The system integrator representative shall have 1 year experience in field testing of equipment working for the System Integrator or equivalent. If the representative does not demonstrate necessary experience or competence during testing or start-up, the System Integrator shall provide a representative meeting the required competence and experience.

C. Electrical Contractor Representative

1. The Electrician shall have 5 years minimum experience working with industrial control systems and have a Journeyman level experience rating.

1.05 SUBMITTAL REQUIREMENTS

A. The Contractor shall ensure that the Testing Company, System Integrator, and all equipment suppliers provide the submittal documentation required in this section. Submittals shall be complete, neat, orderly, and indexed. The Contractor shall check all submittals required under this Division for the correct number of copies, adequate identification, correctness, and compliance with the Contract Specifications and Drawings, and initial all copies certifying compliance.

B. The System Integrator shall assemble and submit for approval complete testing procedures and forms at least two weeks prior to the start of testing. Contractor is responsible for compiling testing procedures and forms from multiple sub-contractors as required.

C. Test submittal shall include: (as applicable)

1. Proposed procedure for operational testing whether it is performed in the factory or field. Procedure shall include method, simulated I/O requirements, bypass piping, telemetry, and necessary materials and equipment to conduct test.

2. Test forms (for all tests, factory and field, and regardless of who performs tests). Test forms shall be electronically completed prior to submittal with entry spaces filled to the extent possible. The only remaining data that shall require completion during the test is the test data itself. Test forms shall be provided as illustrated at the end of this section or equal.

3. Approved shop one-line, elementary diagrams and PLC I/O drawings.

4. Control strategies photocopied at 75% reduction with room at the side of page for comments on each paragraph or control strategy.

PART 2: PRODUCTS

2.01 TEST EQUIPMENT

A. Test equipment required to perform testing and document results shall be provided by Contractor, Testing Company or System Integrator.

B. Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology. Instrument calibration shall be current to one year from date of start-up. Test equipment accuracy shall be at least twice the accuracy of instrument being calibrated. Test instrument certificates of calibration shall be on-hand and provided prior to testing.

C. All test equipment to be used as part of the testing shall be listed in the submitted testing sheets. Contractor supplying the component or system to be tested shall provide all necessary test equipment.

D. The overall accuracy of each input and output loop shall be checked to ensure that it is within manufacturer s Specification tolerances. In no case shall the error exceed 0.25% or 0.04 mA.

PART 3: EXECUTION

3.01 FACTORY TESTING

A. General Requirements

1. The System Integrator shall conduct a thorough and complete factory test witnessed by Engineer per the criteria specified herein. Factory test shall be held within 150 miles of project location.

2. Temporary wiring and equipment shall be provided and connected during these tests to simulate the complete assembled system.

3. The testing shall not be started until the manufacturer has completed fabrication, wiring, setup, programming; quality control testing; and can demonstrate the system is complete and operational.

4. The equipment required for factory testing shall consist of, but is not limited to, control panels, MCCs, and/or miscellaneous electrical panels as provided under this contract.

5. Two digital multimeters/signal generators (minimum +/- 0.1% accuracy) with clip-on leads shall be supplied and utilized during testing for measurement of digital and analog outputs.

6. All factory tests shall be conducted at the System Integrator's facility. All factory tests shall be completed prior to shipment to the jobsite. The

equipment shall be fully assembled, and connected (and programmed) similar to as it will be installed.

7. The length of the factory testing shall be a minimum of one (1) working day(s) (8 hours per day).

8. If the equipment is not ready for factory testing, the test will be cancelled and rescheduled for a later date. The Contractor shall be responsible for paying liquidated damages for expenses incurred by the Owner Representative to come to a cancelled test. One thousand dollars ($1000.00) in liquidated damages shall be deducted from his contract each occurrence.

9. Faulty and/or incorrect hardware or software operation of major portions of the system may, at the discretion of the Engineer, be cause for suspension, cancellation, or restarting of the factory test, at no additional cost to the Owner or extension in Contract time.

10. The factory test will be considered complete only when the integrated system has successfully passed all tests. No electrical equipment shall be shipped to jobsite without completed test documentation.

11. During the testing period, under the supervision of the System Integrator, the Owner's Representative shall have unlimited and unrestricted access to the usage and testing of system hardware, configuration, software, meters and tools.

12. The System Integrator shall pay all expenses incurred by his personnel including labor, material, transportation, lodging, daily subsistence, and other associated incidental costs during the factory testing.

13. Acceptance and witnessing of the factory tests does not relieve or exclude the Contractor from conforming to the requirements of the Contract Documents.

14. All modifications to documentation as a result of the factory tests shall be corrected and completed before the submittal and delivery of "Operation and Maintenance" Manuals.

15. Copies of the completed and witnessed factory testing forms shall be included in the Operation and Maintenance Manual.

B. Factory Tests

1. Structured Factory Tests: The associated factory tests are to be performed by the System Integrator and witnessed by the Owner's Representative. The associated test forms shall be completed during each stage of the test.

a. Visual and Mechanical Inspection Tests

b. Wiring Tests

1) Contractor shall confirm correct panel wiring per System Integrator panel shop drawings. Panel shop drawings shall be compared with Contract P&IDs and other Drawings to verify all hardwire logic are accounted for. Panel drawings used in factory tests shall be redlined and inserted into Factory Testing Results submittal.

c. MCC and Control Panel Pre-Operational Tests

d. Logic Controller I/O Point to Point Tests

e. Simulated Alarm Tests

1) Simulate the digital and/or analog signals at the terminals to verify that each PLC I/O point is functional and properly programmed. Verify that all parameters (i.e., setpoints, enable/disable toggle bits, timers, etc.) for the alarms operate according to the Specifications. Multiple alarm states (i.e., LO, LO-LO, HI, HI-HI, etc.) shall be checked.

f. Simulated Operational Control Tests

1) Simulate the digital and/or analog signals at the field terminals to verify that each control system is functional and properly configured and programmed.

2) Each line of control logic in the Control Strategies section shall be checked. When the complete control strategy has been checked, it shall be signed and dated by testing person and person witnessing test.

3) Verify that all parameters (i.e., setpoints, runtimers, totalization, etc.) operate according to the Specifications.

2. Unstructured Factory Tests: The various unstructured tests shall include, but are not limited to, the following.

a. Simulate the equipment failure and power fail/restart of PLC. Check the effects of each failure on maintaining operations with the remaining equipment.

b. The factory tests, as a minimum, shall simulate all normal and abnormal operating conditions including steady state, change of state, variable changes, fluctuations, transients, upsets, start-up, shutdown, power failure, and equipment failure conditions.

c. Communications test to devices located within control panel and/or in MCCs.

d. Simulation of PLC communication error. Demonstrate error detection, alarming, and recovery.

e. Measure and test all power supplies for correct voltage. Operate rechargeable devices under battery power to test run duration, alarms and automatic recovery.

3.02 FIELD TESTING

A. General Requirements

1. Field testing is broken down into 4 components

a. Pre-Energization testing
b. Pre-Operational Testing
c. Operational Testing
d. Commissioning

2. Project wide, all Pre-Energization testing must be completed prior to Pre-Operational testing, all Pre-Operational testing must be completed prior to Operational Testing, and all Operational Testing must be completed prior to Commissioning.

a. Any deviation of this order, whether on a component level or larger scale, must be approved.

b. Out of order testing, if allowed, will be evaluated on a case-by-case basis when brought to the attention of the Owner's Representative. The Owner's Representative may require that the entire system, or portions thereof, be retested once the missing component(s) are installed and functional.

3. All equipment supplied by the Contractor or others shall be tested by Contractor per these specifications.

4. Two digital multimeters/signal generators (minimum +/- 0.1% accuracy) , AC current meters, torque wrench, and other specialized test equipment shall be provided by the Contractor for use during testing.

5. If the equipment is determined not to be ready for testing, the test will be cancelled and rescheduled for a later date.

6. Faulty and/or incorrect hardware or software operation of major portions of the system may be cause for suspension, cancellation, or restarting of the area of testing, at no additional cost or extension in Contract time.

7. During the Operational testing period, under the supervision of the System Integrator, the Owner's Representative shall have unlimited and unrestricted access to the usage and testing of all hardware and software in the system.

8. The System Integrator shall pay all expenses incurred by his personnel including labor, material, transportation, lodging, daily subsistence, and other associated incidental costs during field testing.

9. Acceptance and witnessing of the tests does not relieve or exclude the Contractor from conforming to the requirements of the Contract Documents.

10. All modifications to documentation as a result of the tests shall be corrected and completed before the delivery of "as-built□documentation.

11. Copies of the completed and witnessed field testing forms shall be included in the Operation and Maintenance Manual.

12. The various contractors on this project (General Contractor, Electrical Contractor, Testing Company, and System Integrator) shall assume the lead role in testing activities as listed below. The Contractor shall obtain assistance of suppliers and/or manufacturers representatives for any major equipment testing.

    a. Electrical Contractor:

        1) Pre Energization Tests
            a) Visual Mechanical Tests
            b) Wire Insulation and Continuity Tests.
            c) Panelboard Tests
            d) Breaker Tests

        2) Operational Tests.
            a) Generator Tests

        3) Commissioning.

    b. System Integrator:

        1) Pre-Operational Tests
            a) Visual Mechanical Tests
            b) Control panel pre-operational test
            c) MCC pre-operational test
            d) Motor Tests.
            e) PLC I/O point to point tests.
            f) Instrumentation switch tests
            g) Instrumentation transmitter tests.

        2) Operational Tests.
        3) Commissioning

    c. Testing Company

        1) Grounding System Tests
        2) Breaker Device Tests

d. General Contractor

1) Test Scheduling
2) Operational Tests.
3) Commissioning.

e. Application Programmer (software systems)

1) Operational Tests.
2) Commissioning.

B. Electrical Field Tests The following test shall be performed within each test category. Complete test forms for each electrical panel, instrument, and/or device. Provide separate form for each component to be tested.

1. Pre-Energization Inspections and Tests:

a. Visual and Mechanical Inspection Tests
b. Wire Insulation and Continuity Tests
c. Grounding System Tests
d. Panelboard Tests
e. Breaker Tests

2. Pre-Operational Tests:

a. MCC Pre-operational Tests:
b. Control Panel Pre-operational Tests:
c. Motor Testing:
d. Generator Testing
e. Harmonic Measurement: (Required for systems with VFDs)
f. Instrumentation Switch Calibration Tests
g. Instrument Transmitter Calibration Tests
h. PLC I/O point tests.
i. Communication Tests

1) The Contractor shall verify that all communications via radio, telephone, wireline, fiber optic, or other are functional and ready for operational testing. Revise all configurable parameters without additional cost to the Owner as required for an optimally functional system.

2) Verify that all components of the communication system operate together under all operating and power restart conditions. If faults occur, investigate source of problem and correct. Revise all configurable parameters without additional cost to the Owner.

3) Change setpoints from SCADA and confirm that corresponding field setpoint changes correctly. Check every I/O point on every screen, trend, and database.

j. Pump Performance Tests

3. Operational Tests:

a. After all the previous tests in this subsection are complete, the test forms are completed and signed-off, the Contractor shall conduct operational testing.

b. Representatives from the General Contractor, Electrical Contractor, System Integrator, and Owner's Representative shall be present during testing. Operational testing shall be performed by Contractor in the presence of the Owner's Representative.

c. During operational testing the Contractor shall follow the instructions of the Owner. The Owner may place restrictions on operation that must be followed by the Contractor during testing. Any accidents or fines caused by actions of the Contractor where warnings or restrictions were placed, shall be remedied or paid by the Contractor.

d. Alarm Tests

1) Generate the digital and/or analog signals at the primary device to verify that each PLC I/O point is functional and properly programmed. Verify that all parameters (i.e., setpoints, enable/disable toggle bits, timers, etc.) for the alarms operate according to the Specifications. Multiple alarm states (i.e., LO, LO-LO, HI, HI-HI, etc.) shall be checked.

e. Operational Control Tests

1) Generate the digital and/or analog signals at the primary device by raising or lowering the actual measured process. Inject signal into the terminals or utilize a "force" function within the device only as necessary. Verify that each control system is functional and properly configured and programmed.

2) Each line of control logic in the Control Strategies section shall be checked. When the complete control strategy has been checked, it shall be signed and dated by testing person and person witnessing test.

3) Verify that all parameters (i.e., setpoints, runtimers, totalization, etc.) operate according to the Specifications.

4) Verify that all data, setpoints, alarms are being received at SCADA correctly and that all I/O points on screen are true and accurate representations of field information.

f. Other Tests

1) Force a power failure and power fail/restart of PLC and all other systems. Check the effects of each failure on each piece of equipment and automatic recovery.

2) Force a PLC communication error. Demonstrate error detection, alarming, and recovery.

3) Perform additional operational testing that has not already been witnessed.

4) Perform any additional operational testing as necessary to confirm robust and error free operation under all operational conditions.

4. Trial Period

a. Station/Equipment shall be activated to automatically run for 5 days, 24 hours per day Monday through Friday.

b. During the trial period the Owner's Representative will test all modes of operation and will look for errors and malfunctions. A punchlist will be generated to be completed by Contractor and re-tested prior to Commissioning.

c. If equipment failure occurs during the trial period, the Contractor shall repair or replace the defective equipment and shall begin another trial period, Monday through Friday.

d. This test shall be repeated until all new equipment functions acceptably and without failure for consecutive days.

C. Commissioning:

1. Commissioning shall not commence until Operational testing and System Training are complete with documentation submitted and with prior approval.

2. The Owner may delay Commissioning for a period up to 30 days, during which time all testing documentation will be reviewed and preparation for operation will be made. Costs for project delays during this review may not be forwarded on to the Owner.

3. Commissioning period

a. The new equipment shall be activated by the Contractor to operate in full automatic for 10 consecutive days, 24 hours per day. Commissioning shall only start on Mondays or Tuesdays.

b. During Commissioning, the Owner will monitor and run the station in normal automatic mode. If equipment failure occurs during Commissioning, the Contractor shall repair or replace the

defective equipment and shall begin another commissioning period after repairs are complete.

c. Parallel, existing and/or back-up systems shall remain in place and functional during commissioning period. Demolition of parallel, existing or back-up systems shall not begin until commissioning is completed.

d. This test shall be repeated until the new equipment functions acceptably for a consecutive commissioning period.

e. Warranty will begin at the start of a successful commissioning period. However, if major hardware failure occurs during commissioning, the warranty and commissioning will restart once the problem has been identified and repaired.

3.03 WARRANTY:

A. Provide warranty per Electrical Specifications [Electrical General, Warranty].

1. The completion of the above tests does not relieve the Contractor from any warranties specified in the Electrical Specifications or other sections.

2. Warranty shall begin on the start date of a successful Commissioning period.

3.04 FINAL ACCEPTANCE:

A. Final Acceptance per Electrical Specifications [Electrical General].

SECTION 26 66 00

TEST FORMS

Index of Forms:

PC	Power Conductor Test Form
CC	Control Conductor Test Form
IC	Instrumentation Conductor Test Form
GS	Grounding System Test Form
VM	Electrical Equipment Visual and Mechanical Inspection Form
PB	Panelboard Test Form
MCO	MCC Operational Test Form
CPO	Control Panel Operational Test Form
BD	Breaker Device Test Form
GCL	Generator Field Check List
GPT	Generator Performance Test Form
GSLD	Generator Sound Level Data Form
HM	Harmonic Measurement Test Form
IOP	Programmable Logic Controller I/O Point-to-Point Test Form
ISC	Instrumentation Switch Calibration Test Form
ITC	Instrumentation Transmitter Calibration Test Form

END OF SECTION

POWER CONDUCTOR TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

EQUIPMENT #: _____

INSULATION TESTS						
CONDUIT	PHASE TO GROUND			PHASE TO PHASE		
#	A	B	C	AB	BC	CA

NOTES:

1) Use single form for up to 25 power conduits. Use additional forms as necessary.

2) Disconnect both ends of wiring prior to megger tests.

3) Megger insulation resistances of all 600 volt insulated conductors using a 500 volt megger for 10 seconds (30 seconds for motor leads). Make tests with circuits installed in conduit and isolated from source and load. Each conductor shall be meggered conductor-to-conductor and conductor-to-ground. These tests shall be made on cable after installation with all splices made up and terminations installed but not connected to the equipment.

4) Each megger reading shall not be less than 22 Meg-ohms resistive. Corrective action shall be taken if values are recorded less than 10 Meg-ohms. Conductors with low ohm values, that do not match similar lengths of conductors the same size, shall be replaced at no additional cost to the Owner.

5) Values of different phases of conductors in the same conduit run showing substantially different Meg-ohm values, even if showing above 22 Meg-ohms shall be replaced.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

CONTROL CONDUCTOR TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

INSULATION TESTS											
COND. # OF #	COND. TO GROUND	CONDUCTOR TO CONDUCTOR									
1		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		X									
2		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		X	X								
3		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		X	X	X							
4		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		x	x	x	x						
5		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		X	X	X	X	X					
6		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		x	x	x	x	x	X				
7		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		x	x	x	x	x	x	x			
8		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		x	x	x	x	x	x	x	x		
9		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		x	x	x	x	x	x	x	x	x	
10		1 TO #	2 TO #	3 TO #	4 TO #	5 TO #	6 TO #	7 TO #	8 TO #	9 TO #	10 TO #
		X	X	X	X	X	X	X	X	X	x

NOTES:

1) Use single form for each conduit.

2) Disconnect both ends of wiring prior to megger tests.

3) Megger insulation resistances of all 600 volt insulated conductors using a 500 volt megger for 10 seconds. Make tests with circuits installed in conduit and isolated from source and load. Each conductor shall be meggered conductor-to-conductor and conductor-to-ground. These tests shall be made on cable after installation with all splices made up and terminations installed but not connected to the equipment.

4) Each megger reading shall not be less than 22 Meg-ohms resistive. Corrective action shall be taken if values are recorded less than 10 Meg-ohms. Conductors with low ohm values, that do not match similar lengths of conductors the same size, shall be replaced at no additional cost to the Owner.

5) Values of different phases of conductors in the same conduit run showing substantially different Meg-ohm values, even if showing above 22 Meg-ohms shall be replaced.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

INSTRUMENTATION CONDUCTOR TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

CONDUIT NUMBER: _____ EQUIPMENT #: _____

CONTINUITY TESTS			INSULATION TESTS	
CONDUCTOR PAIR # OF #	CONDUCTOR TO CONDUCTOR	CONDUCTOR TO SHIELD	CONDUCTOR TO CONDUCTOR	SHIELD TO GROUND

NOTES:

1) Disconnect both ends of wiring prior to megger tests.

2) Megger insulation resistances of all 600 volt insulated conductors using a 500 volt megger for ten seconds. Make tests with circuits installed in conduit and isolated from source and load. Each conductor shall be meggered conductor-to-conductor and conductor-to-ground. These tests shall be made on cable after installation with all splices made up and terminators installed but not connected to the equipment.

3) Each megger reading shall not be less than 10 Meg-ohms resistive. Corrective action shall be taken if values are recorded less than 10 Meg-ohms. Conductors with low ohm values, that do not match similar lengths of conductors the same size, shall be replaced at no additional cost to the Owner.

4) Continuity Tests: Each instrumentation conductor twisted shielded pair shall have the conductor and shield continuity measured with an ohmmeter. Conductors with high ohm values, that do not match similar lengths of conductors the same size, shall be replaced at no additional cost to the Owner.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

GROUNDING SYSTEM TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

TECHNICIAN: _____ TEST LOCATION: _____

EQUIPMENT NAME: _____

SOIL CONDITION: circle one WET DRY MOIST DAYS SINCE LAST RAIN # _____ OVER 7 _____

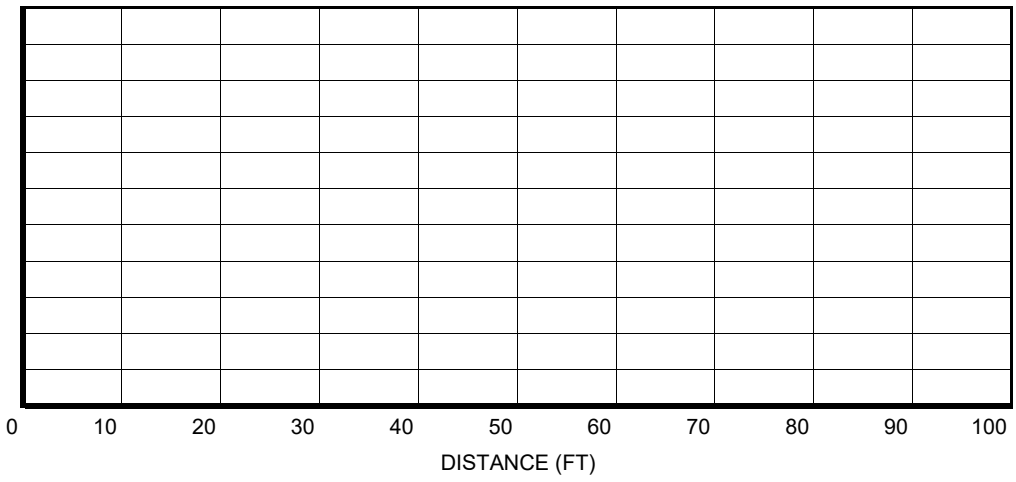
TEST ROD LOCATION RELATIVE TO SYSTEM GROUND UNDER TEST (DISTANCE AND DIRECTION) _____

COMMENTS:

FALL OF POTENTIAL TEST

MEASURED VOLTAGE PROBE	
DIST.	RESIST.
20	
30	
40	
50	
60	
70	
80	
90	

GRAPH OF MEASURED RESISTANCE VS. DISTANCE FROM TEST PROBE



NOTES:

1) Use ground resistance test meter and perform separate ground test for each building or independently derived grounding system.

2) Verify ground system is in compliance with drawings and specifications.

3) Perform the test not less than two days after the most recent rainfall and in the afternoon after any ground condensation (dew) has evaporated.

4) Investigate point-to-point resistance values which exceed 1.0 ohm. Correct (by adding additional grounding systems as necessary) and re-test. Consult design engineer if for direction on additional grounding materials and methods.

5) Connect all ground electrodes and/or UFER ground together and perform fall of potential test.

6) Perform fall-of-potential test in accordance with IEEE Standard 81 and NETA 7.13 on the main grounding electrode or system. Install test electrodes a minimum of 100 feet from system under test.

7) Measurements shall be made at 10 feet intervals beginning 20 feet from the test electrode and ending 80 feet from it in a direct line between the system being tested and the test electrode. Plot resistance readings on graphical chart above.

8) Perform point-to-point tests to verify low resistance between the main grounding system and all electrical equipment connected to the grounding system. Purpose is to check Cad-Weld connections and continuity point to point.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

ELECTRICAL EQUIPMENT
VISUAL AND MECHANICAL INSPECTION FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

EQUIPMENT NAME: _____ EQUIPMENT #: _____

NAMEPLATE DATA (complete as applicable)

MANUFACTURE: _____ ENCLOSURE: _____

MODEL #: _____ U.L. #: _____

VOLTAGE: _____ PHASE: _____

BUS AMPERAGE: _____ SERVICE: _____

BUS TYPE: _____ BUS BRACING: _____

VERTICAL BUS: _____ HORIZONTAL BUS: _____

GROUND BUS: _____ NEUTRAL BUS: _____

SERIES #:

PHYSICAL INSPECTION CHECKLIST

ENTER A-ACCEPTABLE R-NEEDS REPAIR OR REPLACEMENT NA-NOT APPLICABLE

ITEM	CHECK	NOTES
CHECK NON-ELECTRICAL FASTENERS FOR TIGHTNESS		
TORQUE TEST ALL WIRING AND BUS CONNECTIONS		
VERIFY ANCHORAGE IS PER SPECS AND/OR CALCS		
CHECK BUS BRACING AND CLEARANCE		
CHECK MAIN GROUNDING CONNECTION AND SIZE		
VERIFY GROUND BUS BONDING		
VERIFY EQUIPMENT GROUNDS		
VERIFY CONDUIT GROUNDS AND BUSHINGS		
CHECK NEUTRAL BUS AND CONNECTIONS		
VERIFY ALL BREAKERS AND FUSES ARE RATED PROPERLY		
INSPECT FOR BROKEN OR DAMAGED EQUIPMENT		
INSPECT ALIGNMENT OF PANEL AND DOOR		
VERIFY REMOVAL OF ALL DEBRIS AND DUST		
VERIFY WIRE LABELS ARE INSTALLED		
VERIFY ALL WIRE TERMINATIONS		
CHECK FOR PROPER WIRE SIZES		
CHECK FOR PROPER WIRE COLOR CODES		
VERIFY ALL NAMEPLATES		
CHECK FOR PROPER CLEARANCES AND WORKING SPACE		
INSPECT ALL PAINT SURFACES		
CHECK HEATERS AND THERMOSTATS		
CHECK VENTILATION AND FILTERS		
CHECK IF DRAWINGS MATCH EQUIPMENT		
CHECK ACCURACY OF OPERATION & MAINTENANCE		

NOTES:

1) Complete checklist above. Note any items that were found out of compliance.

2) Torque all electrical connections to values defined by equipment manufacturer or per NEC 110-14.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

PANEL BOARD TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

PANEL NAME: _____ PANEL TAG #: _____

PANELBOARD NAMEPLATE DATA

UL #: _____ MANUFACTURE: _____

MAIN BREAKER RATING: _____ MODEL #: _____

PHASE: _____ VOLTAGE: _____

VERTICAL BUS RATING: _____ BUS AMPERAGE: _____

NEUTRAL BUS RATING: _____ BUS TYPE: _____

GROUND BUS RATING: _____ ENCLOSURE: _____

ENTRY LOCATION: _____ SERIES: _____

PHYSICAL INSPECTION CHECKLIST

ITEM	CHECK	NOTES
TIGHTEN ALL BOLTS AND SCREWS		
TIGHTEN ALL WIRING AND BUS CONNECTIONS		
VERIFY ALL BREAKERS AND FUSES ARE RATED PROPERLY		
CHECK BUS BRACING AND CLEARANCE		
CHECK MAIN GROUNDING CONNECTION AND SIZE		
VERIFY GROUND BUS BONDING		
VERIFY EQUIPMENT GROUNDS		
VERIFY CONDUIT GROUNDS AND BUSHINGS		
CHECK NEUTRAL BUS AND CONNECTIONS		
INSPECT FOR BROKEN OR DAMAGED EQUIPMENT		
INSPECT ALIGNMENT OF PANEL AND DOOR		
VERIFY ANCHORAGE		
VERIFY REMOVAL OF ALL DEBRIS AND DUST		
VERIFY CIRCUIT BREAKER LEGEND PER CONTRACT		
INSPECT ALL PAINT SURFACES		
VERIFY WIRE LABELS ARE INSTALLED		
VERIFY ALL WIRE TERMINATIONS		
VERIFY PANEL SCHEDULE WITH TERMINATIONS		
VERIFY PROPER WIRE SIZE		

NOTES:

1) Complete checklist above by entering a checkmark for acceptable, R for needs repair or attention

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

MOTOR CONTROL PRE-OPERATIONAL TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

MCC NAME: _____ MCC MANUFACTURE _____

MCC TYPE: _____ MCC LOCATION: _____

EQUIPMENT NAME	EQUIPMENT TAG #	CUBICLE #	LOCAL DEVICE CHECKS AND TESTS						REMOTE DEVICE CHECKS AND TESTS		
			CONTROL SWITCH	TIME RELAY SETTINGS	METERING & INDICATIONS	OVERLOAD RESET	INTERLOCKS & CONTROL	ALARM & STATUS	CONTROL SWITCH	PUSHBUTTON LOCKOUT & STOP	METERING INDICATIONS

NOTES:

1) Verify equipment powers up and operates correctly in hand.

2) Perform trip functions and verify equipment returns to normal operation with only necessary operator intervention.

3) Enter data for each piece of equipment being served from MCC or Control Panel.

4) Enter NA - for non applicable entries.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

CONTROL PANEL PRE-OPERATIONAL TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

CONTROL PANEL NAME: _____ CONTROL PANEL TAG #: _____

CONTROL PANEL MANUFACTURER: _____ CONTROL PANEL TYPE: _____

CATEGORY	EQUIPMENT TAG #	DEVICE CHECKS AND TEST								
		CONTROL SWITCHES	OPERATOR INTERFACE	PANEL METERS	PANEL LIGHTS	PANEL NAMEPLATES	PLC POWER SUPPLY	I/O CARDS		
Height										
Voltage										
Function										
CATEGORY	EQUIPMENT TAG #	POWER SUPPLY 1 (V)	POWER SUPPLY 2 (V)	POWER SUPPLY 3 (V)	UPS	PANEL LIGHTS				
Function										
Voltage										

NOTES:

1) Set configurable parameters and verify voltage input prior to applying power.

2) Verify equipment powers up and operates correctly.

3) Perform trip functions and verify equipment returns to normal operation with only necessary operator intervention.

4) Complete checklist above by entering a checkmark (CM) for acceptable, or R for needs repair or attention, or NA for not applicable

Attention Requied:

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

BREAKER DEVICE TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

PANEL NAME: _____ PANEL TAG #: _____

PANEL TYPE: _____

EQUIPMENT INFORMATION

EQUIPMENT NAME: _____ EQUIPMENT H.P.: _____

EQUIPMENT TAG#: _____ EQUIPMENT KVA: _____

BREAKER INFORMATION

MANUFACTURE: _____ VOLTAGE: _____ CHARACTER: _____

PART #: _____ INTERRUPT: _____ CURVE: _____

FRAME #: _____ RATING: _____ LOCATION: _____

BREAKER TESTS

MFGR TRIP TIME @300% MIN: _____ BREAKER RATING/ RANGE: _____

MFGR TRIP TIME @300% MAX: _____ FINAL BREAKER SETTING: _____

MFGR INST. PICKUP AMPS: _____

CONTACT RESISTANCE TESTS - OHMS / INSULATION RESISTANCE TESTS - MEGOHMS

PHASE A	PHASE B	PHASE C	A-GND	B-GND	C-GND

CURRENT TESTS
TRIP TIME IN SECONDS @ 300% AMPS / INSTANTANEOUS CURRENT TRIP TESTS
AMPS

PHASE A	PHASE B	PHASE C	PHASE A	PHASE B	PHASE C

ADDITIONAL TESTS AND SETTING AS APPLICABLE

	PICK UP		DELAY-TIME		
FUNCTION	RANGE	SETTING	RANGE	SETTING	
LONG TIME					
SHORT TIME					
GROUND FLT.					

NOTES:

1) All breakers shall be checked for proper mounting, conductor size, and feeder designation. Operate circuit breaker to ensure smooth operation. Inspect case for cracks or other defects. Check tightness of connection with torque wrench in accordance with manufacturer's recommendations.

2) Thermal magnetic breakers, 100 amps and above, shall be test pet NETA specification 7.6.1.1. Time current characteristic tests shall be performed bypassing 300% rated current through each pole separately. Trip time shall be noted. Instantaneous pickup current shall be determined by run up or pulse method. Clearing times should be within 4 cycles or less. At end of test the thermal breakers shall be set by Contractor.

3) Magnetic breakers (MCP), regardless of amperage rating, shall be tested. Instantaneous pickup current shall be determined by run up or pulse method. Clearing time should be within 4 cycles or less. At end of test the breaker trip setting shall be set by Contractor based on the motor locked rotor current.

4) Contact resistance shall be measured and be compared to adjacent poles and similar breaker. Deviations of more than 50% shall be reported to Engineer. Insulation resistance shall be measured and shall not be less than 50 megaohms. All trip times shall fall within NETA Table values. Instantaneous pickup current levels should be within 20% of manufacturer's published values.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

GENERATOR FIELD CHECK LIST

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

No.	Check box	Description
1		Equipment installed in suitable location?
2		Adequate clearance on all sides to allow ease of maintenance?
3		Proper construction and leveling of mounting base?
4		Anchorage installed per seismic calculations?
5		Adequate heating for equipment room?
6		Battery-powered emergency lighting installed in equipment room?
7		Adequate incoming and outgoing air (louver motors adjusted, tested and of proper voltage)?
8		Radiator duct properly sized and connected?
9		Cooling system properly filled?
10		Proper level of specified oil in crankcase?
11		Adequate fuel supply for test?
12		Flexible sections installed in cooling water lines?
13		Manually-operable fuel and cooling water valves open and ready for operation?
14		Flexible fuel lines installed between engine and fuel piping?
15		Fuel tanks and piping installed in accordance with applicable codes and standards?
16		Adequate fuel transfer tank pump lift and pump motor properly wired?
17		Proper size exhaust line and flexible connector(s)? Flexible connector(s) should not be bent.
18		Exhaust line condensate trap with drain installed?
19		Exhaust line installed with proper downward outgoing incline?
20		Proper-specified muffler installed with hangers and mounts tight?
21		Battery(ies) of proper size and voltage?
22		Battery(ies) filled with electrolyte and properly connected to charger?
23		Battery charger AC circuit properly connected and charger operational?
24		Battery(ies) properly mounted with adequate ventilation?
25		Starting cables of proper length and gauge?
26		Starting cables properly connected to battery(ies)?
27		Generator load conductors of proper ampacity, and properly connected to the correct location?
28		Load conductors, engine start leads, battery and heater power source leads installed and in correct conduits?
29		All other wiring, including customer added options, connected properly?
30		Nameplate voltage and frequency of both generator set and transfer switch matching normal/utility source ratings?
31		Has generator phase rotation been checked versus utility?
32		Transfer switch AC conductors properly connected?
33		Transfer switch switching mechanism free from binding? NOTE: Disconnect all AC sources, and operate manually to check.
34		Generator room clean of all loose material not related to Generator?
35		Exhaust stack protected from entry by rain, snow, and animals?
36		Approved heat-isolating thimble(s) installed at points where exhaust line passes through combustible wall(s) or partition(s)?
37		Exhaust system termination located to prevent entry of exhaust gases into structures?
38		Exhaust line free of excessive bends and restrictions? Back pressure under specified limit?
39		Have all manufacturers' start-up instructions been completed?

NOTES: Before start-up, the Contractor and Generator Supplier must make the following installation checks in addition to those recommended by Generator Manufacturer. Some checks may require a running generator and should be checked immediately during first generator run

This form is intended to be used as a general guide. Use the manufacturer's Operations and Maintenance manual for reference in performing each of the following checks

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

GENERATOR PERFORMANCE TEST REPORT

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

NAMEPLATE DATA

MANUFACTURER:		S/N:		KW:		KVA:	
GENERATOR MODEL		S/N:		VOLTS:		PH:	
ENGINE MODEL:		S/N:					
ALTERNATOR MODEL:		S/N:					

PRELOAD TESTS VOLTAGE MEASUREMENTS

L1 TO L2:		L1 TO N:		BLOCK HEATER VOLTAGE	
L2 TO L3:		L2 TO N:		BLOCK HEATER WATTAGE	
L3 TO L1:		L3 TO N:		BATTERY VOLTAGE	

PRELOAD TESTS AND SHUTDOWNS

PRE-ALARMS	INDICATOR LIGHT	SHUTDOWNS	INDICATOR LIGHT	SHUTDOWN FUNCTION
GENERATOR RUN LIGHT		OVERSPEED		
ALARM HORN & SILENCE		OVERCRANK		
SWITCH NOT IN AUTO		EMERGENCY STOP		
PRE LOW OIL PRESSURE		LOW OIL PRESSURE		
PRE HIGH ENGINE TEMPERATURE		HIGH ENGINE TEMPERATURE		
PRE LOW COOLANT LEVEL		LOW COOLANT LEVEL		
PRE LOW FUEL LEVEL		LOW FUEL LEVEL		
LOW COOLANT TEMP WARNING				
LOW/HIGH BATTERY VOLTAGE				
AUXILLIARY FAULT		AUXILLIARY		

PERFORMANCE TESTS / LOAD ACCEPTANCE

FULL LOAD	VOLTAGE DIP	%	FREQUENCY DIP	%	
	RECOVERY TIME	SEC	RECOVERY TIME	SEC	
WITH SPECIFIED	VOLTAGE DIP	%	FREQUENCY DIP	%	
MOTOR LOAD	RECOVERY TIME	SEC	RECOVERY TIME	SEC	

LOAD TEST @ 1.0 POWER FACTOR

TIME STAMP	LOAD	VOLTS	AMPS	HZ	KW	AMB ºF	WATER ºF	OIL PSI	ENGR HRS
WARM UP	0								
0.1	25								
0.1	50								
0.2	75								
0.2	100								
3.4	100								

NOTES:

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

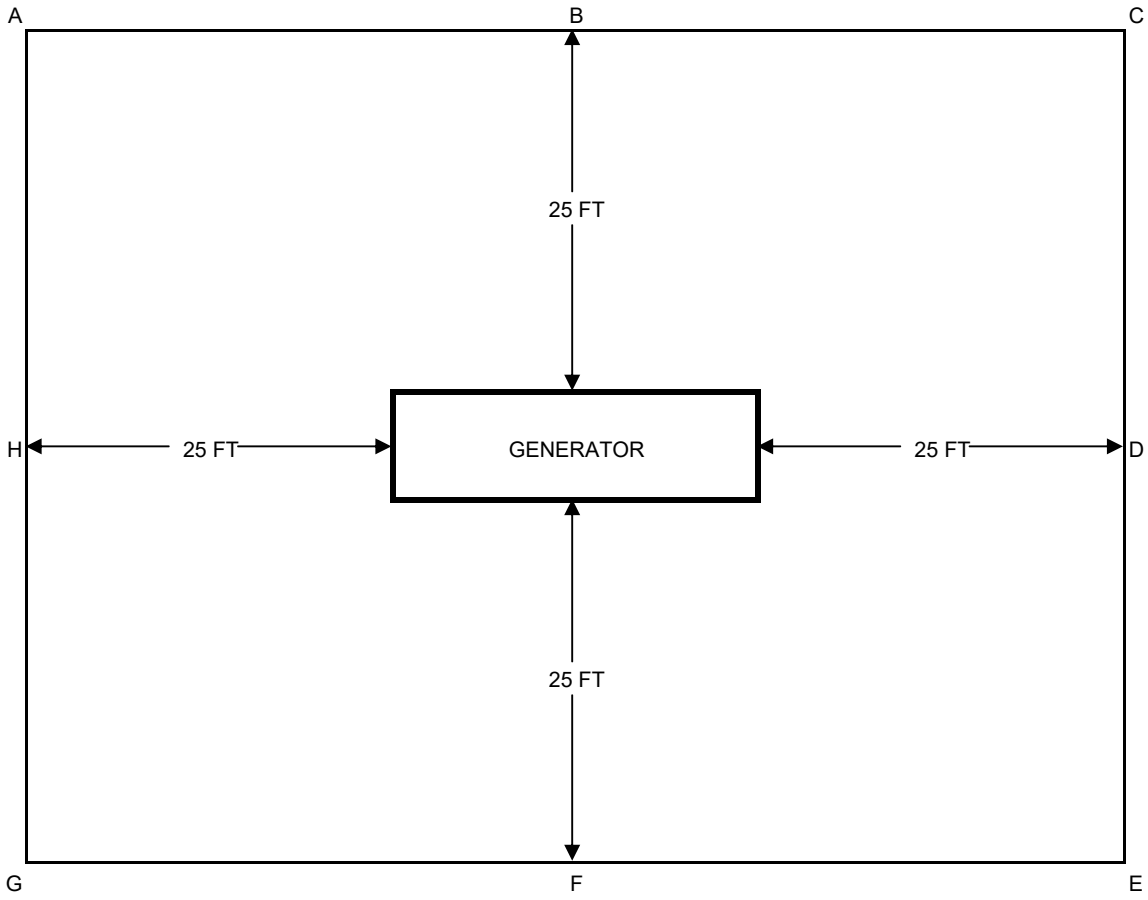
SIGNATURE COMPANY DATE

GENERATOR SOUND LEVEL DATA FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

SITE CONDITIONS



MEASURED NOISE - LOCATION									
	A	B	C	D	E	F	G	H	
NOT RUNNING									
NO LOAD									
EXPECTED MAX LOAD									
FULL LOAD									

NOTES:

1) Note permanent obstructions (within 25 FT) as they exist on site on this drawing.

2) Measure sound pressure level (dB) using acoustic sound meter on "A" setting.

3) Measure SPL background noise, generator at idle, and at full load.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

HARMONIC MEASUREMENT TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

TECHNICIAN _____ EQUIPMENT NAME: _____

POINT OF MEASUREMENT: _____

(If available, take measurements on primary side of main breaker, otherwise, on secondary side of main breaker.)

COMMENTS:

MEASURED HARMONIC VOLTAGE VALUES												
RUNNING CONDITION			TIME	VOLT	AMPS	THD(V)	THD(A)	5TH	7TH	11TH	13TH	15TH
PUMP 1 SPEED	PUMP 2 SPEED	PUMP 3 SPEED										
0	0	0										
70	0	0										
90	0	0										
100	0	0										
70	70	0										
90	90	0										
100	100	0										
70	70	70										
90	90	90										
100	100	100										

NOTES:

1) Measure the harmonics with a harmonic analyzer with each combination of pumps shown or as designated by Engineer at start-up in operation on the Utility source. Repeat test on generator (if applicable).

2) Use multiple forms and/or attach printouts of harmonic analyzer machine.

4) Expand this chart for pump stations/systems with more than 3 VFD pumps.

5) All harmonic conditioning equipment shall be on-line and operate other non-VFD loads as normal during test.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

PROGRAMMABLE LOGIC CONTROLLER I/O POINT-TO-POINT TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING CO: _____ TEST LOCATION: _____

PANEL NAME: _____ PANEL TAG #: _____

PLC NAME: _____ RACK # _____ SLOT # _____ I/O TYPE _____

I/O POINT			Scale			Digital	Operator	SCADA	Pass/Fail
I/O #	TAG #	Description	@4mA	@20mA	Units	On/Off	Interface	Screen	CM or R
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

NOTES:

1) Connect signal generator to each I/O point for factory testing.

2) Utilize connected to device to generate signals for field pre-operational tests.

3) Verify function and accuracy of loop by by switching the digital signal or modulating the analog signal from the device.

4) Field verify all instruments and indicators within loop of signal.

4) Confirm polarity of signals and calibration ranges are equivalent for all components in loop.

5) Include significant digits past decimal in scale columns

6) Complete checklist above by entering a checkmark (CM) for acceptable, or R for needs repair or attention

7) Note items that need attention below

Attention Requied:

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

INSTRUMENTATION SWITCH CALIBRATION TESTS FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

INSTRUMENT NAME: _____ INSTRUMENT TAG#: _____

INTRUMENT UNITS: _____ NAME: _____

TYPE: _____ MODEL: _____

SERIAL #: _____

MANUFACTURER	INSTRUMENT
NAME: _____	UNITS: _____
TYPE: _____	
MODEL: _____	
SERIAL #: _____	

PROCESS SETPOINT	INCREASING TRIP POINT	DECREASING TRIP POINT	DEADBAND	SETPOINT TIME DELAY	ACTUAL TIME DELAY

NOTES:

1) Include mounting elevations for level instruments.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

INSTRUMENTATION TRANSMITTER CALIBRATION TEST FORM

PROJECT NAME: _____ DATE OF TEST: _____

TESTING COMPANY: _____ TEST LOCATION: _____

INSTRUMENT NAME: _____ INSTRUMENT TAG#: _____

MANUFACTURER		INSTRUMENT	
NAME:		RANGE:	
TYPE:		SCALE:	
MODEL:		UNITS:	
SERIAL #:		TRANSMITTER OUTPUT:	
REMOTE SENSOR TYPE:		FACTORY SPECIFIED ACCURACY:	
(If Applicable)		REMOTE SENSOR OUTPUT:	
		(If Applicable)	

DESIGNED VALUE				ACTUAL VALUE			
INPUT SIGNAL	OUTPUT	ENG VALUE	CALCULATED TOLERANCES	INSTRUMENT DISPLAY	INSTRUMENT OUTPUT SIGNAL	PROCESS INDICATOR	LOGIC VALUE

NOTES:

1) Attach factory calibration forms for all flowmeters.

2) Provide separate form for each instrument.

3) Field test and calibrate all control systems and instrumentation in accordance with the specifications and the manufacturer's instructions. Instrumenatation shall meet specified accuracy or shall be repaired / replaced.

4) Provide parameter value for each parameter changed from factory default.

CERTIFIED BY: _____ _____ _____

SIGNATURE COMPANY DATE

WITNESSED BY: _____ _____ _____

SIGNATURE COMPANY DATE

SECTION 26 79 05
CONTROL PANELS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Provide and install Control Panels per Drawings.

B. Provide complete wired and tested panel with all devices installed per the contract Drawings and as stated herein.

C. Provide all necessary hardware, conduit, wiring, fittings, and devices to connect the control panel to equipment provided under other Sections.

1.02 REFERENCES

A. Electrical Specifications [Electrical General].

B. Electrical Specifications [Low Voltage Wire & Data Cable]

C. Electrical Specifications [PLC & OI Hardware]

D. Electrical Specifications [PLC & OI Application Programming]

E. Electrical Specifications [Instrumentation]

1.03 SUBMITTAL REQUIREMENTS

A. Provide submittals and Drawings as specified in Electrical Specifications [Electrical General, Submittal Requirements].

B. Submit shop construction Drawings for the Control Panel. The following Drawings shall be provided as a minimum:

1. Scaled drawings of the Control panel elevation, baseplan. The dimensions and locations of the cutouts shall be dimensioned from the bottom left corner of the door(s).

2. Scaled drawings of the backpan including all mounted components and wireways.

3. Wiring diagrams for AC and DC power distribution, I/O for each card in the PLC and communications block diagrams.

C. Calculations for environmental controls. Environmental controls (including air conditioners, exhaust fans, heaters and circulation fans) shall maintain interior panels temperatures within ratings of all internal equipment given the intended installation location.

1. Design and install environmental control systems to meet requirements herein and prevent premature failure of panel internal components.

2. Environmental controls may be shown in the Drawings and shall be considered the minimum level required. Additional components or systems shall be provided to meet internal temperature requirements.

3. Environmental control systems shall prevent and control intrusion of dust and bugs through the use of filtration systems.

4. Environmental control systems shall maintain humidity below that of the external ambient air and without condensation within panel.

D. Copy and mark-up contract Drawings and submit where changes are anticipated. Additional drawings are not necessary to be produced for the control panel.

E. Mark-up contract Drawings and submit where changes were necessary during the shop build process. Do not make changes to panel or drawings without prior approval. Shop drawings are not necessary to be produced for this panel.

1.04 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide operating instructions as specified in Electrical Specifications [Electrical General].

PART 2: PRODUCTS

2.01 ENCLOSURE

A. The enclosure for the control panel shall be (at minimum) sized as shown in the Contract Drawings.

1. Arrangement: Where so indicated, the instruments mounted in the panels shall have the nominal size and general arrangement shown. Panel layouts and nameplates shall conform to the approved submittal.

2. Assembly: Mount all equipment on 12 ga. painted white backpan(s) that is bolted to rear (and sides) of the enclosure. Use drill and tap method for machine thread screws for all internal components on mounting panels. Provide extra mounting bolts through the rear of the structure if equipment weight exceeds backpanel mounting stud capacity.

3. Hardware: Provide door latch and accessories as detailed in the Contract Drawings or as required to meet NEMA area ratings.

a. Provide one or two single point latches for panels up to 36□height.

b. Provide 3 point latching mechanisms for panels over 36□height consisting of rotating handle with latch, extension bars with plastic wheels at ends and guide slots at top and bottom of door, or as otherwise shown on drawings.

c. Hinges, pins, bolts and screws shall be of 316 stainless steel only.

4. When physical size requirements for individual components are different

than that detailed on the Control Panel backpan drawing, the wiring diagrams and specifications herein shall supersede the elevation drawing and the Contractor shall furnish additional panel width as needed to fit the electrical equipment. Deviations with sufficient evidence for the change shall be submitted for approval. The Contractor is required to provide for all equipment including spares and spaces as shown in the wiring diagrams.

5. The control pedestal enclosure shall be as required per Drawings and custom manufactured by Tesco, Gaylord, Hoffman, or equal

2.02 CONTROL PANEL CIRCUIT BREAKERS

A. Furnish circuit breakers and accessories as required per Drawings and application.

1. Copper busbar systems, up to 480VAC, 115A, 1, 2 or 3 phase as needed for application

2. Trip rating per Drawings or as needed for protected device. Trip curves as selected by System Integrator.

a. B curve magnetic trip point: 3 to 5 times the rated current, typically used for computers and electronic equipment with very low inrush loads (PLC wiring).

b. C curve magnetic trip point: 5 to 10 times the rated current, typically used for small transformers, pilot devices, etc.

c. D curve magnetic trip point: 10 to 20 times the rated current, typically used for transformers or loads with very high inductive loads.

3. Quantity of pins and feed in lugs as required.

4. Auxiliary contact, shunt trip as required in Drawings.

5. DIN rail mounted, 18mm width per pole, finger safe pressure plate terminals.

B. Motor applications:

1. UL489 for branch circuit protection up to 40A, 1 to 3 pole.

2. 5 kAIC interrupting capacity @ 480 VAC

3. Alltech, Eaton FAZ, or equal.

C. Control circuit transformers and other Non-motor applications:

1. UL1077 supplementary protection up to 63 amps, 1 to 2 pole, AC or DC.

2. Used where a UL489 protective device is upstream powering the circuit (from a panelboard or other source).

3. Used within control circuits for power supplies, control power transformers, relays and PLC I/O points.

4. Used in place of fuses that are applied as supplementary protection.

5. Eaton FAZ, or equal.

2.03 FUSES AND FUSE HOLDER

A. Fuses shall not be used in branch or control circuits unless specifically shown in the Drawings. Circuit breakers shall be furnished and utilized where possible.

B. Fuses used in circuits 200 VAC and above shall be time- delay, 13/32" x 1-1/2", and have an interrupting rating of 10,000 AIC at 500 VAC. Fuses shall be Bussman type FNQ or approved equal. Fuse holders shall feature open fuse indication lights and shall be rated 30A at 600 VAC. Fuse holders shall be Bussman Optima Series OPM or equal.

C. Fuses used in 120 VAC shall be time-delay, 1/4" x 1-1/4", and have a rating of 250 VAC. Fuses shall be Bussman type MDA or approved equal. Fuse-holders shall be of the same manufacturer, series and color as the adjacent terminal blocks and have blown fuse neon indicators. Fuse holders shall be Entrelec ML 10/13.SFL, Allen Bradley 1492-H4 or equal.

D. Fuses used in signal and 24 VDC circuits shall be fast acting, 5mm x 20mm and have a rating of 250 VAC. Fuses shall be Bussman type GMA or approved equal Fuse-holders shall be of the same manufacturer, series and color as the adjacent terminal blocks and have blown fuse LED indicators. Fuse holders shall be Entrelec M 4/8.SFDT, Allen Bradley- 1492-H5 or equal

E. Fuses shall be sized in conformance with the NEC.

2.04 TERMINAL BLOCKS AND ACCESSORIES

A. General

1. Terminal blocks to be clamp type, 5 spacing, 300 volt, minimum rating of 20 amps, and mounted on DIN rail. DIN rail shall be same type as used for the relays. Install extra DIN rail on each type of terminal strip with 10% spare terminals for future additions.

a. Provide larger terminal as necessary based on gauge of connected wiring. Those terminals with 10 gauge larger gauge wiring or more than one 12 gauge wire should be evaluated and changed.

2. Provide terminal blocks with "follower" plates that compress the wires and have wire guide tangs for ease of maintenance. Terminal blocks that

compress the wires with direct screw compression are unacceptable. All power, control and instrument wires entering and leaving a compartment shall terminate on terminal blocks with wire numbers on terminals and on both ends of the wires.

3. Provide end clamps, separators, din rails, and jumpers to complete terminal block system. See example PLC I/O drawing for additional information. Engineer can provide on request if not available in plans.

4. Terminal Tags and Markers: Each terminal strip shall have a unique identifying alphanumeric code at one end (i.e.: TB1, TB2, etc.) or as shown in Drawings.

5. Plastic marking tabs shall be provided to label each terminal block. These marking tabs shall have a unique number/letter for each terminal which is identical to the "elementary" and "loop" diagram wire designation. Numbers on these marking strip shall be machine printed and 1/8□high letters minimum.

6. Terminal blocks shall be physically separated into groups by the level of signal and voltage served an by PLC I/O card. Power and control wiring above 100 volts shall have a separate group of terminal blocks from terminal blocks for wiring below 100 volts, intermixing of these two types of wiring on the same group of terminal blocks is not allowed.

7. Terminal blocks shall be gray in color unless otherwise shown on the Drawings.

8. Provide a ground terminal or connection point for each grounding conductor.

9. Provide a separate signal, common, and/or neutral terminal for every wire and PLC or remote device connection at minimum.

B. CP □ Control Panel Terminal Blocks

Description	**Model number, Allen Bradley or equal**
General Purpose Terminal Block, 20A	1492-W3
Disconnecting Terminal Block, 20A	1492-JKD3
Grounding Terminal Block	1492-JG4
PLC AI Sensor Block, 4 Level with GND	1492-WTS3
PLC Digital Output Relays, 120VAC, 6A, SPDT	700-HLT1U1

Note 1: General purpose relays are defined in ELECTRICAL □ GENERAL

Note 2: Accessories are not listed such as end caps, anchors, jumpers, bridges, marking strips, or other items necessary to make up a complete terminal block layout. Furnish all parts necessary per manufacturer's intended solution.

C. MCC □ Motor Starter Cubicle Terminal Blocks

1. MCC cubicle terminal blocks shall be pull apart as supplied standard by MCC manufacturer.

D. Power Power terminal Blocks

1. Backpan mounted termination blocks shall be rated for 600V (min). The power termination blocks shall be rated to accept Copper or Aluminum cable and rated as shown on Contract one-line diagrams. Termination blocks shall be insulated with molded plastic covering and finger safe cover. Each termination block shall be provided with quantity and size of primary and secondary cable connections as required per installation. The power termination blocks shall be Erico UD, UDJ, BD, TD, or SB series or equal.

2. Unmounted termination blocks shall be constructed of aluminum and suitable for use with Aluminum and copper wire. Size and quantity of cable connections shall be as required for installation. Termination blocks shall be insulated with molded high-dielectric strength plastic covering and eliminate the need for tape insulation of electric connection. The termination block shall have removable access plugs over the wire entry and hex screw ports. Provide NSI Polaris IPL or IPLD Series terminal blocks or equal.

E. Panel Ground

1. Each electrical enclosure shall have a copper ground bus. Screw type fasteners shall be provided on all ground busses for connection of grounding conductors. Ground bus shall be a Challenger GB series, ILSCO CAN series or equal.

2. A 12ga. copper ground wire shall be attached between the ground bar and the panel enclosure, and between the ground bar and the mounting panels. The ground connection to the enclosure and panel shall be made by sanding the paint finish off a small area, drilling a hole for a 0.25 inch bolt and mounting a 0.25-20 bolt to the panel to serve as grounding stud. The grounding stud shall be attached with a nut and flat washers on both sides of the enclosure/panel, and with an inside tooth star lock washer next to the panel surface. The star lock washer shall be on the inside surface of the enclosure, and the front surface of the mounting panel. The grounding wire shall be secured to the stud with a nut and inside tooth star lock washer. These grounding points shall be located within 12 inches of the bottom to the grounding bar. Each terminal strip rail shall be individually grounded by means of a #12 AWG wire to the ground bus.

3. Components within the panel shall be grounded according to the manufacturer s recommendations.

2.05 POWER SUPPLIES

A. Uninterruptible Power Supply (UPS)

1. The UPS shall be installed within the control panel and power all process related 120 VAC devices and DC power supplies.

2. The UPS capacity/size shall be as shown in the contract Drawings. The battery capacity shall be such that it may provide nameplate power for 10 minutes (min) from a fully charged battery(s).

3. The UPS shall provide surge protection and filtering: 0.3% IEEE surge let-through, zero clamping response time to meet UL 1449. The inverter shall provide true sine wave output.

4. When the Utility power voltage is outside of a preset range (approx. <100 < V < 130 VAC) then the UPS shall power the load from storage batteries and a solid state inverter.

5. The power supply shall be wired into the control panel power circuit per the contract Drawings.

6. The UPS operating ambient temperature range shall be 32 deg F to 122 deg F minimum.

7. The inverter shall be self resetting and continuously on-line regardless of the Utility power existence. Configure the UPS to restart automatically upon restart of utility power without operator intervention. The rectifier/charger shall recharge and maintain float charge on the batteries automatically.

8. The UPS shall be of a readily available commercial manufacturer. Provide American Power Conversion Smart UPS, Marathon Vault Series, or equal.

B. DC Power Supply (PS)

1. The DC power supply shall utilize a switching power stage, rectifier and voltage regulator. The power supply case shall be DIN rail mountable.

2. The power supply shall operate on 120V AC and provide DC output voltage and current as shown in the Contract Drawings.

3. The power supply shall be wired and fused per manufacturer instructions and Contract Drawings. Power supply output shall include self resetting overcurrent protection.

4. Power supplies below 101 Watts output power shall be Class 2 rated.

5. The power supply shall provide 2% voltage regulation for a change of 10% load to 100% full load.

6. The DC power supply shall be IDEC PS5R Series, Phoenix Contact Quint Power, Genesis Automation GDA, or equal.

2.06 MISCELLANEOUS COMPONENTS

A. Wireway: Manufactured from light gray rigid PVC suitable for continuous use at temperatures up to 50 deg C. Wireway shall be 2□height, width as required with 0.5□slot spacing with removable covers. Provide Panduit type □F□or equal.

B. Intrusion Switch: The intrusion switch shall have a pin plunger that is depressed when the door is closed. The form C contacts shall be rated 2A at 120 VAC. Provide Hoffman A-LFSWD, Microswitch 1AC2 or equal.

C. LED Strip Light: The LED light shall be an □under cabinet□style with multiple LED lamps and acrylic diffuser. Lamp shall be switched on/off from integral switch or PIR motion sensor. Light housing shall be capable of magnet mount to top or side of enclosure or will include mounting tabs for mounting to brackets. Lamp shall be powered from 120VAC or from 24~48 VDC or shown in the contract Drawings. LED Strip Light shall be Stego 02540, or equal.

D. Circulation Fans: The control panel temperature shall be maintained 10 deg. F below lowest internal device's temperature rating. The fans shall be 4□or 6□ unless otherwise noted on Contract Drawings. The Contractor shall calculate the heat generation of all internal components and determine if the fans submitted will meet the cooling requirements of the internal components. Circulation fans shall include louver with filter and bug screen for outdoor installations.

E. Forced Air Heater: The control panel temperature shall be kept above 50 deg. F through the use of a resistive forced air heater when the panel is located outdoors. The heater shall contain a fan, heating elements, and thermostat within a single self contained unit. The wattage of the heater shall be as calculated by the supplier using the manufacturers sizing method to meet the temperature requirements. The heater shall be Hoffman D-AH series, or equal.

F. Thermostats: The air circulation fans shall be controlled by adjustable thermostat. The thermostat shall be mounted near the top of the panel and easily accessible by a technician. The thermostat shall be capable of control of a heater or cooling fan(s) by selecting the proper contact logic. The thermostat range shall be adjustable from 30 to 140 deg F. Thermostat shall be Hoffman A-TEMxx, or equal.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in Electrical Specifications [Electrical General, Workmanship].

3.02 FABRICATION

A. Equipment Mounting:

1. Mount all equipment using manufacturers mounting tabs/holes or brackets where possible. Where not possible, construct custom brackets

to panel mount or backpan mount components as shown in the Contract Drawings.

2. Equipment or laptop shelves shall be provided where shown on the Contract Drawings. Equipment shown on shelves shall not be placed on the bottom of the panel after field installation.

3. All nuts, bolts, screws, washers and hinges used in the panel shall be stainless steel. All components shall be mounted using bolts or screw fasteners only which are drilled and tapped into the backpan. Pop rivets shall not be allowed within panel except for enclosure support arms.

B. Environmental:

1. Control panel environmental accessories including fans, louvers, filters, bugscreens, air conditioners, etc. shall be provided as noted in the Drawings and as necessary for a complete environmental solution.

2. Panels environmental controls shall be designed during shop drawing submittal and fabricated to maintain temperatures 10 degrees F below lowest internal equipment maximum temperature rating.

3. Contractor shall provide [additional] fans, louvers, screens, sunshades, air conditioners, etc. as necessary to prevent equipment malfunction or premature failure. Provide associated wiring and thermostats as needed.

4. Environments:

a. NEMA 4X rated panels shall be cooled/heated with closed loop type conditioning systems to include air conditioners, internal panel circulation fans and resistive heaters.

b. NEMA 3R rated outdoor panels shall be cooled/heated with open loop type conditioning systems to include air conditioners, exhaust fans and louvers, internal panel circulation fans and resistive heaters. All exhaust fans and louvers shall include filters and bugscreens.

c. NEMA 12 or 1 rated indoor panels shall be cooled/heated with open loop type conditioning systems to include air conditioners, exhaust fans and louvers, internal panel circulation fans and resistive heaters. All exhaust fans and louvers shall include filters and bugscreens.

C. Wiring:

1. Panel Wiring: All wiring shall be installed in wireways between terminal blocks, PLC, and devices. Reference Contract Drawings for control panel power distribution diagram and control panel elementary diagrams.

3.03 INSTALLATION

A. Wiring:

1. Install all equipment per Electrical Specifications [Electrical General].

2. All internal and field wiring shall be per Electrical Specifications [Low Voltage Wire].

3. Panel Wiring: All wiring shall be installed in wireways between terminal blocks and devices. Reference Contract Drawings for Control panel power distribution diagram and control panel elementary diagrams.

4. Field Wiring: Wireways shall be provided for field wiring. Reference Contract Drawings for control panel power distribution diagram and control panel elementary diagrams.

B. Cleaning:

1. The Contractor shall clean the inside of the control panel of any dust or debris remaining at the completion of installation and testing.

2. The Contractor shall exercise care when using a vacuum cleaner or compressed air such as not to damage any component within the panel.

3. Many electrical and computer components are open for ventilation. Falling debris can penetrate the openings and cause equipment failure. Equipment with debris inside shall be removed, cleaned and/or replaced.

3.04 FIELD ASSISTANCE

A. Provide testing as specified in Electrical Specifications [Factory and Field Testing].

3.05 WARRANTY

A. Provide warranty as specified in Electrical Specifications [Electrical General, Warranty].

3.06 FINAL ACCEPTANCE

A. Final Acceptance per Electrical Specifications [Electrical General].

END OF SECTION

SECTION 26 79 10
PLC & OI HARDWARE

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Providing and installing Programmable Logic Controller (PLC) and Operator Interface Hardware and all supporting hardware, wiring and devices as specified in Electrical Specifications.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Electrical Specifications [Low Voltage Wire and Data Cable]
C. Electrical Specifications [PLC and OI Application Programming]

1.03 SUBMITTAL REQUIREMENTS

A. Provide submittals per Electrical Specifications [Electrical General, Submittal Requirements].

B. Submit documentation showing the number and type of I/O modules required to meet the I/O requirements specified herein. Include complete manufacturer's part and model numbers.

1. PLC I/O points are determined by the P&ID Drawings. The Contractor shall count and total the PLC I/O points per PLC controller and per type of I/O required based on the P&ID diagrams. Provide 25% spare I/O points per I/O type per PLC.

C. Submit calculations showing that the power supply meets the specified requirements and the requirements of the devices powered. Confirm PLC power supply is sufficient for all possible operable conditions.

D. Submit shop drawings showing physical backpan layout of equipment in Control Panel.

E. Submit communications block diagram including PLC, OI, motor controls, power supplies, switches, routers, radios, and any other connected components.

F. Submit hardware Operations and Maintenance Manual per Electrical Specifications [Electrical General].

PART 2: PRODUCTS

2.01 GENERAL

A. Provide PLC modules from a single family of products, using the same software and interchangeable I/O cards, that can be configured for a range of applications

from small, uncomplicated sites to large, complex sites with a variety of equipment.

B. Provide a PLC that will meet the following requirements:

1. Size and provide a CPU and power supply to accommodate the CPU, I/O cards, communication devices, etc. as specified herein.

C. Provide a Tesco L3000 based PLC system with I/O modules and full size operator interface. No equals are allowed for PLC and OI components since they are required to match Owner standards.

2.02 MECHANICAL

A. Provide modular PLC consisting CPU, power supply, communications, and I/O modules.

B. Provide I/O modules with removable terminal strips so that I/O modules can be removed without disconnecting field wiring.

2.03 ETHERNET SWITCH

A. The Ethernet switch shall have 8 ports with automatic uplink detection and OPC monitoring capability. Ports shall be auto-sensing 10/100 Base-Tx with RJ-45, 8 pin female connectors, meeting IEEE 802.3 standards. Case shall be ventilated steel with provisions for wall or DIN rail mounting. Switch shall be suitable for power from 10 - 30 VDC. Switch shall be N-TRON 308TX-N, or equal.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. All work in this Section shall conform to the codes and standards specified in Electrical Specifications [Electrical General, Workmanship].

3.02 INSTALLATION

A. Fabrication

1. Mount, wire and Ground PLC and OI per manufacturer's recommendations.
2. Organize equipment on control panel backpan per Backpan Layout detail in Contract Drawings.
3. Locate and install PLC(s) and OI(s) per Contract Drawings.

B. Wiring

1. Terminate status, control and analog wiring on terminal blocks.
2. Label and wire PLC to terminal blocks per Electrical Specifications [Wire, Fuses & Terminal Block] and Example I/O Wiring Diagram in the Drawings.
3. All spare I/O points shall be wired to terminal blocks.

4. Install communication cables to connect the PLC to external devices.
5. Bundle and tie down wires in a neat and orderly manner.
6. Terminate drain wire of shielded cables at backpan terminal block only.

3.03 FIELD ASSISTANCE

A. Provide testing as specified in Electrical Specifications [Factory and Field Testing].

3.04 WARRANTY

A. Provide warranty per Electrical Specifications [Electrical General, Warranty].

B. Perform the following services during the warranty period:

1. Repair or replace damaged modules returned for service within 24 hours.
2. Determine and report the cause of failure of modules returned for service.
3. Resolve design or implementation problems discovered.

3.05 FINAL ACCEPTANCE

A. Final Acceptance per Electrical Specifications [Electrical General].

END OF SECTION

SECTION 26 79 15
PLC & OI APPLICATIONS PROGRAMMING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Programming of the PLCs, OIs and SCADA to control the water system functions.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]
B. Project Drawings

1.03 QUALIFICATIONS

A. Services furnished under this specification shall be performed by qualified programmers meeting requirements specified in Electrical Specifications [Electrical General, Qualifications].

1.04 SECTION INCLUDES

A. Control descriptions for Programmable Logic Controller(s) (PLCs) and Operator Interface(s) (OIs).

B. System Integrator shall perform all PLC and OI programming requirements as defined in this section.

C. Related work as specified in Electrical Specifications [Electrical General].

1.05 SUBMITTAL REQUIREMENTS

A. Provide submittals per Electrical Specifications [Electrical General, Submittal Requirements].

B. Submit software operations manual including the following as a minimum.

1. Program Code

a. Program code demonstrating function in compliance with descriptions herein.

2. Setpoint listing with description

3. Program description

a. Provide written description of program operation. Description shall cover all aspects of normal operation and alarm shutdowns. Describe all alarms and their effect on operation. Describe alarms

that require manual reset.

4. Register cross reference listing
   a. The listing shall be in table format and include all program constants and variable registers with their functions.
   b. The listing shall show (block and rung number) where the register is used within the program code.

5. Configuration and Set-up
   a. The configuration of the processor and hardware selections shall be summarized.
   b. The configuration of the communication ports shall be shown.

6. Data Tables

   a. Print data tables with initial register values shown.

7. Special files

   a. Include any special files that are particular to the manufacturer. All files pertinent to programming or configuration shall be submitted.

C. Submit software documentation demonstrating understanding of control software requirements and compliance with Portability and Maintainability requirements specified in this Section.

1. Submit OI graphic layout and PLC program listing with cross-references for approval 4 weeks prior to factory test.

2. Provide two (2) sets of SCADA and OI graphic screens and PLC applications programs on flash drives, in native file format with each software submittal and at the end of the project for as-programmed final documentation for O & M manuals. Each drive shall have a typed label clearly stating the contents, date, filenames, and submittal (i.e., initial or as-programmed final).

3. A hard copy listings of SCADA and OI graphic screens and PLC applications programs (with comments) shall be printed with standard laser print 8½" x 11" paper and supplied with the initial submittal and for as-programmed final documentation for O&M manuals. Copy and binding method shall not cut off any parts of program logic and comments. Print shall be sized so that the complete program logic run fits on one sheet, rungs extending to multiple sheets will not be accepted and will be returned without review.

1.06 PROGRAMMING METHODS

A. Design and code programs per the following:

1. Utilize ladder logic programming language as available in the PLC

manufacturer's configuration software. Other software languages such as function block, flow charts, and structured text shall not be used unless approved through RFI/submittal process.

2. Clearly comment each line of program logic code. Include module headers detailing the purpose of the module, programmer name, date of last revision, revision history, and description of sequence of events.

3. Comment for each block of code explaining purpose of program block.

4. Code shall use the P&ID device names as the prefix to the names or tagnames throughout the program logic. Reference tag formation below. If PLC does not use tagnames as data reference, then provide tagname in symbol name or in comment areas at minimum.

5. Data arrays may be used in tagname aliases for communication data transfers.

6. Provide program file for each type of program logic. The following are types that should be used, as applicable and at minimum.

    a. Analog input scaling
    b. Analog output scaling
    c. Analog alarms
    d. Digital alarms
    e. PLC clock, midnight and today/yesterday control
    f. Flow totalizations
    g. Equipment runtimes
    h. Equipment starts
    i. Communications
    j. Each individual piece of controlled equipment (digital control)
    k. Each individual piece of controlled equipment (analog control)
    l. Each individual process system (digital control)
    m. Each individual process system (analog control)
    n. Miscellaneous systems

B. All custom software, including diagnostic, configuration and applications programming software shall become the sole property of the Owner for their use on this and future Owner projects.

C. No software or documentation shall be labeled proprietary.

D. Provide complete hardware and original manufacturer software manuals describing how to use the configuration software.

E. Provide two (2) disks copies and two (2) hard copies of all as-installed programs at the end of the project.

F. Furnish and maintain 256MB (min) USB RAM stick on site and within control panel so that latest program files are always available and up-to-date. Upon conclusion of each downloaded program change, the USB RAM stick shall be

updated.

PART 2: PRODUCTS

2.01 APPLICATIONS PROGRAM CODE

A. The System Integrator will provide, install and test (with Contractor assistance) application programming. The descriptions provided herein are not final and may have modifications made to them during construction that may change the nature of operation.

B. The descriptions are provided to give the Contractor an insight as to the level of testing effort that will be required in the later stages of the project. Minor modifications should be expected and will not constitute a change in project testing assistance scope unless those modifications cause significant additional testing time or materials by Contractor. Significant time shall be defined as 4 hours and only time or materials related to program modifications since bid may be accounted.

C. The PLC program, OI and SCADA screens shall be modeled after a similar station. Modify I/O layouts as needed and adjust programming as needed to meet requirements herein.

D. The program code shall be written without any "hard-coded" constants that would effectively require a program change to modify the value. All function blocks shall contain variable registers only.

2.02 CONTROL STRATEGIES

A. General Requirements:

1. The following requirements (General and Specific) are intended to be used as a guideline for application programming of the PLC. They are the major functions and are not intended to be completely comprehensive of all requirements of the station operation and do not attempt to cover all necessary program routines for an operational system. Additional features, functions and registers will be required for an operational system.

2. The following general program functions shall be provided:

a. Enable/disable toggle bits and variable time delays for all alarms.

b. Analog input noise filtering -- software or firmware.

c. SCADA Auto-Off-Manual controls for all equipment controlled by the PLC. These control buttons shall also be accessible via the OI(s).

d. All equipment to have a Remote Reset feature available from SCADA and OI(s). Remote Reset signal to be held on until

cleared by Reset Feedback signal.

e. Normal operations shall continue with loss of SCADA connection. The PLC code shall act on I/O connections, PLC to PLC communications, and non-SCADA communications only to control the system. Only in the event of SCADA override, shall the system not act on PLC I/O connections and non-SCADA communications. None of the program code to control the system shall reside in the SCADA system.

f. Time of day clock synchronization with SCADA system. PLC shall have registers defined for SCADA system clock write. The PLC shall have code written to recognize that the register(s) have been written to, stop the real time clock, set the clock, and restart it, with the value in the register(s). Date and time of day shall be set.

g. Resettable and non-resettable operation hour meters for all equipment and resettable starts counters for all equipment.

h. Scaling to engineering values of all variables. Minimum of 3 significant digits required.

1) Level in 1/10th Feet or Inches
2) Pressure in 1/10th PSI.
3) Flow in GPM.
4) Flow totalization
    a) Total non-resettable flow displayed in MGD with 9999999.999 presentation layout.
    b) Total resettable flow displayed in MGD with 9999999.999 presentation layout.
    c) Total yesterday flow displayed in KGAL with 99999.9 presentation layout.
    d) All registers shall roll over to zero automatically.
5) Speed in percent %.
6) Motor current in 1/10 amps.
    a) Convert current input to power (in KW) where shown on drawings. Assume voltage to be 480 and power factor to be 0.85.

i. Data register types:

1) Any register that requires precision past the decimal shall be floating point type.

2) Integer registers may be used where decimal precision is not required.

3) Boolean registers shall be used for all statuses and on/off controls.

j. All set point registers, enable/disable toggle bits and settable variable time delays shall be adjustable from the OI direct to

program data table.

k. Provide communications messaging as required to share data information and interlocks between PLCs. Message structure shall be fail safe as to keep overflows or other improper operation from occurring.

l. A power fail shall reset all routines.

m. Pumps and equipment shall have backspin delays and power fail sequential re-start delay routines.

n. All powered equipment and devices shall have an assigned essential / non-essential status for purposes of generator load shedding.

o. Programming code shall have automatic error checking and proper initialization to prevent illegal operations such as negative values being placed in timer presets or mathematical out of range functions which could cause a processor fault.

p. PLC shall be programmed so that, in the event of a power interruption, the equipment controlled shall resume normal operation upon power restoration without requiring a manual reset unless otherwise shown.

q. Set points

1) Minimum required set points for Lead / Lag pumping scenario.

a) Lead Pump start level
b) Lag Pump start level
c) Lead Pump stop level
d) Lag Pump stop level
e) Pump Start delay time
f) Pump Stop delay time
g) Backspin delay time
h) Sequential Start delay time
i) Pump rotation selection (0=auto rotate, 1=P1 Lead, 2=P2 Lead)

2) Additional minimum required set points for Lead / Lag pumping scenario when variable speed control is used.

a) Minimum Lead Pump speed to start Lag Pump
b) Minimum Lag Pump speed to stop Lag Pump
c) Maximum Pump Speed
d) Minimum Pump Speed

3. Analog Scaling:

a. All analog values shall be adjusted (if necessary) prior to scaling for required offsets due to hardware / firmware conditions.

b. All analog input values shall be scaled into real world engineering units and presented in REAL (floating point) format for use by SCADA and the OI(s).

c. All analog output values shall be scaled from real world engineering units into INT (decimal) format to control current or voltage output from an analog output device.

4. Alarms General:

a. Common alarms: Provide all applicable alarms per device based on available P&ID inputs and outputs.

1) Motor power or amperage alarms shall be disabled when the motor is not running.

2) If a device is called to start or move and the associated run status does not confirm start or move after a time delay then post a device "Run fail" alarm. (*YNRFA).

3) All equipment (as marked on P&ID drawings) shall have a non-running alarm. (*YNRNA)

4) Not in Auto alarm: All devices (valves, gates, pumps) with auto switch monitoring shall have associated "Not in auto" alarms. (*HNAFA).

5) Moisture / Temperature alarms: All submersible pumps shall have "Moisture" and "Over temperature" alarms. (*SMFA and *SOTFA)

6) Seal Water Fail alarm: All sludge type pumps shall have "Seal water fail" alarms. (*SWFA).

7) Pressure alarm: All sludge type pumps shall have "Inlet and Outlet pressure" alarms. (*IPFA and *OPFA).

8) Temperature alarm: All sludge type pumps shall have a pump body "Over Temp" alarm. (*OTFA).

9) Differential pressure alarm: All filters shall have "Differential pressure" alarms. (*DPFA)

10) Low oil alarm: All lubricated mechanical devices (gearboxes etc.) shall have a "Low oil" alarm. *LOFA)

11) Vibration alarm: All moving mechanical devices (gearboxes, aerators, pumps etc.) shall have a "Vibration"

alarm. (*VFA).

12) Over torque alarm: All geared mechanical devices (clarifiers etc.) shall have an "Over torque" alarm. (*OTQFA)

13) VFD Fault: All VFDs shall have a common fault alarm as a minimum. Further breakdown of alarms shall be provided based on data available from the VFD. All VFDs shall have a manual reset available from the OI(s) and SCADA. (*UAFA).

14) Flow, level, pressure, analytical and other analog alarms: All analog values will have at a minimum an associated alarm structure as defined in section 2.03.A.4.b.5 below.

15) All digital alarm values will have at a minimum an associated alarm structure as defined in section 2.03.A.4.c.3 below.

b. Analog Alarms:

1) If an analog value is above/below the associated set point, and the associated time delay has exceeded the time delay set point, then the alarm shall be generated / annunciated.

2) Transducer out of range alarms. If the scaled value of the analog input exceeds 21 mA or falls below 3.5 mA, an out of range alarm shall be triggered for that input.

3) The alarm shall automatically reset unless a latch is required to keep the process from resuming and re-creating the alarm. A latching alarm requires either a reset set point for hysteresis or a manual reset.

4) The low flow alarms (and pressure alarms if applicable) shall only be enabled when the associated pump or system is running.

a) Provide low flow alarm for pump operation where flow is expected above setpoint continuously when running. Alarm shall shutdown system and fail pump. If other pumps are available, they shall be called in its place.

5) Example analog alarm display structure (Units per alarm type). ENABLE / DISABLE shall be a toggle switch. DELAY to be editable timer base value for associated alarm delay timer. SET POINT column to contain current analog value in Transducer Fail Alarm row. Other alarm

rows to contain editable alarm set point value with REAL (floating point) data type. LATCH to be either reset set point value for reset of alarm or manual reset toggle (blank if alarm is not latching).

Description	Status	En / Dis	Delay	Set Point	Latch
Transducer Fail Alarm	ALARM	Enable	10 sec.	28.4 GPM	Reset
High Alarm	OK	Enable	5 Sec.	xxx.x GPM	OK
High Warning	ALARM	Enable	5 Sec.	xxx.x GPM	
Low Warning	OK	Enable	5 Sec.	xxx.x GPM	xxx.x GPM
Low Alarm	OK	Disable	5 Sec.	xxx.x GPM	xxx.x GPM

c. Digital Alarms:

1) If the digital alarm state is TRUE and the associated time delay timer has exceeded the time delay set point, then the alarm shall be generated / annunciated.

2) The alarm shall automatically reset unless it is designated as "latch". A latching alarm requires a manual reset.

3) Example digital alarm Structure. ENABLE / DISABLE to be a toggle switch. DELAY to be editable timer base value for associated alarm delay timer. LATCH to be a manual reset toggle (blank if alarm is not latching).

Description	Status	En / Dis	Delay	Latch
Generic Digital Alarm 1	OK	Disable	10 sec.	
Generic Digital Alarm 2	ALARM	Enable	10 sec.	Reset

d. Communications Alarm:

1) The SCADA and connected PLC(s) shall monitor for communications between controllers and they shall post an alarm if any PLC fails to respond to message queries.

5. Totalization:

a. Flow totalization (Example):

1) If an analog flow input value (Fxxxx) is positive, then increment the flow totalizers (FxxxxNRTOT, FxxxxRTOT and FxxxxTTOT) for each 1000 gallons of accumulated flow.

2) If internal flow reset status (FxxxxRST) is set, then set resettable flow totalizer (FxxxxRTOT) to zero and reset FxxxxRST.

3) Similar for all flowmeters / totalizers.

b. Hour Meters (Example):

1) If Generic Pump #1 running (PxxxxYNR) is set, then start hour timers PxxxxHRS, PxxxxRHRS and PxxxxTHRS.

2) If internal run time hours reset status (PxxxxRHRSRST) is set, then set resettable run time hours (PxxxxRHRS) to zero and reset PxxxxRHRSRST.

3) Similar for all device run time hours.

c. Starts Counters (Example):

1) If Generic Pump #1 running input (PxxxxYNR) is set or Generic Pump #1 start command (PxxxxXCS) is set (if running input is not available), then increment starts counters PxxxxS, PxxxxRS and PxxxxTS.

2) If internal starts reset status (PxxxxSRST) is set, then set resettable starts counter (PxxxxRS) to zero and reset PxxxxSRST.

3) Similar for all device starts.

d. Intrusion Alarms (Example):

1) Provide intrusion alarms for panels and buildings with intrusion switches.

2) Alarm shall be generated after an adjustable time delay to SCADA.

3) If an OI or SCADA is present, then provide a way for an operator to reset and disable the intrusion alarm for a setpoint period of time.

4) After that time elapses, then the alarm shall be re-activated automatically.

5) If no SCADA or OI, then the alarm shall reset automatically once the condition is returned to normal state.

2.03 OPERATOR INTERFACE (OI)

A. Operator Interface

1. Full manual and automatic control interface to be provided on each OI. Group controls logically to provide intuitive navigation through display screens for operators.

2. Include all setpoints and controls on each OI to allow full station operation independent of SCADA.

2.04 SPECIFIC REQUIREMENTS □

A. Well Pump

1. To be further defined by System Integrator and submitted for review. Include all operations to provide a fully functioning system.

2. Must comply with general requirements.

a. Provide time delays and time delay setpoints for all functions.

3. Consists of programming function for the following:

a. Rio Linda Well 16 Pump PLC

1) Interlock well operation with alarms □ high pressure, low flow, and 480 VAC power fail.

2) This well will be a slave to the central well system under normal conditions.

a) If the well receives a call from the output of the Banner Radio via serial communications or hard I/O, then start well pump.

b) If the does not receive a call from the output of the Banner Radio via serial communications or hard I/O, then stop well pump.

c) Modulate speed using an inverse related PID algorithm to maintain system pressure at the well outlet. Provide setpoints for minimum and maximum speed, PID tuning, and for desired setpoint.

3) If pressure in the local area of the well falls to a very low value, then the local PLC shall start the well and maintain pressure independent of the central well control system.

a) If the pressure at the well is below start setpoint for setpoint seconds, then start the well pump.

b) If the pressure at the well is above stop setpoint for setpoint seconds, then stop the well pump.

c) Modulate speed using an inverse related PID algorithm to maintain system pressure at the well outlet. Provide setpoints for minimum and maximum speed, PID tuning, and for desired setpoint.

B. Sodium Hypochlorite Chemical System

1. To be coordinated with the Hypochlorite System Supplier and further defined by System Integrator and submitted for review. Include all operations to provide a fully functioning system.

2. Must comply with general requirements.

3. Consists of programming function for the following:

a. Sodium Hypochlorite Pump(s)

1) Continuous operation of sodium hypochlorite pumps including SCADA manual on off control.

2) Pump speed shall be controlled by a compound PID control loop based on influent flow pace and residual chlorine content.

3) Start □ stop control shall be lead / lag where applicable. Reference general requirements for setpoint details.

PART 3: EXECUTION

3.01 WORKMANSHIP

3.02 SOFTWARE DEVELOPMENT

A. The programming, setup and configuration of the PLC & OI shall be done by the System Integrator.

B. The PLC & OI shall be ready to be placed in operation at the time of Operational Testing.

C. Do not enable or set any passwords on the PLC software or hardware for this project.

D. Additional Programmer Labor Hours

1. The Contractor shall include in his bid price an additional 32 hours of PLC/OI program configuration changes to be designated by the Engineer or Owner during testing and start-up.

3.03 MEDIUM

A. Provide PLC & OI applications programs on USB Flash Drive media with each

submittal. Clearly label drive with station name and contents. Flash drive shall contain the following:

1. Application program, configuration and data tables.

2. OI software with graphics and all support files.

3. These disks and all copyrights shall become the property of the Owner, for its use on this and future projects.

B. In addition, one USB Flash drive of the application PLC & OI programs shall remain on site in the control panel. All programs and files shall be updated each time the System Integrator modifies the PLC program.

C. Provide two (2) copies of as-installed applications programs printed with standard laser print 8 1/2" x 11" paper at end of project. Insert new print-outs into the Operations and Maintenance manuals. Provide number of copies as specified in 16010 Operations and Maintenance Instructions.

3.04 FIELD ASSISTANCE

A. Provide testing as specified in Electrical Specifications [Factory and Field Testing].

3.05 WARRANTY

A. Troubleshoot and correct all program abnormalities, glitches and bugs uncovered during the warranty period. Provide phone and/or on-site support as required to correct problem(s).

B. Software support which shall be provided by the System Integrator:

1. Free technical PLC / OI software and hardware configuration phone support for a period of one year. PLC / OI phone support shall be provided directly from the person(s) that configured the PLC / OI. Phone support shall be available between 8 a.m. and 4 p.m. Pacific Standard Time Monday through Friday.

2. The System Integrator shall correct any PLC / OI software configuration error that is discovered within the warranty period, at no additional cost to Owner. Updated documentation for each "operation and maintenance" manual and new USB flash drives of updated software shall be provided for each correction.

** END OF SECTION **

SECTION 26 79 25
SCADA SYSTEM APPLICATIONS PROGRAMMING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Application programming and configuration of Existing Supervisory Control and Data Acquisition (SCADA) system for display of station parameters, alarms and reports.

B. SCADA System modifications includes all required programming and/or integration of the human-machine interface / supervisory control and data acquisition (HMI/SCADA) software, auto-dialer software, report generation software, historical database software, and other required hardware and software components to yield a complete and operational system.

1. Well 16 □ All I/O points, controls, statuses, alarms, setpoints per 16915, and as shown on the P&IDs minimum.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]

B. Electrical Specifications [PLC & OI Applications Programming]

C. Electrical Specifications [SCADA System Hardware]

1.03 SUBMITTAL REQUIREMENTS

A. Provide submittals per Electrical Specifications [Electrical General, Submittal Requirements].

B. Obtain, modify and submit SCADA layout and communications block diagram incorporating the new site. Submit RFI for ACAD file from previous projects for modification. SCADA diagram shall use similar conventions as previously used and be very detailed and include communication protocols, methods and wire types.

C. Submit completed color screen print outs of the new SCADA system screens, including all menus. Submit one screen per sheet of paper.

D. Submit a list of all alarms identified by the system including descriptions as shown on the Alarm Summary screen.

E. Submit remote automatic alarm dialer voice script in a text version for review.

F. Submit a total of three (3) different report formats for review. Identify the report generation software and additional software utilized in creating and printing each report.

G. SCADA programmer's prior work experience and resume.

1.04 MODULARITY

A. Configuration shall be modular and capable of merging new changes into existing SCADA systems as applicable or as remote changes are necessary.

1.05 MAINTAINABILITY

A. All software, including SCADA application generated files, diagnostic, configuration, and SCADA applications programming software shall be licensed directly to and become the sole property of the Owner for their use on this and future projects. Licensing information will be provided upon request.

B. No SCADA software configuration or documentation shall be labeled proprietary and all passwords shall be revealed to the Owner prior to system start-up.

C. Provide two (2) CD-ROM diskette copies of all as-installed SCADA program files at the end of the project.

1.06 QUALITY ASSURANCE

A. SCADA programming and integration performed under this Section shall be by an integrator who has been regularly engaged in control integration of water and wastewater treatment systems.

B. The System Integrator's trained field representative shall have the following experience requirements:

1. Has programmed, setup, and configured similar sized control systems for the last two years with the System Integrator/Contractor awarded the project.

2. Has integrated similar SCADA systems into at least two water or wastewater treatment plant control systems using the same SCADA software (current or earlier versions) being used on this Project.

C. The Owner reserves the right to judge if the SCADA application programmer assigned to this project is adequate for the task. If the programming performed is deemed inadequate by Owner, then the system supplier/integrator shall provide a qualified SCADA application programmer to meet these requirements.

PART 2: PRODUCTS

2.01 SCADA APPLICATION SOFTWARE

A. Upgrade existing SCADA software, historical database software, alert notification software and report generating software and drivers as required to support programming modifications.

PART 3: EXECUTION

3.01 SOFTWARE DEVELOPMENT

A. Modifications to the existing programming, setup and configuration of the SCADA system shall be done by the System Integrator.

1. Each and every system, subsystem, automated device, and package equipment shall be fully automated to the extent possible and as defined in this and other sections.

2. Each system shall have graphical screens displaying the process, alarms, setpoints, trends and other controls.

B. The SCADA system configuration shall be completed in parallel with PLC programming and tested during factory and field testing.

3.02 SCADA CONFIGURATION

A. General

1. Design SCADA configuration such that anticipated system growth can be accomplished without the need for system regeneration. Design SCADA application programs to use the database as a means of determining the system configuration.

2. The SCADA application software shall allow Operators to interface with any controlling devices; to display process data, equipment status, and alarm information. The system shall transfer operator initiated control commands to the controlling PLC(s).

3. The Programmable Logic Controller(s) within the system shall perform all process control. The SCADA system shall not perform any control or function that would, on its own, change the way a controlling device (PLC or dedicated controller) controls the process. All commands must be initiated by an Operator and not be the programming of the SCADA system. All Timers, Totalizers, Counters, or any other control function devices will be implemented in the PLC.

B. Communications

1. The SCADA shall monitor for communications and shall post an alarm if a PLC fails to respond to message queries.

2. The SCADA system shall track a ratio of completed message to missed messages in a 100 entry shift register. Therefore, the communications integrity to each station will be displayed as a percentage of completed messages. Show message integrity percentage on SCADA overview screen.

3. The SCADA system shall re-transmit interlock data from one PLC/RTU to another for the purposes as described in this section and Section 16915, PLC &OI Applications Programming.

C. Graphic Screens:

1. Model screens after the existing SCADA System screen and the P&IDs as shown in the contract drawings. If existing sites are similar, the new screens shall be similar in look and functionality as the existing screens.

2. Display all analog values on the graphic screens with bar graph, symbols, and analog readout along with its associated alarm setpoints arranged next to bargraph in ascending order (i.e. low alarm setpoints at bottom and high alarm setpoints near the top).

3. Setup control parameter screen listing all setpoint registers. All settable values shall be changeable from the graphic screens permitted with the appropriate password.

4. Provide an alarm summary screen(s) listing all alarms. Flashing Alarm Indication. Acknowledge button to acknowledge alarms displayed.

5. All values shall be displayed with engineering units.

6. Analog values shall be displayed with the resolution as described above.

7. Display indicating a new alarm regardless of the screen currently displayed.

8. Setup color convention to be used (for new installations):

    a. Background colors:

        1) Window - Gray.
        2) Changeable variable points - Cyan.
        3) Non-Changeable variable points - White.

    b. Control Switch Colors

        1) Hand - Red.
        2) Off - Grey.
        3) Auto - Green.

    c. Pump and Equipment Colors

        1) Run - Green.
        2) Off - Red.
        3) Fail □ Flashing Yellow.

    d. Valve Position Colors

        1) Closed □ Red
        2) Modulating □ Purple
        3) Open □ Green

    e. Circuit Breaker Colors

        1) Closed □ Green

2) Open □ Red

f. Relay Logic Colors

1) Closed Relay Contact □ Green
2) Open Relay Contact □ Red

9. Navigation Bar

a. Menu screen with jump buttons to all screens.

b. Jump button displayed on all screens to go to a menu screen.

c. Jump button displayed on all screens to go to the last screen.

10. Provide the following graphic screens:

a. Overviews of station/project refer to P&ID drawings □ one per P&ID (minimum).
b. Setpoint □pop-up□menus for each device to configure alarms.
c. Control screen to allow configuration of operation per the control strategies.
d. Alarm configuration screen with setpoint listings and descriptions.
e. Totalization (flow and/or runtime) for all devices.
f. Trending screens for each analog device.
g. Alarm summary screens with acknowledge and reset.
h. Modifications to existing overview screen as applicable. (large overview showing multiple related stations and/or systems).
i. Configure drop down menus and □go-to□ buttons for each new screen.

D. System Security

1. As a minimum, provide the following password protected modes:

a. Operator level 1 □ Display Mode to allow monitoring.
b. Operator level 2 □ Limited Operations Mode to allow control functions to be performed limited to that operator□s area of responsibility.
c. Operator level 3 □ Supervisory Operations Mode to allow control functions to be performed for all areas.
d. Operator level 4 □ Configure Mode to allow programming, system configuration, computer operating system access, and engineer functions to be performed.
e. Administrator □ System Manager Mode to all password and account privilege access.

2. Provide an on-line method for users to change their passwords.

3. Provide security to protect unauthorized access to the password file.

4. Provide the means to prevent unauthorized access to the operating system command line.

5. Log password changes and login information to a secure file.

6. Automatically log out users after 5 minutes of non-use.

3.03 FIELD ASSISTANCE

A. The SCADA system shall be tested with the PLC control systems as defined in other sections. The SCADA system shall be ready for testing at the Factory Test and again at the Field Test. The SCADA application programmer shall be performing testing, making corrections and/or on stand-by during all testing. There shall be no time limit to perform such testing and completion will be as determined by the Owner's Representative.

B. Provide testing as specified in Electrical Specifications [Factory and Field Testing].

3.04 ADDITIONAL PROGRAMMER LABOR HOURS

A. The Contractor shall include in his bid price an additional 16 hours of SCADA application program configuration changes to be designated by the Owner's Representative or Owner during testing and start-up.

B. All SCADA application programming configuration changes shall be performed by the original programmer and shall be made in the presence of the Owner's Representative in the field. None of the hours shall be used for travel costs, overhead, etc., that are not related to programming changes.

3.05 MEDIUM

A. Provide SCADA applications programs on CD recordable disk media with each submittal. Clearly label CD with station name and contents. CD disk shall contain the following:

1. Tag name data tables.
2. Colored graphic screens.
3. These disks and all copyrights shall become the property of the Owner, for its use on this and future projects.

B. In addition, one (2) sets of CD-ROM diskettes of the application SCADA programs shall remain on site. All programs on the disks shall be updated each time the Contractor is called out to modify the programs.

C. Provide two (2) copies of as-installed SCADA application screens and tag name data tables printed with standard laser print 8 1/2" x 11" paper at end of project. Insert new print-outs into the Operations and Maintenance manuals. Provide number of copies as specified in Electrical Specifications [Electrical General, Operations and Maintenance Instructions].

3.06 TRAINING

A. The SCADA programmer shall provide a minimum of 8 hours of training for 4 to 6 of the Owner's engineering, operations, and maintenance personnel. The training shall consist of the following minimum sessions:

1. 4 hours □ SCADA Configuration and Maintenance Course shall include:

   a. Training in entering configuration mode and creating symbols, assigning references, editing tag database.
   b. Making data back-ups and creating a back-up schedule.
   c. Making SCADA configuration back-ups.

2. 4 hours □ SCADA Operations Course shall include:

   a. Screen usage.
   b. Password heirarchary.
   c. Dos and Don'ts.
   d. Reports and file management.

3.07 WARRANTY

A. Troubleshoot and correct all program abnormalities, glitches and bugs uncovered during the warranty period. Provide phone and/or on-site support as required to correct problem(s).

B. Software support which shall be provided by the System Integrator:

1. Free technical SCADA software and hardware configuration phone support for a period of one year. SCADA phone support shall be provided directly from the person(s) that configured the SCADA System. Phone support shall be available between 8 a.m. and 4 p.m. Pacific Standard Time Monday through Friday.

2. The System Integrator shall correct any SCADA software configuration error that is discovered within the warranty period, at no additional cost to Owner.

END OF SECTION

SECTION 26 89 40
INSTRUMENTATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The major components in the instrumentation scope of work are:

1. Furnish, configure, test, commission, and warrant instrumentation as shown in the P&IDs, plans, and/or listed in specification section.

2. Include necessary piping, valves, pressure reducers, mounting brackets or flanges, supports, and anchors to complete installation.

3. Provide sunshades for instrumentation for all instruments that are exposed to direct sunlight.

B. System Integrator selection of instrumentation shall be per manufacturer's recommendation for the application and per specifications. If a manufacturer's recommendation or installation instructions are inconsistent with the Contract installation details or specifications, then the Contractor shall submit an RFI describing the inconsistency. If the inconsistency is due to substitution from the first named equipment, then the responsibility of coordination and any additional cost shall be borne by the Contractor.

C. Projects that come into contact with drinking water: (NSF-61 certification)

1. Furnish NSF/ANSI 61 certified products that have undergone testing for any device, valve, instrument, or assembly that will come into contact with drinking water.

2. The certification determines what contaminants may migrate or leach from the product into drinking water and confirms if they are below the maximum levels allowed to be considered safe.

3. Flowmeters, pressure transmitters, and chemical analyzers are a few of the products that may fall into this category requirement.

D. Provide all devices, valves, tubing, fittings, wiring, terminal blocks, calibration consumables, initial calibration equipment, accessories, sunshades and enclosures as specified herein and as shown on Contract Drawings.

E. The Contractor shall furnish all tools, calibration equipment, calibration materials, specialized parts and incidentals necessary to integrate the instrument to the application.

F. Contractor shall furnish labor for installation, verification, start-up, calibration, testing and commissioning. Contractor shall prove proper function of instrument prior project completion.

1.02 REFERENCES

A. Electrical Specifications [Electrical General]

B. Electrical Specifications [Factory and Field Testing]

1.03 SUBMITTALS AND DRAWINGS

A. Submit shop documents and drawings for approval in accordance with this subsection and as specified in Electrical Specifications [Electrical General, Submittal Requirements].

B. Submit Operating Instructions (O&M Manuals) for each instrumentation device prior to equipment installation.

1.04 OPERATING AND MAINTENANCE INFORMATION

A. Provide operating instructions as specified in Electrical Specifications [Electrical General, Operating and Maintenance Instructions].

PART 2: PRODUCTS

2.01 QUALITY

A. Electrical Specifications [Electrical General, Quality].

B. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without requiring a manual reset.

C. Signal transmission from remote or field electric and electronic devices shall be 4-20 mA, sourced by a 24 VDC supply internal to the instrument or from a 24 VDC power supply located within the panel that is to receive the signal. Nonstandard transmission methods such as impulse duration, pulse rate, and voltage regulated will not be permitted except where specifically noted.

D. Transmitters or devices located in Class 1, Division 1 hazardous areas shall be rated for hazardous location installations per NEC and UL. Explosion proof enclosures and raceways or current/spark limiting devices located inside or outside of the classified area shall be furnished to comply with code requirements.

E. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately converted to 4-20 mA signals for remote transmission.

2.02 INSTRUMENT IDENTIFICATION

A. All major instrumentation and equipment items or systems specified in this Division and/or on the P&IDs are identified by tag numbers. Tag field equipment with assigned instrumentation tag number and functional description.

1. Tags shall be 1/2□ stainless steel DYMO impressed tape with 3/16□(minimum) height characters.

2. Metal tape embosser shall feature a built in hole punching device and scissor cutoff tool.

B. Attach tags to equipment with a 4□long, 20-gage stainless steel wire leash for small devices, or two stainless steel screws for larger instruments; however, such permanent attachment shall not be on an ordinarily replaceable part or in an area that will be subject to unintended overuse fatigue. Make the tag plainly visible.

2.03 LEVEL COMPONENTS

A. Float Switch

1. Tilting float level switches shall be a mercury free float switch, whose specified weight is less than that of the process liquid displaced, to actuate switches as the level changes. The non-mercury hermetically sealed snap action switch is actuated by a steel ball rolling back and forth within a switching tube in plastic float housing. The SPDT switch shall be rated 16A at 250 VAC shall be integrally mounted in the float and connected to a control box by a PVC jacketed waterproof electric cable with three finely stranded No.17 conductors. The weight shall be integrally mounted so that no metals shall contact the process liquid. Tilting type level switch shall be MJK Model 7030, or equal.

B. Submersible Level Transmitter

1. The submersible level transmitter shall be 4-20 mA loop powered with integral manufacturer's cable containing electrical conductors and breather tube. The transmitter shall include lightning protection and a dessicant air dryer for installation on the end of the breather tube.

2. Lightning protection

a. Lightning protection shall be incorporated within the level transmitter and shall be consistent with IEC 61000-4-5, Level 4 requirements.

b. Lighting protection module shall be installed in termination box and grounded per manufacturers instructions.

3. The calibration of the level transmitter and cable length shall be as shown in the instrument schedule.

4. The body of the transmitter shall be rated IP68 and constructed of stainless steel with a ceramic diaphragm measuring cell. The transmitter shall be suspended from the electrical cable.

5. The submersible level probe shall be Endress and Hauser FMX-21 Water Pilot or approved equal.

C. Ultrasonic Level Transmitter:

1. The ultrasonic level transmitter shall utilize non-contacting ultrasonic signal reflection technology to provide level monitoring for up to 50 ft range.

2. The transmitter shall feature advanced echo processing algorithms that can be configured to ignore selected echos.

3. The transducer level element (LE/LIT) shall have the following features:

   a. NEMA 4X / IP65 enclosure.
   b. Ground isolated 4-20 mA loop powered, 24 vdc.
   c. Integral 4 button keypad for configuring parameters.
   d. Integral 1.5□x 4□(min) backlit LCD display.
   e. Operating temperature range from -40 to 140 deg. F.
   f. Rated for Class 1, Div. 2 hazardous atmospheres.
   g. Operating temperature of -40 to 200 deg F.
   h. 3 dB emitting angle: (from centerline)
      1) 5.5° for sensors up to 25 ft
      2) 4.5° for sensors up to 35 ft
      3) 3.0° for sensors up to 50ft
   i. Blocking distance: Maximum 5% of instrument range.

4. The calibration of the level transmitter and cable length shall be as shown in the instrument schedule.

5. Provide one hand held or integral programming interface with each transmitter provided.

6. The ultrasonic level transmitter shall be Endress and Hauser Prosonic M FMU4x, or equal.

2.04 PRESSURE COMPONENTS

A. Gauge, Absolute, or Differential Pressure Transmitter:

1. The pressure indicating transmitter shall be a loop powered, two wire, 4-20 mA signal transmitting device with signal derived from the applied sensor pressure. Transmitter shall be capable of driving 0 to 500 ohm loads with 24 VDC supply.

2. The transmitter shall have the following features:

   a. Programmable 4-digit Liquid Crystal Display (LCD) process indicator.

   b. HART programming with programming selections for square root extraction, output calibration, and adjustable dampening 0.0 to 36.0 seconds, minimum.

   c. Integral microprocessor based circuitry with RFI filtering and shielding.

d. The transmitter shall have accuracy of +/- 0.1% of span over a range of minimum 10 to 1 turndown. Elevated zero setting capable of 0-30% upper calibration limit.

e. Operating temperature range shall be -40 to 185°F (minimum). Process wetted materials shall be compatible with fluid being measured with minimum hastalloy or ceramic diaphragm and 316 stainless steel wetted parts.

f. Process connection shall be as follows:

1) Low solids content - 1/2" MNPT with calibration valve.

2) High solids content - 1-1/2□or 2□flange with flushing ring and valve.

3) And as required per installation detail.

g. The transmitter shall be scaled as shown in the instrument schedule.

3. Provide mounting bracket per mounting requirements shown in Contract drawings.

4. The gauge pressure transmitter shall be Endress and Hauser Cerabar M PMC 71, Rosemount Smart 3051, or equal.

B. Calibration Valve:

1. Calibration valve for use with gauge transmitters shall have the following features:

a. Stainless steel body with integral blocking valve and calibration valve and port.

b. Calibration port shall be 1/4□FNPT with 1/4□MNPT x 1/2□FNPT adapter.

c. Valve shall have a non-rotating stem tip and a fully backseated bonnet.

d. Process and transmitter connections shall be 1/2□MNPT. Include 1/2□stainless steel close nipple as required.

2. Calibration valve shall be Hex HB59, Anderson Greenwood, or equal.

C. Pressure Switch:

1. Each pressure switch shall be SPDT rated minimum of 15 amps @ 120VAC. Pressure switch shall consist of a pressure sensing mechanism and the switch itself enclosed in a NEMA rated housing. Pressure switch shall be diaphragm type with stainless steel wetted parts and mechanical

snap action switch. Switch shall have two setpoint adjustments (trip & reset setpoints) with setpoint indicator calibrated in engineering units. Pressure switch shall be UL listed. The pressure switch shall be Static-O-Ring 66 Series, Ashcroft B series; ASCO or equal.

D. Pressure Guage:

1. The pressure gauge shall be 1% accurate with C-type bourdon tube. The bourdon tube, socket and connection tube of the gauge shall be 316 stainless steel. The case and bezel ring shall be constructed of type 304 stainless steel. The dial shall be 4□in diameter with a black pointer and a white gauge face with black print. The gauge shall be filled with liquid glycerin. A bottom mount process connection shall include a snubber as a separate component. The process connection shall be 1/2□stainless steel. The pressure gauge shall be Ametek gauge model 1550, Ashcroft 1009, or equal.

2.05 FLOW COMPONENTS

A. Magnetic Flow Meter:

1. The magnetic flow meter shall consist of a flow tube FE and a converter FIT, complete with interconnecting cables.

2. The magnetic flow meter shall be of the low frequency electromagnetic induction type and shall produce a DC pulse signal directly proportional and linear to the flow rate, with the duration not less than 100 milliseconds. Complete zero stability shall be an inherent characteristic of the metering system. Meters requiring field zero adjustment will not be acceptable. The meter accuracy shall not be affected by changes in fluid pressure, temperature, viscosity, or conductivity.

3. Accuracy

a. The maximum error of the complete metering system including flow element and flow indicating transmitter shall be 0.30% of actual flowrate (in specified units) and readout over the range of full scale velocity settings from 1 to 30 feet per second. Variations in temperature, voltage, and frequency within the ranges listed herein shall not affect the overall measuring accuracy.

b. The flow meter shall not require more than three diameters of straight pipe length from the center of the meter to upstream or downstream obstructions to obtain specified accuracies.

4. Flow Element (FE)

a. The flow element shall be based on a pipe spool with ANSI class 150 flange connections or be flangeless construction as required by mechanical drawings. Class 300 flanges shall be provided where shown or when the pressure and temperature of the

process fluid exceeds the rating of a 150 lb flange. The flow element size shall be as shown in the mechanical drawings and listed in the Instrumentation Schedule. Flange type and bolt pattern shall be coordinated with the mechanical Contractor prior to submittal.

b. The flow element shall have Hastalloy C4 coil and grounding electrodes.

c. Stainless steel grounding rings shall be provided at both ends of the flow element for all flowmeter applications. Grounding rings shall be manufactured from stainless steel, 2 mm thickness with grounding tab for electrical wire connection, and fit within the flange bolt circle. Grounding ring shall be self centering within pipe.

d. The flow element internal liner material shall be Teflon, polyurethane or hard rubber, unless recommended otherwise by the manufacturer for the application and approved.

e. Nema rating as defined in the Instrumentation Schedule.

5. Flow Indicating Transmitter (FIT)

a. The electronic transmitter shall be provided in a NEMA rated enclosure per the Instrumentation Schedule.

b. The transmitter shall be interchangeable with all sizes of flow elements and shall be field replaceable (without replacing flow element) in the event of transmitter failure.

c. The transmitter shall be microprocessor controlled, utilizing digital signal processing with automatic zero correction to provide a linear 4-20 mA signal proportional to flow rate.

d. The transmitter shall incorporate a high impedance amplifier of 100,000 Megohms or greater, eliminating the need for electrode cleaning systems.

e. The transmitter shall contain a self test mode to allow the operator to manually simulate the output 4-20 mA signal to any value between 0% and 100% to check out any driven devices in the loop.

f. Rate indicator and totalizer: An alphanumeric LCD backlit display shall be provided to continuously display the flowrate and totalizer with units and all programming functions.

g. All programming configuration of the Flowmeter shall be completed through the transmitter's pushbutton interface. A communication device shall not be necessary to configure the flow

transmitter.

h. PC based software shall be available and included for configuration and troubleshooting. Connection to flowmeter shall be via computer USB port and include interface cables as required.

i. The transmitter shall be designed for operation from a power source of 120 volts AC, with a power consumption of less than 20 watts. The flow element shall be powered from the transmitter.

j. The transmitter shall operate continuously without fault in an ambient temperature range from 14 to 140 °F. The flowmeter shall be suitable for operation in direct sunlight without the use of a sunshade. If a sunshade becomes required after installation for any operational reason, one shall be furnished and installed free of charge.

k. The following configurable parameters shall be provided at a minimum:

1) Field adjustable flow signal dampening.

2) Low flow cutoff (forces zero flow signal) between 0.0-5.0% of full scale rate.

3) Empty pipe detection (forces zero flow signal) if the pipe is not full.

4) Selection for forward/reverse/both flow directions.

6. Flow Indicating Transmitter (FIT) I/O Interface

a. Flow Signal: 4-20 mA signal proportional to the flow. The signal shall be field configurable for the flow calibration specified and others within the flow tube accuracy range. The flow signal shall be capable of measurement for forward and reverse flows combined by offsetting zero to mid scale (12 mA).

7. If the flow indicating transmitter (FIT) is shown in the Contract drawings to be mounted remotely from the flow element (FE), the manufacturer shall provide all cabling between flow element and flow indicating transmitter.

8. All mounting hardware and/or devices necessary to complete the installation shall be provided by the manufacturer at no additional cost to the Owner.

9. The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Bureau of Standards. A certified copy of the calibration test results shall be submitted to the Owner prior to shipment of the meter.

10. The magnetic flowmeter shall be Endress and Hauser Promag 400L, Endress and Hauser Promag 53W, Krohne Enviromag 2100, Rosemount 8705, or equal.

2.06 ANALYTICAL ELEMENTS

A. Chlorine Residual / pH Analyzer:

1. Description: Direct sensing chlorine analyzer to monitor a continuous flow of process water to determine free chlorine residual level.

2. The microprocessor based analyzer shall continuously display the chlorine residual with range as shown on the Instrumentation Schedule.

3. The measuring cell shall provide continuous on-line measurement of residual levels from 0-5 mg/l to 0-20 mg/l. The display shall be capable of 0.01 mg/l resolution (min) for the lower scale range.

4. Operating temperature: 32° F to +122° F. Provide sunshade when exposed to direct sunlight.

5. Analyzer Electronics.

a. The analyzer shall be controlled by microprocessor based electronics powered from 120 VAC. Analyzer shall be protected from voltage fluctuations commonly found in water/wastewater applications. Additional external noise filtering shall be provided as necessary for a robust and operational system. System lock-ups or microprocessor malfunctions will be grounds for rejection throughout the warranty period.

b. Analyzer electronics shall be enclosed in a NEMA 4X polycarbonate enclosure.

c. User interface shall include a membrane keypad and backlit LCD display.

d. Alarm conditions shall be identified through the display.

e. The system shall have one isolated 4-20 mA output which represents chlorine residual and scaled by the user during commissioning from a selected list of ranges from 0-0.1 to 0-50 mg/l. Output signal shall be configurable to desired span without recalibration of the sensor

f. Three (3) user configurable alarm relays shall be provided for low residual, high residual and diagnostic conditions.

1) Relay contacts shall be rated 5 amperes at 110 V.

6. Probe

a. Membraned aperometric sensor probe with electrolyte fill liquid. Maximum pressure or flow at probe shall not be exceeded.

b. The probe shall include temperature sensor for temperature compensation in chlorine measurement.

c. The pH sensor shall include the flow thru cell and sensor for online measurement.

d. Include flow cell and associated valves, pressure regulators, tees, strainers and piping for complete installation in the intended location. Installation of flow cell piping shall maintain liquid on probe surface even when flow is shut off.

7. Spare Parts.

a. One year supply of consumable materials as recommended by manufacturer.

b. On spare electrode, complete unit with plug-in to transmitter.

8. Chlorine Analyzer shall be Endress and Hauser Liquisys M CCM223 with CCS141 probe and flowfit CCA250 or approved equal.

2.07 TEMPERATURE DEVICES

A. Room Temperature Transmitter:

1. The temperature indicating transmitter shall provide display of temperature and provide linear output signal derived from the temperature of the integral or remote RTD measuring sensor.

2. Temperature Transmitter

a. Loop powered, two wire, 4-20 mA, capable of driving 0 to 500 ohm loads from 24 VDC supply.

b. 3-1/2 digit, 0.37□H, Light Emitting Diode (LED) display.

c. Zero and span adjustments for display and temperature transmitter.

d. The transmitter shall have accuracy of +/- 0.5% of span over an operating temperature range of 0 to 150°F.

e. Furnish remote RTD for outdoor temperature measurement as required per plan.

3. The wall mount transmitter shall be Devar Model D-RTTI(-R)or equal.

2.08 EVENT, STATE OR POSITION DEVICES

A. Position Switch:

1. Door switch □ door intrusion switch shall have a wide gap magnetic sensor with S.P.D.T. contacts mounted in 1535an extruded aluminum housing with integral 3 foot stainless steel armored cable for wiring to a junction box. Switch contacts shall have 0.25A at 30VAC/VDC minimum capability. When attaching to a ferrous metal surface, space sensor components away from metal by minimum ¼□ using plastic spacer in order to maintain magnetic gap. Intrusion door switches shall be Sentrol 2507-A or equal.

A. Smoke Detector:

1. General

a. The smoke detector shall detect smoke produced by fire and signal an alarm system. The detector shall be housed in a flame retardant plastic housing and shall be unaffected by vibration. Detector shall be sealed against dirt, insects and back pressure

b. Detector shall utilize photoelectronic sensor technology.

c. The detector/base shall be 120V, four-wire operation with built-in Form A and Form C dry contacts. Form A contact shall be rated for 2.0A at 30VAC/DC. Form C contact shall be rated for 2.0A at 30VAC/DC and 1.0A at 120VAC.

d. The detector shall have an operating temperature 32 to 120°F and an operating humidity of 10 to 93% relative humidity.

e. The detector shall have built-in test switch (magnetic proximity actuation) and 360 degree view angle of built-in alarm LEDs.

f. The detector shall be approved by UL and Factory Mutual and meet requirements of NFPA 72.

2. The fire alarm smoke detector shall be photoelectric type. The smoke detector shall be System Sensor 100 Series model 2151 with B114LP base, Gentex 8000 Series with 120VAC base, or equal.

2.02 INSTRUMENTATION SUN PROTECTION

A. Instrument Sunshade

1. Provide wall mount bracket or pole mounted sunshade where instruments are exposed to direct sunlight. Sunshades shall be fabricated from stainless steel with hinged rubber flap on front for viewing of displays and performing calibrations. Sunshade shall be custom manufactured for the instrument protected and sized such that there is 3□free space around sides and front of instrument.

2.03 INSTRUMENTATION SCHEDULE

A. The Instrumentation Schedule spreadsheet (located at the end of this section) is intended to be a summary of instrumentation equipment required for this project. Not all instrumentation details are shown on the schedule. Some requirements may be shown in the Instrumentation Schedule such as enclosure rating and instrument span that are not described in the specifications. Both are required for a complete specification.

B. If an instrument is shown in the P&IDs or on the site plan, then the device shall be provided whether or not it is shown on the Instrumentation Schedule.

PART 3: EXECUTION

3.01 WORKMANSHIP

A. Instrumentation work shall conform to workmanship standards specified in Electrical Specifications [Electrical General, Workmanship].

B. The Contractor shall employ personnel who are skilled and experienced in the installation and connection of equipment defined in this section. Contractor qualifications are specified in Electrical Specifications [Electrical General].

C. Verify that all equipment and materials fit properly.

D. All instrumentation configuration, programming and calibration shall be completed prior to the start of field tests.

E. Equipment without approved submittals shall not be installed.

F. All equipment shall be properly stored indoors while awaiting installation. Protect installed equipment from construction debris or mishaps. The Contractor will replace any equipment that is not in new condition at the time of installation and/or start-up.

G. Perform work to remedy non-compliant installations after inspection.

3.02 INSTALLATION

A. Install and supply all products necessary to provide an operational instrumentation system. This shall include the following:

1. Contract Drawings are intended to show the basic functional requirements of the instrumentation system. Insufficient detail does not relieve the Contractor from the responsibility to provide a complete and functioning system. If additional detail or clarification is required, the Contractor shall request such information prior to installation.

2. Provide relays, signal converters, isolators, boosters, power conditioners, circuit cards, and other miscellaneous devices as required for the compatible and functional interface.

3. Provide analog loop isolators where required to eliminate "ground loops."

4. The instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions and located as shown on the Drawings or as approved. When manufacturer's installation literature specifies a particular location or orientation in a process line due to measurement accuracy considerations, the installation shall be in conformance with the manufacturer's instructions.

B. Instrument installation methods.

1. Install instruments at the location shown on the Plans or approved. Instruments enclosures shall be NEMA rated for the installed location.

2. Install level and plumb.

3. All instruments shall be provided with floor stands or wall brackets as shown in installation details or as required for functional installation.

4. Mounting stands shall be custom manufactured of aluminum channel with base plate unless otherwise noted in installation detail.

5. Mounting channels (unistrut), and spacers shall be galvanized steel above ground outdoors and stainless steel below ground (wetwell), unless otherwise noted in installation details.

6. All screws, bolts and anchors shall be stainless steel.

C. Wiring and raceway installation methods:

1. Terminal blocks shall be provided at all instrument cable junctions and all wires shall be identified at such junctions.

2. Instrumentation wiring shall be run without splices between instruments, terminal boxes, or panels.

D. Wiring, grounding, and shielding: The following practices shall be observed unless modified by manufacturer's standards.

1. Each electronic equipment chassis shall be grounded to power ground.

2. Shielded twisted pair, shielded triad, or manufacturer supplied cables only shall be used for analog signals and communications signals.

3. Drain wire of shielded cables used for analog inputs to the PLC shall be connected at the PLC unit only. Shield shall be isolated from ground at all other termination points including transmitters.

4. Drain wire of shielded cables used for analog outputs from the PLC shall be connected at signal receiving device only. Shield shall be isolated from ground at all other termination points.

5. If electrical interference noise is imposed on DC status and alarm signals, then they shall be re-routed or wire changed to shielded twisted pair cables.

6. Each shield drain wire which is not connected to ground shall be cut off covered with a heat shrink insulating boot at cable jacket end. Shields shall be connected together at each transition from one cable to another for an effectively continuous shield circuit.

3.03 SUPPLIER SERVICES

A. The Contractor shall be responsible for each supplier of equipment to provide the following minimum services for each type of instrument supplied. Each supplier shall provide a qualified instrumentation field technician to perform services listed herein. Contractor shall supply all calibration materials necessary to commission unit and shall not use any consumable materials that are intended to be furnished for the first period of use.

1. Advise and instruct Contractor on proper installation requirements.

2. Inspect, calibrate, test, and place equipment in operation. Calibrate instruments to values as shown in the instrument index or as noted herein. If instrument spans are required to change (within instrument range) during startup for process reasons, the Contractor shall change them as directed by the Engineer.

3. Programmable devices shall be programmed and tested prior to startup. Programming shall be adjusted or changed as directed by the Engineer at any time prior to final acceptance.

4. Perform testing in the presence of Engineer.

5. Visit the project site as often as required and spend as much time as necessary to ensure accurate and operational instrumentation.

6. Provide training as specified in FIELD ASSISTANCE.

B. The Contractor shall coordinate with each supplier of instrumentation to confirm that primary elements are provided in a timely manner, meeting critical path scheduling. The Contractor shall coordinate process connection size, equipment size, and material type when applicable and oversee the installation, calibration, and acceptance testing.

3.04 FIELD ASSISTANCE

A. The instrument supplier shall provide a minimum of one (1) hour of field training to instruct Owner's personnel in the use, operation, calibration, programming, and maintenance on each type of "field" instrument.

3.05 SPARE PARTS

A. Provide spare parts as described in each products section herein and specified in Electrical Specifications [Electrical General, Spare Parts].

B. Contractor shall supply all calibration materials necessary to commission unit and shall not use any consumable materials that are intended to be handed over to the Owner as defined in the instrument specifications.

3.06 WARRANTY

A. Provide warranty as specified in Electrical Specifications [Electrical General, Warranty].

3.07 FINAL ACCEPTANCE

A. Final Acceptance per Electrical Specifications [Electrical General].

END OF SECTION

26 89 40 INSTRUMENTATION INDEX

DWG # P&ID	Tag No.	DESCRIPTION	Type	Specification Section	Min. NEMA Rating	Size	SP/ Range	Units	DWG. DET. Reference	Notes
E3	AE/AIT 81	Sensor	CL2/pH	16940-2.06 A	4X	-	0-5	mg/l	Wall Mount	
E3	FIT 71	Flow Indicating Transmitter	Magnetic	16940-2.05 A	4X	10"	0-2000	GPM	FMD/FFA	
E3	LIT 53	Level Indicating Transmitter	sonic	16940-2.03 C	4X	-	0-20	FT	ULS	
E3	LSH 52	Level Switch	Float	16940-2.03 A	-	-	-	-	FLTS	15 Ft. Cable
E3	LT 51	Level Transmitter	Submersible	16940-2.03 B	-	-	0-500	FT	WLT	Cable as required per plan
E3	PI 61	Pressure Gauge	Gauge	16940-2.04 D	4X	-	0-150	PSI	PIT	
E3	PIT 61	Pressure Indicating Transmitter	Gauge	16940-2.04 A	4X	-	0-150	PSI	PIT	Calibration Valve
E3	PSH 61	Pressure Switch	Diaphragm	16940-2.04 C	4	-	20-200	PSI	PTD	
E3	TIT 82	Temperature Indicating Transmitter	Room	16940-2.07 A	1	-	0-150	deg F	Wall Mount	

10/2/2019

SECTION 31 00 00

TRENCHING, BACKFILLING, AND COMPACTION

PART 1 - GENERAL

1.01 SUMMARY

A. Description of Work: All excavation, trenching, shoring, dewatering, backfilling, compaction and grading necessary for the construction of the work in accordance with the Contract Documents. The excavation shall include the removal and disposal of all materials of whatever nature encountered, including water and all other obstructions that would interfere with proper construction and completion of the work. This work includes but is not limited to:

1. All excavating, filling and grading to the elevations shown on the Drawings.
2. Trench excavation, backfilling and compaction for utilities.

1.02 REFERENCE DOCUMENTS

A. Reference Specifications: Whenever the words "Standard Specifications" are referred to, the reference is to the Rio Linda/Elverta Community Water District Standard Specifications.

1.03 SUBMITTALS

A. General: Submit the following items in accordance with Section 01 33 13 Submittals.

B. Samples: Furnish such quantities of earthwork materials as may be required by the Owner for test purposes. The Contractor shall cooperate with the Owner and furnish necessary facilities for sampling and testing of all materials and workmanship. All material furnished and all work performed shall be subject to rigid inspection, and no material shall be delivered to the site until it has been favorably reviewed by the Owner or used in the construction work until it has been inspected in the field by the Owner.

C. Test Results: Submit test results of tests conducted under paragraph 1.04.

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Safety Regulations: Work shall comply with all Federal, State and municipal regulations regarding safety, including the requirements of the following:
   a. Williams - Steiger Occupational Safety & Health Act of 1970
2. Local Requirements: All work falling under the jurisdiction of Sacramento County shall conform to their applicable requirements.
3. All trenching work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission (CSIAC)

B. Observation and Testing:

1. Source Quality Control: Contractor shall test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent testing laboratory.
2. Field Quality Control:
   a. The Owner will pay for soil compaction testing by an independent testing laboratory. Contractor shall coordinate compaction testing as indicated in 31

20 00 Earthwork. If the work fails to pass an inspection or test, the Contractor shall be responsible for all costs associated with retesting and re-inspection. See also 3.07D.

3. Testing Methods:
   a. Durability Index: Manual of Test, State of California, Department of Transportation.
   b. Laboratory Density: ASTM D1557, Method A or C.
   c. In-place Density: ASTM D1556 or ASTM D2922.
   d. Particle Size Analysis of Soils: ASTM D422.
   e. Plastic Limit and Plasticity Index: ASTM D424.
   f. In-place Moisture Content: ASTM D3017.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials: Neatly place imported and excavated materials suitable for backfill far enough from the excavation to prevent stability problems. Keep the materials shaped so as to cause the least possible interference with the owner's operations and drainage. Storage of materials within public right-of-way or private property during non-working hours is prohibited, unless approved by the County, Agency with jurisdiction, or property owner.

1.06 PROJECT SITE CONDITIONS

A. Existing Conditions:

1. Surface Conditions: The Contractor is responsible to protect poor road surfaces to the fullest extent possible to minimize repaving required by Sacramento County. If it is determined by the Owner that the Contractor is using excessive equipment or not taking reasonable measures to protect the roadway surface the Owner will charge the Contractor for all costs associated with re-paving of the roadway. The Contractor is responsible for demonstrating competency in protecting the roadway.
2. Subsurface Conditions: No subsurface investigations were conducted in preparation for this project.
3. Existing Facilities: Maintain access to existing facilities to permit continued operation. Maintain access for firefighting and emergency equipment and to fire hydrants.

B. Seasonal Limits: No fill shall be placed during weather conditions which will alter the moisture content of the fill materials sufficiently to make adequate compaction impossible. After placing operations have been stopped because of adverse conditions, no additional fill material shall be placed until the last layer compacted has been checked and found by the Engineer to be compacted to the specified densities.

C. Existing Site Conditions: Contractor shall become acquainted with all site conditions. Contractor shall promptly notify the Owner of any utilities not shown on the drawings found during excavation operations. Contractor shall cease operations in this area until the Owner provides instructions to the Contractor to resolve any conflict issues at no additional cost to the Owner. Failure to do so will make the Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on Drawings.

1.07 POTHOLING

A. The Contractor shall pothole all known utility conflicts with the proposed water main alignment that have not previously been potholed (as indicated on the plans) prior to the installation of any water lines.

B. Contractor shall, prior to any pipeline installation, mark with white paint the limits of pavement removal for the proposed pipeline alignment and mark the depth of all utilities crossing the proposed alignment.

1.08 CLEAN-UP AND DISPOSAL

A. Clean-up: The Contractor shall maintain cleanliness on roadways and other public areas used by the equipment and will be held responsible for immediate removal of all spillage on the public pavements. The Contractor shall remove form the site daily all rubbish and debris found thereon, and all materials and debris resulting from demolition, leaving the site in a safe and clean condition.

B. Disposal: All items and materials not indicated or specified to be reused or to become the Owner's property shall become the Contractor's property and shall be removed from the premises. The Contractor shall make all arrangements for the disposal of materials and pay all costs involved.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe Bedding Materials: Provide and compact to 95% max. dry density sand for backfill within the Pipe Zone.

B. Intermediate Backfill Materials: Provide and compact to 95% max. dry density imported select material. All spoils must be hauled off-site.

C. Water: The water used shall be free of silt, oil, organic matter, alkali, salts, and other impurities. Water quality shall be acceptable to the Owner.

D. Tracing Wire: Bury all pipe with a No. 10 gauge solid, insulated, soft-drawn copper wire laid in the trench to facilitate locating the pipe at a later date. Stub the wire up inside each valve box. The locating wire shall include 3/64 inch type TW insulation.

PART 3 - EXECUTION

3.01 GENERAL

A. Underground Services Alert (USA): Contractor shall contact Underground Services Alert at 1-800-642-2444 and have underground utilities located at least 2 days prior to the start of excavation.

B. Barriers: Barriers shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations. Trenches within public right-of-way shall be backfilled and finished with temporary pavement or plated.

C. Demolition of Pavement: Where excavation occurs in paved areas, the pavement shall be sawn, ground, and broken ahead of the excavation operation. The extent of paving removed shall be limited to the minimum necessary for the excavation. Final pavement removal shall be in accordance with Sacramento County Standards.

D. Support of Excavations:

1. Adequately support excavation for trenches and structures to meet all requirements in the current rules, orders, and regulations prescribed in the Construction Safety Orders of the Department of Industrial Relations, Division of Industrial Safety, State of California. Excavation shall be adequately shored, braced, and sheeted as necessary so that the earth will not slide or settle and so that all existing structures and all new pipe and structures will be fully protected from damage.
2. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from the high groundwater table and the nature of the soil excavated. Attention is directed to Section 832 of the Civil Code of the State of California relating to lateral and subjacent supports, and wherever structures or improvements adjacent to the excavation may be damaged by such excavation, the Contractor shall comply with this law.
3. The support for excavation shall remain in place until the pipeline or structure has been completed. During the backfilling of the pipeline or structure, the shoring, sheeting, and bracing shall be carefully removed so that there shall be no voids created and no caving, lateral movement or flowing of the sub-soils.

E. Control of Water:

1. General: All excavations shall be kept free from water and all construction shall be performed in the dry. Maintain BMP's as noted in Section 11 of the Sacramento County Standard Specifications.
2. Groundwater: All dewatering shall adhere to or surpass Owner and County standards. Contractor shall provide, maintain, and operate all necessary pumping equipment for dewatering excavations as follows:
    a. Contractor shall provide a sufficient number of pumps so as to hold the water level at an elevation of not less than one foot below the lowest elevation of the structure being installed.
    b. Standby pumps shall be available at the work site for immediate use in case other pumps become inoperable.
    c. Water from dewatering operation shall be disposed of in a manner that shall not cause injury or nuisance to public or private property. Contractor shall obtain all necessary discharge permits.
    d. Provide erosions controls to prevent the disposal of sediments to adjacent lands, gutters, storm drains, or waterways as necessary.
    e. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water during construction, while concrete is curing, and until backfill has been placed and compacted to a sufficient elevation to resist possible flotation of the structure and above highest water level.
    f. Dewatering devices shall be adequately installed and filtered to prevent the removal of fines from the soil.
    g. The Contractor shall be responsible for any damage to the new work or existing structures or property caused by the dewatering operation or failure thereof.
    h. The Contractor shall remove dewatering equipment after completion of dewatering operation. All areas affected by Contractor's dewatering operation shall be cleaned and repaired back to original condition.

3. Surface Water: Contractor shall be responsible for providing temporary drainage facilities to convey and dispose of surface water falling on or passing over the work site.

F. Existing Utilities:

1. Underground Utilities: The known existing buried utilities and pipelines are generally shown on the Drawings in their approximate locations. The Contractor shall exercise care in avoiding damage to all utilities whether shown or not as he will be responsible for their repair if damaged.
2. Potholing: Contractor shall pothole to determine the actual location of all underground utilities where crossings, interferences, or connections to the new facility are shown on the Drawings, marked by the utility company, or indicated by surface signs and have not been previously potholed as indicated on the plans. Potholing shall commence prior to preparation of piping shop drawings or the excavation for any new pipelines or structures. Any variation in the actual elevations or locations and the elevations or locations indicated in on the Drawings shall be brought to the Owner's attention. Contractor shall backfill and compact excavations after completing potholing.
3. Interferences: If interferences occur at locations other than shown on the Drawings, the Contractor shall notify the Owner, and a method for correcting the interference shall be supplied by the Owner. See drawings for additional requirements regarding existing utilities.

3.02 CLEARING, GRUBBING, AND SITE PREPARATION

A. Materials removed which are suitable for fill or backfill as specified herein may be temporarily stockpiled on site as approved by the Owner or their representative.

B. All vegetation, rubble, rubbish, rock fragments exceeding six inches (6") in final size, loose existing fill or other loose and/or saturated materials, roots and organic matter within (2') of final grade, underground utilities removed within two feet (2') of final grade shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free of unsightly debris. Excavations and depressions as well as loose solid deposits that extend below planned finished sub-grade level shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications.

3.03 TRENCH EXCAVATION

A. Excavation for pipe and other utilities such as duct banks shall be in open cut trenches unless otherwise shown or indicated on the Drawings. The trench shall be as wide as necessary for sheeting and bracing and the proper performance of the work or as shown on the drawings. The sides of the pipe trenches shall be vertical in paved areas. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings except for engineered pipe where pipe manufacturer’s lay drawings are prepared, bottom of trench shall be constructed to the grades shown on the favorably reviewed manufacturer’s lay drawings.

B. Take care not to over-excavate. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Dig bell holes and depressions for joints after the trench bottom

has been graded. Remove stone as necessary to avoid uneven bearing at high points.

C. Backfill and compact over-excavations to 95% relative compaction with bedding material. There shall be no additional payment to the Contractor for over-excavations not directed by the Engineer. Remove unsatisfactory material encountered below the grades shown as directed by the Owner and replaced with Import Backfill. Payment for the Owner directed removal and replacement of such unsatisfactory material more than 12” below the trench sub-grade shown on the drawings shall be made in accordance with the provisions of the General Conditions.

D. Grade trenches so that they are uniformly sloped between the pipe elevations shown on the Drawings.

3.04 STRUCTURE EXCAVATION

A. Excavations for structures shall be done to the dimensions and levels indicated on the Drawings, as specified herein, or as necessary to install the work. Excavate to such width outside the lines of the structures to be installed as may be necessary for proper working methods.

B. Take care to preserve the foundation surfaces shown on the Drawings in an undisturbed condition. If the Contractor overexcavates or disturbs the foundation surfaces shown on the Drawings or specified herein without written authorization of the Owner, he shall replace such foundations with concrete fill or other material favorably reviewed by the Owner in a manner which will show by test an equal bearing value with the undisturbed foundation material. No additional payment will be made for the added quantity of concrete fill or other material used because of overexcavation.

C. Inspection of Excavation: Notify the Owner when excavation for the structure is complete.

D. Where unsatisfactory material is encountered below the grades shown, for structural excavations, it shall be removed and replaced and compacted with bedding material as directed by the Owner. Payment for removal and replacement of such unsatisfactory material directed by the Owner exceeding 12” below the sub-grade shown on the drawings shall be made in accordance with the provisions of the General Conditions.

E. All excavated material shall be disposed of offsite. Obtain all necessary permits and pay all costs of disposal.

3.05 TRENCH BACKFILL

A. Place bedding as shown on the Drawings or if not shown as recommended by the pipe manufacturer and compact to 95 percent relative density on favorably reviewed trench bottom.

B. Place pipe zone material in 6-inch lifts evenly on each side of pipe.

C. Backfill material shall not be placed over the pipe or conduit joints until after the joints have been completed and favorably reviewed by the Owner.

D. Backfill remaining trench with material shown on the drawings placed in uniform 12-inch lifts measured before compaction, to the grade shown on the Drawings or where not specifically indicated on the Drawings as necessary to match existing adjacent finished grade. Place warning or detection tape as shown on the Drawings.

E. Compact trench backfill to the densities shown on the Drawings. Where densities are not shown on the Drawings, compact trench backfill to 90 percent relative density except within 12 inches of finished grade in paved areas. Compact backfill within 12 inches of finished grade in paved areas to 95 percent relative density.

F. It shall be incumbent upon the Contractor to protect the pipe or conduit from damage during the construction period. It shall be his responsibility to repair broken or damaged pipe at no extra cost to the Owner. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers, and other machines that will not injure or disturb the pipe. Carefully place backfill around and over the pipe and do not allow it to fall directly upon the pipe.

3.06 STRUCTURE BACKFILL

A. Rock Sub-grade: Place a layer of rock, compacted to at least 95 percent relative compaction, under structures to the lines, grades, and minimum thicknesses shown on the Drawings. Provide 6-inch thick rock sub-grade, whether shown or not, for all structures unless specifically deleted by note on the Drawings.

B. Backfill:

1. Backfill shall not be placed against cast-in-place concrete structures until after the structure has cured for 28 days or has attained at least 80 percent of the design strength. Concrete strength shall be demonstrated by field cured cylinders tested at the Contractor's expense, prepared and tested in accordance with ASTM C31 and ASTM C39.
2. Remove formwork prior to placing backfill and where sub-grade is less than the specified density, bring sub-grade to specified moisture content and compact as herein specified.
3. Backfill shall be of the type and compaction shown on the Drawings. Where not shown on the Drawings backfill shall be Native Backfill or Imported Backfill compacted to at least 90 percent relative compaction except within 12 inches of finished grade in paved areas. Compact backfill within 12 inches of finished grade in paved areas to 95 percent relative density.
4. Place backfill materials in uniform, level layers not exceeding 12-inch thickness measured before compaction. Backfill shall be brought up evenly on all sides of the structure. Continue backfill placement to the grade shown on the Drawings or as necessary to match existing adjacent finished grade.

3.07 COMPACTION

A. Add water to the backfill material or dry the material as necessary to obtain moisture content within two percent of optimum. Employ such means as may be necessary to secure uniform moisture content throughout the material of each layer being compacted.

B. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

C. Compaction of embankment and backfill materials by flooding, ponding, or jetting will not be permitted.

D. When densities of compacted materials do not meet the requirements, remove and/or re-compact the material until the requirements are met. The Contractor will be back charged the cost of retesting all failed tests including the initial retest and fined

$100). Such back charges will be deducted from the Contractor's Progress Payments.

3.08 FINISHED GRADING

A. Finish grade the site to the elevations shown on the Drawings. Where finish grades are not shown on the Drawings, restore the finish grade to the original contours and the original drainage patterns. Grade all surfaces to drain away from structures. Finish grade shall be uniform and pleasing and shall provide drainage from all areas to collection points. Finish surfaces shall be smooth and compacted.

3.09 DISPOSAL OF EXCAVATED MATERIAL

A. Dispose offsite any unsuitable backfill material or excavated materials in excess of that needed to complete the work

**** END OF SECTION ****

SECTION 31 00 00
SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Protecting existing trees that are to remain
2. Removing existing trees, shrubs, groundcovers, plants, and grass
3. Clearing and grubbing
4. Stripping and stockpiling topsoil
5. Removing above- and below-grade site improvements
6. Temporary erosion and sedimentation control measures

1.02 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

1.03 MATERIAL OWNERSHIP

A. Except for materials indicated to remain on District's property by the Engineer, cleared materials shall become Contractor's property and shall be removed from the project site and legally disposed of by the Contractor.

1.04 SUBMITTALS

A. The Contractor shall take and submit to the Engineer photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. The photographs or videotape shall be submitted per Section 01 33 13 Submittals.

1.05 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Engineer.

B. Salvable Improvements: Carefully remove items indicated to be salvaged by the Engineer and store on District's premises where indicated.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees to remain.

C. Protect existing site improvements to remain from damage during construction. Restore damaged improvements to their original condition, as acceptable to the Engineer.

3.02 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

B. Do not remove trees indicated to remain.

C. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

D. Grind stumps and remove roots, obstructions, and debris extending to a depth of 24 inches below exposed subgrade.

E. Use only hand methods for grubbing within tree protection zone and obtain prior approval of the Engineer.

F. Coordinate with Section 31 20 00 Earthwork.

G. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork are indicated. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.03 COBBLES, RIVER ROCK, AND TOPSOIL

A. Contractor shall import cobbles, river rock, and top soil in quantities required to complete landscape installation as shown on the drawings and Section 32 94 19 Landscaping.

3.04 SITE IMPROVEMENTS

A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

C. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

D. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.05 DISPOSAL

A. Topsoil and Clean Excess Soil: Shall be stockpiled off-site at a location within 4 miles of the project site, as directed by the Engineer.

B. Recycled Materials: Comply with the provisions of General Conditions.

C. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off District's property.

**** END OF SECTION ****

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SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, and landscaping
2. Excavating and backfilling for structures
3. Base course for concrete walks and pavements
4. Base course for asphalt paving
5. Excavating and backfilling for utility trenches

1.02 REFERENCES

A. See Appendix A for a copy of the site specific geotechnical report.

B. The term “Caltrans Specifications” refers to the most recent edition of the Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation (Caltrans). In case of conflict between the Standard Specifications and these specifications, these specifications shall govern. Any provisions for measurement and payment specified within the Standard Specifications shall be disregarded and the provisions of this contract shall govern.

C. American Society for Testing and Materials (ASTM): ASTM C33 - Standard Specification for Concrete Aggregates

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

E. California Code of Regulations Title 8

1.03 SUBMITTALS

A. Provide submittals per Section 01 33 13

B. Retain only those Submittals required for Project.

C. Deliver samples of backfill materials to Engineer in quantities sufficient for testing. Deliver at least 15 days prior to use.

D. Submit a Confined Space Emergency Plan in accordance with the General Conditions, prior to any personnel entering trenches or excavations greater than 5 feet in depth.

1.04 QUALITY ASSURANCE

A. Testing and Inspection Service: Contractor shall provide a third party, independent testing and inspection firm (firm) for quality control testing during earthwork operations.

B. Engineer shall direct the firm for the testing and inspection during the earthwork operations.

1.05 PROJECT CONDITIONS

A. Verify that survey bench marks and intended elevations for the Work are as indicated on the Drawings.

B. Protect trees and other features to remain.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Subsurface Conditions: Contractor responsibility to determine the exact nature and extent of subgrade conditions. Subgrade and geotechnical information provided in the Appendix shall not relieve the Contractor of responsibility for being familiar with the character and extent of subsurface conditions that may be encountered during performance of the work.

E. Location of existing underground utilities in areas of Work is Contractor's responsibility regardless of whether indicated on the Contract Documents or not. Consult Engineer for directions immediately upon discovery of uncharted and incorrectly charted utilities.

F. The use of explosives is not permitted.

1.06 WARRANTY

A. The Contractor shall warrant against settlement for a period of 2 years after the date of Final Completion and shall repair damage caused by settlement within that time. For the purpose of this Specification, settlement will be deemed to have occurred if on paved surfaces, the depression falls 3/8 inches below the average of the sides of the uncut portion.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Onsite soils are considered satisfactory for use in engineered fill construction if free of rock or gravel larger than 4 inches in any dimension and significant concentrations of organic materials, rubble, and debris.

1. Aggregate Base Course: Aggregate for Base Course: Class “2,” 3/4-inch maximum grading as specified in Section 26-1.02B in the Standard Specifications.
2. Engineered Fill: Granular material with non-plastic fines (Plasticity Index of 15 or less), minimum R-value 20, and contain no particles larger than 4 inches in any dimension.
3. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
4. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 SOURCE QUALITY CONTROL

A. See General Conditions for general requirements for testing and analysis of soil material.

B. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is in Section 31 10 00 Site Clearing.

C. Protect and maintain erosion and sedimentation controls, which are specified in Section 31 10 00 Site Clearing, during earthwork operations.

3.02 DEWATERING

A. Prevent surface water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXCAVATION, GENERAL

A. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered.

B. Unclassified excavated materials may include rock, soil materials, and obstructions.

C. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.04 EXCAVATION FOR STRUCTURES

A. Over-excavate all areas under structures and five (5) feet outside of the structure footprint to 12 inches below the planned bottom of concrete. Scarify and recompact existing soil to 95%, a minimum of 8 inches. Place and compact to 95% 12 inches minimum of ¾" aggregate base in 8 inch maximum lifts, moisture conditioned to or slightly above optimum moisture content.

B. Clay lenses encountered with the structure excavations described above, shall be removed to a minimum depth of 5 feet and filled with Engineered Fill or ¾" aggregate base. Place and compact to 95%, Engineered Fill or ¾" aggregate base in 8 inch maximum lifts, moisture conditioned to or slightly above optimum moisture content.

C. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

D. For footings and foundations, do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 PIPE BEDDING

A. Bedding Excavation: Excavate trenches below grade of pipe bottom to the following minimum depths:

Pipe Type	Depth (Inches)
Ductile Iron	6
PVC	6
Polyethylene	6
Standard Steel	6
Corrugated Metal	3
Reinforced Concrete	3

B. Stabilization of Trench Bottom: When trench is unstable due to wet or spongy foundation, stabilize trench bottom with gravel or crushed rock.

C. Placement of Bedding Material: Place sufficient bedding material in trench bottom up to grade of bottom of pipe. Relative compaction of tamped material shall be not less than 90 percent relative compaction. Place and compact additional bedding material to provide uniform bearing under the full length of the pipe to a minimum width of 60 percent of its external diameter.

3.07 TRENCHING

A. Perform operations necessary to excavate earth, regardless of character and subsurface conditions, from the trench or adjacent thereto, and to place stabilization, bedding, cover, water removal, backfill and base, as shown on the drawings and as specified herein, as well as providing traffic control and regulation through construction areas.

B. The Contractor shall do excavation of whatever substance is encountered to the lines and grades shown on the Drawings. Materials suitable for use as backfill shall be piled in an orderly manner a sufficient distance from the edge of the trench to avoid overloading and to prevent sliding into the trench.

C. The Contractor shall do such grading or work as is necessary to prevent surface water from entering the excavation.

D. Demolish and remove existing pavement, curb and gutter, and other facilities shown on the drawings. Existing asphalt concrete pavement to be removed shall be saw cut in longitudinal neat straight lines while maintaining the cuts vertical for the full depth of the asphalt concrete pavement. Portions of existing concrete curbs, gutters, and sidewalks to be removed to permit new construction shall be cut using a concrete saw to provide neat straight lines with vertical cuts.

E. Maximum allowable open trench is 600 L.F. at any one time. Trenches are to be covered at end of each workday.

F. Notify the Engineer of unexpected subsurface conditions.

G. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored or as required by OSHA.

H. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.

I. Remove excavated material that is unsuitable for re-use from Project Site.

J. Stockpile excavated material suitable for re-use in area designated by Engineer.

K. Sides of trenches shall be vertical, shored, as required, and shall be of uniform width from top to bottom except where otherwise specifically permitted by the Engineer.

L. The Contractor shall backfill the pipe zone with the bedding material. The trench shall be graded to provide a secure bedding as specified with hand excavations made for bells or collars. Bedding material shall then be added to the trench so that it will extend up on the pipe to half of its diameter. Additional bedding shall be installed and the bedding material along the sides of the pipes tamped to not less than 90-percent compaction to secure full height bedding and proper pipe wall support.

M. Native backfill shall be compacted by machine in uniform layers not exceeding 8 inches. Backfill shall be compacted to a relative compaction of not less than 90 percent to within 2 feet of subgrade. The upper 2 feet of subgrade shall be compacted to 95 percent; 85-percent compaction will be acceptable in the landscape areas.

3.08 FIELD QUALITY CONTROL

A. The Engineer will direct additional soils testing when advised by the Contractor that in the Contractor's opinion sufficient densities have been achieved. If the first tests in any areas fails, the Contractor shall provide additional testing in that area until specified densities are obtained. The Engineer shall determine the number and location of tests required. Contractor shall furnish a backhoe and operator upon request at no additional cost to the District.

B. Preparation, excavation and trenching shall comply with California Code of Regulations Title 8, Chapter 4.4: Construction Safety Orders.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Surveying locations of underground utilities for as-built documentation
2. Testing and inspecting underground utilities
3. Removing concrete formwork
4. Removing trash and debris
5. Removing temporary shoring and bracing, and sheeting
6. Installing permanent or temporary horizontal bracing on horizontally supported walls

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILLS

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

D. Place and compact final backfill of satisfactory soil to final subgrade elevation.

E. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. In addition to the Geotechnical recommendations, place and compact fill material in layers to required elevations as follows:

1. Under landscaping areas, use satisfactory soil material
2. Under walks and pavements, use satisfactory soil material
3. Under driveways and structures, use engineered fill
4. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Revise percentage in paragraph and second subparagraph below according to geotechnical engineer's written recommendations.

B. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content:

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Revise depth of layers in first paragraph below to suit Project.

B. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under landscaping areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated:

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Landscaping areas: Plus or minus 1 inch
2. Walks: Plus or minus 1/2 inch
3. Pavements: Plus or minus 1/2 inch

3.16 BASE COURSES

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:

1. Shape base course to required crown elevations and cross-slope grades.
2. Place base course 6 inches or less in compacted thickness in a single layer.
3. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 PROTECTION

A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and re-compact.

C. Where settling occurs before project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport approved clean excess excavated material to designated soil storage areas on District's property and within 4 miles of Project Site and stockpile soil. Keep enough soil to place 12 inches in planting areas, soil to be clean of debris including gravel.

B. Remove excess excavated material, trash, debris and waste materials and dispose of it legally off of the District's property.

3.19 CONSTRUCTION QUALITY ASSURANCE

A. Fills and Embankment, except Structural Fill

1. Two modified Proctor compaction tests, ASTM D1557, on each type of fill material.
2. One in place compaction test for each 200 cubic yards of material placed.

B. Pipe Embedment and Backfill

1. Two initial gradation tests for each type of material plus one (1) additional test for each 500 cubic yards of each material.

2. Two modified Proctor compaction tests, ASTM D1557, or two (2) relative density tests, ASTM D4253 and D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material.
3. Minimum of one (1) in place compaction test for every two (2) - foot depth of backfill per 100 foot interval will be required.
4. Contractor shall, when requested, excavate to the required depth so density tests may be taken and bring such excavations to required density after testing at no additional cost to the District.

C. Structural Backfill and Structural Fill

1. A minimum of two (2) in place compaction tests for lift of material placed.
2. Two (2) initial gradation tests for each type of material plus one (1) additional test for each 500 cubic yards of each material.

D. Foundation Preparation

1. Four (4) in place density tests for each level of footing or foundation.
2. Test: Nuclear, ASTM D2922

E. Additional Testing

1. Additional tests may be required if, in the opinion of the Engineer, the testing is necessary to ensure the material has been properly installed. The District will pay for the additional testing if the testing shows that the compaction met the compaction requirements.
2. If the additional testing shows that compaction was not met, then the Contractor shall pay for all additional testing until compaction meets the specified requirements.

END OF SECTION

SECTION 31 22 00
GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Removal of topsoil.
2. Rough grading the site for site structures and building pads.
3. Replacement of topsoil and finish grading

1.02 SUBMITTALS

A. The Contractor shall accurately record actual locations of utilities remaining by horizontal dimensions, elevations, or inverts along with slope gradients.

B. All information recorded shall be submitted to the Engineer in an as-built and in accordance with Section 01 33 13 Submittals.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with the latest edition of the Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation (Caltrans).

1.04 PROJECT CONDITIONS

A. Protect above- and below-grade utilities.

B. Protect trees, shrubs, rock outcroppings, and other features to remain as part of the final landscaping.

C. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil excavated onsite shall be:

1. Graded.
2. Free of roots, rocks larger than 1/2 inches (12 mm), subsoil, debris, large weeds and foreign matter.

B. Other Fill Materials: See Section 31 20 00 Earthwork.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage. If a utility shall be relocated, notify utility company to remove and relocate utilities.

D. Protect site features to remain, including but not limited to benchmarks, survey control points, existing structures, fences, sidewalks, paving, curbs and trees from damage by grading equipment and vehicular traffic.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 20 00 Earthwork for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile topsoil and subsoil to be re-used on site; remove remainder from site.

B. Stockpiles: On site stockpiles shall not to exceed 8 feet (2.5 m) in depth; protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:

1. Verify trench backfilling has been inspected.
2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inches in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil in areas where planting is indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

3.06 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.07 FIELD QUALITY CONTROL

A. See Section 31 20 00 Earthwork for compaction density testing.

3.08 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

**** END OF SECTION ****

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SECTION 32 01 17

PAVEMENT REPAIR AND RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work in this section includes reconstruction of all curbs, gutters, sidewalks, mow strips, driveways, road shoulders, pavement and similar items damaged as a result of the work. Reconstruction shall match the original materials and dimensions subject to the minimum requirements of the Contract Documents. All work shall match the appearance of the existing improvements. Work covered in this section shall be completed in accordance with the County Standard Specifications. Where discrepancies exist between this specification and the County Standard Specifications, the County Standard Specifications shall govern.

B. Related Documents: The General and Supplementary Conditions and the applicable sections of Division 1, form a part of this section.

1.02 REFERENCE DOCUMENTS

A. Reference Specifications: Whenever the words "Standard Specifications" are referred to in the Specifications, the reference is to the most recent State of California, Department of Transportation (Caltrans), Standard Specifications. Standard Specifications paragraphs concerning measurement and payment are excluded.

1.03 SUBMITTALS

A. General: Submit the following items in accordance with Section 01 33 13 Submittals.

B. Certification: Certification from the material supplier that the materials supplied for this project meet the Specifications.

PART 2 - PRODUCTS

2.01 CONCRETE AND ASPHALT

A. Concrete and asphalt shall meet the requirements of the County.

2.02 ASPHALT CONCRETE PAVEMENT

A. Aggregate Base: Standard Specifications, Section 26. Class and size as indicated on the Drawings; or if not indicated on the Drawings, use Class 2, 3/4-inch maximum.

B. Prime Coat: Liquid asphalt, Grade SC-70, Standard Specifications Section 37.

C. Tack Coat: Emulsified asphalt, Grade SS-1, CSS-1 or SS-1h, Standard Specifications, Section 37.

D. Seal Coat: Emulsified asphalt, Grade SS-1, CSS-1 or SS-1h, Standard Specifications, Section 37.

E. Asphalt Concrete: Type B, 1/2-inch maximum, medium grading, per County standards.

F. Cutback Pavement: Cold mix asphalt concrete consisting of aggregate and MC800 asphalt cement.

2.03 TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Traffic stripes and pavement markings shall be as specified in Section 84 of the Standard Specifications.

PART 3 - EXECUTION

3.01 PAVEMENT CUTTING

A. After backfilling trenches or excavations and prior to paving, saw cut existing pavement parallel to the trench or excavation, using a concrete saw, to a minimum depth equal to or greater than one-half the pavement thickness. The pavement shall be cut back a minimum of 6-inches on each side of the trench or excavation wall unless otherwise shown. Any pavement damaged outside these lines shall be re-cut and restored at the expense of the Contractor. Should voids develop under existing pavement during construction, those affected areas shall be saw cut in straight orthogonal lines and replaced after the voids have been filled.

3.02 TEMPORARY PAVEMENT

A. Temporary resurfacing consisting of not less than 2 inches of cutback asphalt concrete shall be placed and maintained wherever an excavation is made through an existing pavement. The temporary resurfacing shall be maintained to provide for the safety and convenience of the public. Temporary pavement shall be placed as soon as the condition of the trench backfill is considered by the Owner to be suitable to receive resurfacing. Temporary resurfacing shall be removed prior to permanent resurfacing. Temporary pavement shall be clearly marked “Temporary Pavement” per County standards.

3.03 CONCRETE RESTORATION

A. Concrete restoration shall be per County Standards.

3.04 ASPHALT CONCRETE RESTORATION

A. Shall conform to County Standards.

B. Subgrade Preparation: The upper 6 inches of subgrade shall be compacted (re-compacted) to a minimum 95 percent relative density prior to placement of asphalt concrete. Provide moisture as necessary for proper compaction.

C. Aggregate Base: Provide aggregate base under all asphalt unless specifically noted otherwise on the Drawings. Thickness shall be 6 inches unless otherwise specified or noted on the Drawings. Aggregate base shall be compacted to 95 percent relative density.

D. Asphalt Concrete:

1. Prime Coat: Apply prime coat to base course at a rate of 0.25 gallon per square yard. For small quantities (less than 500 square feet) Contractor may at Contractor's option substitute tack coat for prime coat.
2. Tack Coat: Apply tack coat at a rate of 0.1 gallon per square yard to all vertical surfaces in contact with new asphalt.
3. Thickness: Unless otherwise shown on the Drawings, place asphalt concrete pavement to a thickness equal to the original thickness plus 1 inch. Surface of new asphalt shall be flush with existing adjacent asphalt surface.

4. Placement: Spread and compact asphalt concrete in accordance with the applicable sections of the Standard Specifications Section 39.

3.05 TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Restore traffic stripes and pavement markings to match original unless otherwise indicated on the Drawings. Traffic stripes and pavement markings shall be applied in conformance with Section 84 of the Standard Specifications.

**** END OF SECTION ****

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SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt patching.

1.02 REFERENCES

A. The term “Caltrans Specifications” refers to the most recent edition of the Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation (Caltrans). In case of conflict between the Caltrans Specifications and these specifications, these specifications shall govern. Any provisions for measurement and payment specified within the Caltrans Specifications shall be disregarded and the provisions of this contract shall govern.

B. Asphalt Institute (AI): AI MS-22: Principles of Construction of Hot-Mix Asphalt Pavements

C. American Society for Testing and Materials (ASTM): ASTM D8: Standard Terminology Relating to Materials for Roads and Pavements

D. ASTM D3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

E. ASTM E329: Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

F. ASTM D977: Standard Specification for Emulsified Asphalt

G. ASTM D1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

H. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

1.03 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of the Caltrans Specifications.

B. Measurement and payment provisions and safety program submittals according to the Caltrans Specifications do not apply to this Section.

1.04 SUBMITTALS

A. The Contractor shall prepare all submittals in accordance with Section 01 33 13 Submittals.

B. Product Data: Submit for each type of product indicated. Include technical data and tested physical and performance properties.

C. Mix Designs: Submit proposed mix design for each asphaltic concrete mixture and seal coat to be used in the Work, covering the specific materials to be used in the mixes. Include test data in support of each proposed mix design.

D. Qualification Data: Submit for each manufacturer proposed.

E. Material Test Reports: Submit for each paving material proposed.

F. Material Certificates: Submit for each paving material proposed, signed by the manufacturer certifying the material complies with the requirements of this Section and referenced sections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a paving-mix manufacturer registered with and approved by Caltrans.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 329.

C. Regulatory Requirements: Comply with the Caltrans Specifications for asphalt paving work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturers' labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, or if the following conditions are not met:

1. Asphalt Base Course: Minimum surface temperature of 40°F and rising at time of placement.
2. Asphalt Surface Course: Minimum surface temperature of 60°F at time of placement.

1.08 PROTECTION

A. Protect concrete pavements and walks, curbs, gutters, concrete swales, and other improvements adjacent to the operations with suitable materials. The Contractor shall be responsible for any damage caused by the Contractor's employees or equipment and shall make the necessary repairs. Buildings and other surfaces shall be covered with paper or other protection where required. All damage caused by the Contractor's operations shall be repaired or replaced as required at the Contractor's expense.

PART 2 - PRODUCTS

2.01 BASE COURSE MATERIAL

A. Aggregate for Base Course: Class "2", 3/4-inch maximum grading as specified in Section 26-1.02B in the Caltrans Specifications.

2.02 TACK COATS

A. Tack Coat: Diluted SS-1 or SS-1h emulsion in conformance with Section 37 of the Caltrans Specifications.

2.03 ASPHALT CONCRETE

A. Type “B”, 1/2-inch maximum, medium grading as specified in Section 39 of the Caltrans Specifications.

2.04 ASPHALT PAVING MIXES AND MIX DESIGN

A. Use dry material to avoid foaming. Mix uniformly.

B. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.05 SOURCE QUALITY CONTROL

A. If tests indicate materials do not meet specified requirements, change material and retest.

B. Provide materials of each type from same source throughout the Work.

2.06 ASPHALT MATERIALS

A. Tack Coat: ASTM D 977 emulsified asphalt.

B. Water: Potable.

C. Asphalt Binder: PG 64-10.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Re-compact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.:

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.03 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving:

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Weed Control: Apply pre-emergent herbicide under all area of aggregate base paving.

3.04 PLACING ASPHALT PAVEMENT

A. Install Work in accordance with Caltrans Standard Specifications, Section 39.

B. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

C. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

D. A tack coat shall be applied to all vertical surfaces of existing pavement; to curbs, gutters, and construction joins against which asphalt concrete will be placed; to pavements to be surfaced; and where specified at the approximately rate of 0.05 gallons per square yard. Application shall comply with Caltrans Standard Specifications, Section 39. Immediately prior to placing asphalt concrete, additional tack coat shall be applied to areas where the tack coat has been damaged.

3.05 SEAL COAT

A. Immediately prior to applying the seal coat, surfaces shall be cleaned of all dirt and lose materials. Following cleaning, surfaces shall be uniformly dampened with water at the approximate rate of 0.15 gallons per square yard. The sealcoat shall be applied at the approximate rate of 0.12 gallons per square yard. Applications shall comply with Caltrans Section 37.

B. The entire asphalt concrete pavement shall be fog sealed with an asphalt emulsion and meet SS-1 Fog Seal per Sacramento County requirements. The fog sealer shall be applied with in five calendar days after final asphalt concrete course, at a temperature of 75°F to 130°F, and at a rate of 0.05 to 0.1 gallons per square yard.

3.06 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course:

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints as described in AI MS-22.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.07 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inches.
2. Surface Course: Plus 1/4 inches, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

   1. Surface Course: 1/4 inches.

C. The final grade of the asphalt concrete shall vary not more than the surface course tolerance as specified from the elevations indicated on the Drawings. All areas shall be graded to drain.

3.08 COUNTY STREET PAVING

A. On county streets or where otherwise indicated, pavement removed for trenching operations shall be replaced with 2 inches of temporary paving mix within one day after compaction is approved by the Sacramento County/Engineer. Temporary pavement shall be maintained so that a smooth traversable surface free from ruts, depressions, holes, and loose gravel is available at all times from vehicular traffic. All temporary paving shall meet Sacramento County requirements.

B. Permanent paving shall be installed to replace the temporary paving per Sacramento County requirements.

3.09 FIELD QUALITY CONTROL

A. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D 1556 and per Section 31 20 00, Earthwork.

B. Results will be evaluated in relation to compaction curve determined by testing un-compacted material in accordance with ASTM D 698 ("Standard Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace, and retest.

3.10 FLOOD TEST

A. Prior to acceptance of pavement construction, reconstruction or overlay work, the Contractor shall perform a flood test. The flood test shall be performed with a water tank truck. If a depression is found where water ponds to a depth of more than 1/8 inches, the Contractor shall fill or otherwise correct to provide proper drainage.

**** END OF SECTION ****

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SECTION 32 16 13
CURBS AND GUTTERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Subgrade preparation
2. Aggregate base course
3. Furnishing, placement, and finishing of concrete curb, gutter and curb, and gutter

1.02 SUBMITTALS

A. See Section 01 33 13 – Submittals, for submittal procedures.

B. Product Data: Provide data sheets on all materials, and for all mixes to be used in the Work. Include testing sheets if available. Concrete curb and gutter work shall not proceed until after approval of submittal information.

1.03 QUALITY ASSURANCE

A. Concrete sampling, testing, and inspection shall conform to the requirements found in Section 32 13 13 Concrete Paving.

1.04 WARRANTY

A. Concrete curbs and gutters shall be warranted against cracking, spalling, and settling for the duration of the warranty period. Refer to General Conditions for warranty period and additional warranty requirements.

B. The Contractor shall warranty all Work for the warranty period as stated in General Conditions. Warranty against defects including, but not be limited to cracking, spalling, and settling

C. If during the warranty period, it is found by the Engineer, that the warranty Work needs to be repaired or replaced because of the use of materials, equipment, or workmanship which is inferior, defective, or not in accordance with the terms of Agreement, the Contractor, upon notification, shall promptly and without additional expense to the District:

1. Place in satisfactory condition all of such warranted Work,
2. Make good all damage to the project, or contents thereof, which is a result of such unsatisfactory warranted Work, and
3. Make good any Work, materials and equipment that are disturbed in fulfilling the Warranty, including any disturbed work, materials and equipment that may have been warranted under another contract. Should the Contractor fail to proceed promptly in accordance with the Warranty, the District may have such work performed at the expense of the Contractor and their surety.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: Class D, air-entrained concrete.

B. Reinforcing Steel: ASTM A616, Grade 60, deformed bars.

C. Curing material: ASTM C309, Type 2, white pigmented.

D. Preformed Expansion Joint Fillers: ASTM D1751 or ASTM D1752.

E. Crushed aggregate base: As specified in Section 31 20 00 Earthwork.

F. Common Fill: As specified in Section 31 20 00 Earthwork.

PART 3 - EXECUTION

3.01 FORMS

A. Steel or wood forms of an approved section shall be used throughout the construction. On radii 3 feet or less, 1/4-inch plywood or masonite shall be used. All forms shall have a height equal to concrete thickness. Built-up, battered, bent, twisted, or broken forms shall be removed from the work. Expansion joint materials shall not be used.

B. Forms shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete. On curbs of sharp radius, plywood or other approved flexible material shall be used in sections short enough to form a smooth, uninterrupted curb which shall not vary from the true radius by more than 1/4 inch. Forms shall not deviate more than 1/8 inch in 10 feet from the true horizontal alignment and no more than 1/8 inch in vertical alignment.

C. Where forms are set above general surrounding area, earth shall be placed along outside edges of forms to ensure stability.

D. Forms shall be cleaned and oiled each time they are used.

E. Forms must be approved by the Engineer prior to placing concrete.

3.02 REINFORCEMENT

A. Place 2 bars in gutter pan as specified in Drawings and in the following areas:

1. Where curb crosses a recently filled trench and extending a minimum of 5 feet beyond trench wall
2. Where fill soil of 18 inches or more occurs.
3. In all valley gutter pans (exception – three bars as shown on the detail drawing)
4. In all path ramps and extending a minimum of 18 inches beyond the bottom of the curb taper or curb transition
5. As directed by the Engineer

3.03 CONCRETE

A. Refer to Section 32 13 13 Concrete Paving, for installation requirements and environmental conditions for pouring and placement of concrete.

3.04 JOINTING

A. Retain paragraph and subparagraphs below if excavation is unclassified and no changes in the Contract Sum or the Contract Time will be authorized for rock excavation.

B. Control (contraction) joints shall be perpendicular to the curb edge, 1-1/2 inch deep, open and free of all excess concrete. Control joints shall be placed at intervals of not more than 10 feet and as indicated on the Drawings.

C. Expansion joints shall be placed at all points of curvature, tangency, and at intervals of not more than 100 lineal feet.

3.05 FINISHING

A. Revise tolerances in this Article to suit office practice if applicable.

B. Concrete shall be struck off true to cross section, after which it shall be finished smooth and even. Face forms, if used, shall be left in place until the concrete has set sufficiently so that they can be removed without injury to the curb. The remaining forms shall be rounded with an edging tool. No tool marks are to be left on exposed edges.

C. A straight edge check is to be made while concrete is still plastic. Irregularities exceeding 1/8 inch shall be corrected. Finish surfaces shall not vary from the required cross section as indicated on Drawings by more than 1/8 inch. They shall not vary from the true horizontal alignment by more than 1/4 inch in 10 lineal feet. Sections exceeding those limitations are subject to rejection and replacing at Contractor's expense.

D. Adding water to the surface of the concrete to assist in finishing operations is not permitted. If a finishing aid is permitted by the Engineer, it shall only be an approved product for that intended purpose and then applied according to the product recommendations.

3.06 RAMPS AND DRIVEWAYS

A. Construct driveway as required by Sacramento County requirements.

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SECTION 32 31 19

SECURITY IRON FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall provide all labor, materials, and appurtenances necessary for installation of an 8-foot tall+ industrial welded iron security fence system around the well site property as shown in the drawings.

B. Fence shall also include one motorized automatic rolling gate, one manual rolling gate, and one pedestrian swing gate as defined herein and as shown on the drawings.

1.02 REFERENCES

A. American Society for Testing Materials

1. A239 Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles
2. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanized) by the Hot-Dip Process. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus
3. A1008/A1008M Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High- Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
4. A1011/A1011M Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low- Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
5. B117 Practice for Operating Salt Spray (Fog) Apparatus
6. D523 - Test Method for Specular Gloss
7. D714 - Test Method for Evaluating Degree of Blistering in Paint.
8. D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
9. D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates
10. D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
11. D3359 - Test Method for Measuring Adhesion by Tape Test
12. E4 Practices for Force Verification of Testing Machines
13. F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets
14. F2814 Guide for Design and Construction of Ornamental Steel Picket Fence Systems for Security Purposes

1.03 SUBMITTALS

A. The Contractor shall prepare all submittals in accordance with Section 01 33 13 Submittals.

B. Product Data:

1. Data sheets
2. Shop drawings

3. Installation procedures with information on materials, dimensions, coatings, and installation requirements

C. Work shall not proceed until after approval of submittal information.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved, materials, and techniques specified for the installation of fence and gate system components.

B. Provide complete fence system and gates, with all components provided by a single manufacturer, including all panels, posts, gates, fittings and hardware.

C. Manufacturer Qualifications: company specializing in manufacturing of steel ornamental picket fence systems with a minimum of 5 years documented experience.

1.05 WARRANTY

A. Fence and gate system shall be warranted against corrosion, cracking, flaking, peeling, fading, blistering, and chipping, and shall be warranted for smooth and reliable gate operation for a two-year warranty period or the manufacturer's standard warranty period, whichever is greater. The Contractor shall not perform any modification or repair work during construction or during the Contractor's warranty period which will void the manufacturer's warranty. Warranty work performed during the warranty period shall be warranted for the remaining duration of the warranty period. Refer to General Conditions for warranty period and additional warranty requirements.

B. If during the warranty period the Contractor fails to perform warranty work in a timely manner, the Owner may have the repairs performed by qualified fence technicians at the expense of the Contractor and their surety.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR FENCES AND GATES

A. Fences and gates shall be supplied by the same manufacturer and shall be of the same family of products to ensure consistent appearance.

B. Fences, gates, and all other hardware shall be black in color. The fence posts, gate frames, braces, rails, and pickets shall be powder coated with a zinc phosphate primer coat and a minimum 2-mil thick semi-gloss or gloss black fusion bond polyester powder topcoat.

C. Braces shall be sized, located, and constructed at the factory with the fence panels or gates by the fence manufacturer. Braces shall be square tubing to match the rails. Wire or threaded braces shall not be acceptable.

D. Fences and gates shall be fully welded except that fence panel sections shall be attached to posts using brackets bolted to the post and bolted, or otherwise secured, to the panel rails. Coatings shall be applied at the factory after welding is complete.

E. Fence and gate posts, rails, pickets, and braces shall be pre-galvanized square steel tubular members manufactured per ASTM F2408, having minimum yield strength of 45,000 psi.

F. Fences and gates shall be Merchant Metals Secure-Weld Plus Kent style, Betafence USA Welded Ornamental Fence System Summit Style, Ameristar Montage Industrial (Welded Steel Fence) Style or approved equal.

2.02 FENCES

A. Posts: Minimum 14 gauge with dimensions shown on the drawings

B. Rails: Minimum 14 gauge with dimensions and quantity per panel shown on the drawings

C. Pickets: Minimum 16 gauge with dimensions shown on the drawings, maximum on center spacing of 5 inches, and solid welded tops

D. Post Caps: Press on type steel caps, zinc plated steel or galvanized malleable steel, and finished to match fence system

E. Panel Hangers and Brackets: Bolted, stainless steel or galvanized steel, and finished to match the fence system

2.03 VEHICLE GATE – ROLLING

A. Posts: Minimum 14 gauge and designed by gate manufacturer based on layout shown on drawings

B. Braces: Minimum 14 gauge and designed by gate manufacturer

C. Horizontal and Vertical Framing: Minimum 14 gauge and designed by gate manufacturer

D. Rails: Minimum 14 gauge, dimensions and quantities as shown on the drawings, and rails of gate shall be at the same height as rails of adjacent fence panels

E. Pickets: Minimum 16 gauge, dimensions and quantities as shown on the drawings, and spacing shall not exceed spacing of fence panel pickets

F. Wheels shall be steel v-wheel designed to carry the weight of the sliding gate.

G. Fence posts and gate posts shall meet the minimum size requirements as required for the entire panel assembly to satisfy the loading conditions according to the Design Criteria as described on Drawing S1.

H. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

I. The joining of the posts to the fence panels shall be welded. Repair coating after welding.

J. Fence post caps shall be welded to the posts. Repair coating after welding.

K. Gate track to be anchored (wet set) to the concrete pad using anchors welded to the bottom of the track. No welded ears on the gate track shall be used.

2.04 FABRICATION

A. Pickets, rails, uprights, and posts shall be cut by the manufacturer to the required lengths.

B. All pickets to be face welded to rails. For roll gates, pickets shall be face welded to roll gate frame. Pickets shall be aligned to standard spacing using a specially

calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by gas shielded metal arc welding, gas tungsten arc welding, or approved fusion welding process, for a completely rigid shop-fabricated panel assembly.

C. Roll gates shall be fabricated using fusion welded fence panel material and minimum 2” sq. x 14-gauge gate ends. All rail and upright intersections shall be joined by the specified welding process. All picket and rail intersections shall also be joined by the specified welding process.

D. All weld slag and spatter shall be removed.

E. Completed gates shall be capable of supporting a 2000-lb. load applied at mid-span without permanent deformation.

2.05 PROTECTIVE COATING

A. The manufactured panels posts, and gates shall be powder coated. The panels and posts shall be treated with a zinc phosphate coating, followed by a minimum 2-mil thick semi-gloss or gloss black fusion bond polyester powder topcoat.

B. The coated panels, posts, and gates shall meet or exceed the coating performance criteria of ASTM F2408, and the performance requirements for each quality characteristic below:

1. Adhesion: ASTM D3359 – Method B. Adhesion (retention of coating) over 90% of the test area (tape and knife test).
2. Corrosion Resistance: ASTM B117, D714, & D1654. Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8” coating loss from scribe or medium #8 blisters).
3. Impact Resistance: ASTM D2794. Impact Resistance over 60 inch lb. (Forward impact using 0.625-inch ball).
4. Weathering: ASTM D822, D2244, D523 (60˚ method). Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.06 MANUFACTURER

A. The fence and gate system shall be provided by a single manufacture:

1. Fences and gates shall be Merchant Metals Secure-Weld Plus Kent style, Betafence USA Welded Ornamental Fence System Summit Style, Ameristar Montage Industrial (Welded Steel Fence) Style or approved equal.
2. Fence and gates shall be 3-Rail style
3. Automatic Gate Opener: The automatic gate opener shall be a heavy duty opener sized to open the gate. The contractor shall submit a gate opener and its associated appurtenances to the Engineer for their approval per Section 01 33 13.
4. Gate operator system shall meet UL325 requirements. Doorking 9150 or equal.
5. Gate Opener Warranty: The contractor shall provide a minimum two-year or standard manufacturer’s warranty, whichever is longer, on the gate opener. Contractor shall fix or replace any failed parts at the Contractor’s cost with the specified warranty period.

PART 3 - EXECUTION

3.01 INSTALLATION OF FENCING

A. Fence posts shall be installed and spaced according to manufacturer's recommended installation procedures. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels and posts shall be joined by welding. Contractor fabricated brackets are not allowed. Posts shall be set in concrete footers of the manufactures design.as shown on the Drawings. Refer to Section 32 13 13 – Concrete Paving, and Section 31 20 00 – Earthwork for additional requirements.

B. When cutting/drilling rails or posts per the manufacturer's installation procedures, adhere to the following steps to seal the exposed steel surfaces:

1. Remove all metal shavings from cut area.
2. Apply coating or coatings over the exposed metal area as recommended by the fence manufacturer. Mask or otherwise protect surrounding areas to minimize or prevent overspray.
3. Use of non-manufacturer approved coatings or coating repair methods which would result in voiding the fence and gate manufacturer's warranty for the fence and gate system are prohibited.

C. Weld gate stop to prevent the slide gates from opening too far.

3.02 INSTALLATION OF GATES

A. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate dimensions and gate hardware selected. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations. Roll gates shall be installed so they comply with current ASTM F2200 & UL325 standards. Gate stops for roll gates shall be installed on each track in a way that conforms to current ASTM F2200 standards.

B. Roll gate wheels shall be bolted to the gate between the wheel plates welded near the ends of the gate bottom rail. The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening. Roller guides shall be affixed to the gate posts at a height even with the gate top rail to hold the gate in a vertical position. Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

3.03 AUTOMATIC VEHICLE ROLLING GATE

A. An automatic vehicle rolling gate shall be installed as shown on the plans. The gate shall be activated from an exit loop that shall be cut into the asphalt on the inside of the fencing to activate the gate to exit the well site property.

B. Gate shall have two safety loops, on either side of the gate. The Gate shall also have a safety edge on the front of the gate. The gate shall be activated using a wireless gate opener. Opener shall also open automatic sliding gate at the District's L Street Pumping Plant.

C. The gate operator shall have automatic obstructions detection with automatic reversal upon obstruction detection.

D. The Contractor shall coordinate with Owner the District's standard gate opener. A magnetic lock shall be provided and engaged to lock the gate whenever it is closed. The gate controller shall be powered by a 120V, single phase circuit.

E. The gate actuator shall be sized for the weight, size and makeup of the gate. Provide a 24-inch deep concrete pad sized for the gate actuator. Gate shall have a pedastal mounted Knox Box (3500 series) and an emergency switch for emergency responders.

3.04 PEDESTRIAN SWING GATE

A. A 3-ft wide pedestrian swing gate shall be installed on the well site property as shown on the plans. The gate shall have welded ears with holes to enable a standard padlock to lock the gate.

3.05 TEMPORARY FENCING

A. Once the permanent ornamental iron fencing and CMU sound wall are installed, the Contractor shall remove the temporary fencing, gates, and posts. The Owner has the option to take down any or all of the temporary fencing if needed for District operations.

**** END OF SECTION ****

SECTION 32 84 13

DRIP IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section covers the installation of an automatic irrigation system for the landscaping that is to be complete and operable.

1. The irrigation system shall include, but not be limited to, all pipes, fittings, drippers, valves, automatic control valve, controller, valve boxes, operating wrenches, riser assemblies, piping, connections, testing, cleanup, maintenance, adjustments and other appurtenances necessary for a complete operating system, ready for immediate use upon completion. Minor items necessary for proper construction and functional operation of this system, not specifically described in the Contract Documents, shall be included as a part of the work of this Section.
2. The Contractor’s attention is called to the fact that all PVC piping, drippers, and accessories are not shown on the Drawings. The Contractor shall furnish and install all piping indicated or required for the proper operation of the drip irrigation system.

1.02 REFERENCES

A. This section contains references to the following documents:

Reference	Title
ASTM D 1784, 1785	Schedule 40, 80 PVC Pipe
ASTM D2464	Schedule 80 Threaded Fittings
ASTM D2466	Schedule 40 Socket Fittings
ASTM D2467	Schedule 80 Socket Fittings

1.03 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 13 Submittals.

B. The following submittals and specific information shall be provided:

1. Submit complete lists of irrigation materials and equipment, include manufacturer's name and address, specific trade names, catalog numbers complete with illustrations and/or necessary descriptive literature and clearly mark or underline proposed items.
2. Controller literature, specifications, installation wiring diagram, and circuit breaker information shall be submitted to the Engineer for review prior to ordering.
3. Shop drawings are required for any irrigation structure as may be specified.
4. Prior to final inspection, submit "as installed" drawings, showing locations of all valves, pipes (lines), heads, dimensions, controllers, control lines, and electrical wires. Accurately dimension location including depths of all piping, valves, and control equipment as installed.

1.04 QUALITY ASSURANCE

A. In addition to other inspection as provided by the Engineer, the Contractor shall give at least 72-hour notice to the Engineer for scheduling the following special inspections:

1. The layout of the system
2. Inspection of trenches, backfilling, and equipment
3. Pressure tests
4. Dripper adjustments
5. Automatic operation

B. The Contractor shall notify the Engineer at least 72 hours prior to performing the tests. All tests shall be performed in the presence of the Engineer. Test requirements shall be:

1. After assembly and installation, all pipes, fittings, automatic equipment, and appurtenances shall be tested at a hydrostatic pressure of 150 psi at the lowest point of the system for not less than 60 minutes.
2. Pipes and valves which show evidence of leakage or fail to be watertight shall be repaired or replaced. After all repairs or replacements have been made, the above-required tests shall be performed again.
3. When the drip irrigation system is completed, the Contractor, in the presence of the Engineer, shall perform a drip test to ensure that all plants and trees are being properly watered. The Contractor shall furnish all material and perform all work required to correct any inadequacies identified. The Contractor shall inform the Engineer of any deviation from the Drawings required due to planting, soil, or site conditions that would impact the irrigation system.

1.05 OPERATING MANUALS AND EQUIPMENT

A. Furnish the District with operating and maintenance manuals for all irrigation system equipment such as automatic controllers.

B. Explain, in detail, all irrigation equipment operation and maintenance procedures to the personnel directed by the Engineer before completion of the project.

C. Provide the District with a reduced legible copy of the "as-installed" irrigation plan hermetically sealed in a plastic cover to be installed in the controller cover.

D. Provide one extra new electric remote control valve

E. Provide five extra drippers of each type that are being used for irrigation.

1.06 WARRANTY

A. Provide a 2-year warranty for the entire irrigation system against defects in materials and workmanship from the date of acceptance of the work.

B. The District reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the District will not relieve the Contractor of his responsibilities under the terms of the warranty.

C. Repair any settlement or backfilled trenches, which may occur during a 30-day period after final acceptance by the Engineer, to the Engineer's satisfaction, without expense to the District, including the complete restoration of all damaged planting, paving, or other improvements of any kind.

PART 2 - PRODUCTS

2.01 PIPE AND FITTING

A. Plastic Pipe:

1. Use Schedule 40 PVC plastic pipe for installation on the discharge side of control valves and Schedule 80 PVC plastic pipe for continuously pressurized pipe on the supply side of control valve unless otherwise indicated.
2. Supply Schedule 80 PVC plastic pipes only, when threaded joints are specified, or otherwise permitted by the Engineer.

B. Fittings and Couplings for Plastic Pipe:

1. Threaded or slip-fitting tapered socket solvent weld type. Provide threaded adapters with socket pipe for connections to threaded pipe. Plastic pipe fittings and couplings shall be PVC I or PVC I/II material supplied in the same schedule size specified for the pipe. The type of plastic materials and schedule size shall be marked on each fitting or coupling.

2.02 VALVE AND VALVE BOX

A. Automatic Control Valves:

1. Provide 1-inch Rain Bird 100-B automatic control valves or approved equivalent.

B. Shutoff Valves:

1. Irrigation shutoff valves shall be all bronze ball type manufactuered by Stockham, Crane, Nibco, Gee, Kennedy, or approved equivalent.
2. Shutoff valves will be installed on the branches of all tees.
3. Where in pavement, the valves shall include traffic rated valve boxes.

C. Valve Boxes and Covers:

1. Precast Portland cement concrete
2. Sized as required for easy access to the valve.
3. Covers shall be cast iron double toggle locking lid.

2.03 IRRIGATION DRIPPER

A. An underground, 1/2-inch, schedule 40 PVC line shall be installed to every tree and shrub.

B. At the tree or shrub, an adjustable dripper shall be installed to water the plants.

2.04 AUTOMATIC CONTROLLER

A. The automatic controllers shall be a Rain Bird SST-600 Indoor Series irrigation timer or an approved equivalent.

B. The timer shall be mounted in a steel, pad-lockable NEMA 3R enclosure mounted to the control building exterior concrete block wall.

C. The enclosure shall be provided with a GFI, 20 amp, 120 volt duplex receptacle.

D. The enclosure shall be powder coated with the color to match the control building's wall per Section 09 96 56 Protective Coatings.

2.05 CONDUCTORS FROM AUTOMATIC IRRIGATION CONTROLLER TO CONTROL VALVE

A. Low voltage control conductors shall be UL approved direct burial type U.F., No. 12 AWG solid copper in accordance with the control equipment manufacturer's recommendation.

B. Provide a 3/4-inch conduit from the enclosure to the control valve for the conductors.

PART 3 - EXECUTION

3.01 GENERAL

A. Inspection:

1. In all cases where inspection of the irrigation system is required and where portions of the work are specified to be performed under the direction and inspection of the Inspector, notify the Engineer at least 48 hours in advance of the times such inspection and direction is required.

B. Verifications:

1. All scaled dimensions are approximate. Carefully check and verify all dimensions before proceeding with any work.
2. Immediately notify the Engineer should any errors or conflicts in the Drawings and specifications and/or actual jobsite conditions be found which would affect the proper execution of the irrigation work.
3. Do not work in areas where such discrepancies occur until further instructed by the Engineer.

3.02 IRRIGATION SYSTEM INSTALLATION

A. General:

1. Perform all work on the irrigation system, including hydrostatic and coverage tests, preliminary operational test of the automatic control system, and the backfill and densification of trenches and other excavations after topsoil work and before planting, except as otherwise provided or directed.
2. With the Engineer's approval, make adjustments where necessary to conform to actual field conditions.
3. Make the irrigation system operational with adequate operation of the individual dripper prior to planting.
4. Make water and utility connections as shown on the drawings.

B. Trench Excavating and Backfilling

1. Size trenches and other excavations to accommodate the irrigation system components, conduits, and other required facilities. Provide additional space to assure proper installation and access for inspections.
2. Unless otherwise specified, the minimum depth of cover over irrigation pipe and its associated conduits shall be as follows:
   a. Electrical conduit cover: 24 inches
   b. Waterlines continuously pressurized: 34 inches
   c. Lateral sprinkler lines – 12 inches.
3. Make the bottom of trenches true to grade and free of protruding stones, roots, or other matter which would prevent proper bedding of pipe or other facilities.

4. Backfill trenches so that the specified thickness of topsoil is restored to the upper part of the trench. Compact trench backfill through paved areas in 8-inch layers to 95 percent relative compaction up to subgrade to receive asphalt concrete paving and base material.
5. Resurface trenches through paved areas to match an existing pavement.

C. Irrigation Pipeline Installation

1. Install pipe fittings in accordance with the manufacturer's recommendations and these Specifications. When requested by the Engineer, furnish the manufacturer's printed installation instructions before pipe installation.
2. Bed pipes in at least 2 inches of finely divided material to provide a firm, uniform bearing. Surround the pipe with additional finely divided material to at least 2 inches over the top of the pipe.
3. Deposit trench backfill sufficient to anchor the pipe before the pipeline pressure testing, except that joints shall remain exposed until satisfactory completion of testing.
4. When two or more pipelines are installed in the same trench, separate the pipelines by a minimum horizontal clear distance of 4 inches. Install equipment so that each pipeline, valve, or other component may be serviced or replaced without disturbing another.
5. Accomplish all assemblies as specified and in accordance with the manufacturer's directions.
6. During installation of pipe, fittings, valves, and other pipeline components, prevent foreign matter from entering the system. Temporarily cap or plug all open ends at cessation of installation operations.
7. Accomplish changes in pipeline size with reducer fittings.

D. Plastic Pipeline:

1. Join plastic pipe with socket type solvent welded fittings, threaded fittings, rubber ring fittings, or by other means specified. Install steel pipe first when plastic pipe is jointed to steel pipe.
2. Cut square, externally chamfer approximately 10 to15 degrees, and remove all burrs and fins.
3. Make solvent welded joints in accordance with ASTM D 2855. Use the solvent recommended by the pipe manufacturer.
4. Install plastic pipe in accordance with ASTM D 2774 and the requirements herein.
5. Exercise care in assembling a pipeline with solvent welded joints so that stress on previously made joints is avoided. Handling of the pipe following jointing, such as lowering the assembled pipeline into the trench, shall not occur prior to the set times specified in ASTM D 2855.
6. Apply solvent to pipe ends in such a manner that no material is deposited on the interior surface of the pipe or extruded into the interior of the pipe during jointing. Wipe off excess cement on the exterior of the joint immediately after assembly.
7. Plastic pipes shall not be field threaded.
8. Make threaded joints using Teflon tape or other approved jointing material. Do not use solvent with threaded joints.
9. Protect pipe from tool damage during assembly. Use vises with padded jaws and strap wrenches for installation of fittings and nipples.
10. Remove and replace plastic pipe which has been nicked, scarred or otherwise damaged.

11. Snake plastic pipe from side to side in the trench to allow 1 foot of expansion and contraction per 100 feet of straight run.
12. Do not expose pipelines to water until a minimum of 24 hours after the last solvent welded joint is made.

E. Installation of Valves, Valve Boxes, and Special Equipment:

1. Provide and install all valves and other equipment in strict accordance with the details in a normal upright position, a minimum of 6 inches from the edge of curbs, walks, or pavement, in planting areas. Make all equipment readily accessible for operation, maintenance, and replacement.
2. Install valves the same size as the pipeline in which they are installed, unless otherwise indicated.
3. Install gate valves below ground. House in an acceptable covered box that will permit access for field servicing. Mark covers of irrigation valves "IRR" in 2-inch size letters.
4. Set valve boxes and valve markers to finish grades on a 12-inch deep layer of 1-inch size crushed rock and set valves at sufficient depth to provide clearance between cover and valve handle or key when the valve is in the fully open position. Place crushed rock below the valve.
5. Do not cover the valve with crushed rock.

F. Automatic Control System Installation

1. Install a complete automatic irrigation control system, including the automatic controller, remote control valve and low voltage direct burial wiring, and all necessary accessories.
2. Leave the control system in operating condition with an operational chart mounted within the controller cabinet upon completion of the work.

3.03 FLUSHING AND TESTING

After completion, and prior to the installation of any terminal fittings, thoroughly flush the entire pipeline system to remove dirt, scale, or other material. After flushing, conduct the following tests in the sequence listed below. Provide all equipment, materials, and labor necessary to perform the tests. Conduct all tests in the presence of the Engineer.

A. Irrigation Line Pressure Test:

1. Perform a water pressure test on all pressure mains and laterals before any couplings, fittings, valves, etc. are concealed. Cap all open ends after the water enters the line in such a manner that all air will be expelled. Test pressure mains with all control valves to lateral lines closed. After the pressure main test, open all valves to test lateral lines. The constant test pressure and the duration of the test are as follows: All pipes shall be pressure tested at 125 psi for two hours.
2. The pressure shall remain above 100 psi for the duration of the test.

B. Individual Dripper Test:

1. Inspect each individual dripper for each of the trees and shrubs to ensure they are functioning correctly. Correct any deficiencies identified.

C. Operational Test:

1. Evaluate the performance of all components of the automatic control system for manual and automatic operation. Make all necessary repairs, replacements, and

adjustments until all equipment, electrical work, controls and instrumentation are functioning in accordance with the Contract Documents.

END OF SECTION

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SECTION 33 11 13
PIPING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies all piping, fittings, valves, and accessories as shown on the drawings.

1.02 REFERENCES

A. Related Sections include the following:

1. Section 01 33 13 Submittals
2. Section 09 96 56 Protective Pipe Coatings
3. Section 33 13 00 Disinfection

1.03 SUBMITTALS

A. Submit data to show that the following items conform to the Specification requirements:

1. Pipe, fittings, and accessories (Product Review)
2. Pipe couplings, flexible pipe pieces (Product Review)
3. Valves, meters, and accessories (Product Review)
4. Temporary Piping and Appurtenances (Product Review)

B. Fittings and Coupling Compatibility: To assure uniformity and compatibility of piping components, fittings and couplings shall be furnished by the same manufacturers.

1.04 FIELD QUALITY CONTROL

A. The Contractor shall be responsible for the costs of additional inspection, retesting or repair incurred by the Owner resulting from non-compliance of defective materials provided by the Contractor.

1.05 STANDARD DETAILS AND SPECIFICATIONS

A. All construction shall meet the requirements of the Owner’s standard Specifications and Details (See Appendix A).

1.06 PIPING SYSTEMS

A. The various piping systems are identified on the Drawings and Specifications. All high points in the water lines shall have air release/vacuum breaker valves and low points in the water lines shall have blow-offs.

1.07 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.

B. All pipes, fittings, valves and coatings shall be lead free and NSF 61 certified.

C. All pipe, fittings and appurtenances shall be painted, coated, and/or encased per Section 09 96 56 Protective Pipe Coatings.

2.02 PIPING MATERIALS

A. All piping shall be as follows unless stated otherwise on the plans:

B. Potable Water Pipe:

1. All exposed pipe shall be fusion bonded epoxy lined and coated steel pipe.
2. All underground pipe smaller than 4 inches shall be schedule 80 PVC
3. All underground pipe 4-inches and larger shall be bitumen coated, mortar lined, Class 350 ductile iron pipe.

C. Copper Tubing (Water Services):

1. Copper tubing shall be seamless copper, conforming to ASTM B88. Unless otherwise specified, copper tubing shall be Type L, drawn, where used in exposed service and Type K, annealed or drawn for buried service.
2. Unless otherwise specified, couplings and fittings for copper tubing shall be compression type, brass or bronze, capable of holding the full bursting strength of the tubing; shall meet the requirements of ANSI BI6.26; and shall be Swagelok, Gyrolok, or equal.

2.03 PIPE COUPLINGS AND ADAPTERS

A. General: For typical pipe joints refer to the pipe material specifications. Other joint devices shall be furnished where called for on the drawings and as specified below.

B. Flexible Couplings:

1. Connecting pipe with identical outside diameters: Romac Style 501 or equal.
2. Couplings to be used only where called for on the drawings or allowed by the Engineer.
3. All joints must be restrained

C. Transition Couplings:

1. Connecting pipe with slightly different outside diameters: Romac style RC501 or equal.
2. Couplings to be used only where called for on the drawings or allowed by the Engineer.
3. All joints must be restrained

D. Flange Coupling Adaptors:

1. For sizes 12-inches and smaller: Romac Style RFCA or equal.
2. For sizes 14-inches and larger: Romac Style RFCA or equal.

2.04 VALVES

A. General Requirements for Valves:

1. Valves of the same size and service shall be provided by a single valve manufacturer.
2. Packing shall be non-asbestos material.
3. Valves installed in a given pipe shall be designed to withstand the pressure rating of the pipe.
4. All threaded stem valves shall open by turning the valve stem counter-clockwise.

B. Buried Valves (Unless otherwise noted or indicated)

1. Valves 2 inches and smaller shall have threaded IP ends.
2. Valves shall use Type 316 stainless steel for the bolts and nuts.
3. Valves 12 inches or smaller shall be resilient wedge flanged or mechanical joint gate valves with valve box
   a. As manufactured by Clow Valve Company or equal.
4. Valves 14 inches and larger shall be flanged butterfly valves with geared, side actuators and valve boxes as manufactured by Bray or equal.

C. Above Grade Isolation Valves

1. Above grade isolation butterfly valves 2 inches and larger shall be a wafer type butterfly valve with operator hand wheels and indicating actuators unless noted in the project plans.
2. Above grade isolation gate valves 4 inches and be shall have a rising stem hand wheel and be:
   a. Resilient wedge AWWA C509 manufactured by Clow Valve Company or an approved equal,
   b. Be coated per Section 09 96 56 Protective Coatings and AWWA C550.
3. Acceptable Manufacturers for Isolation Butterfly Valves
   a. Bray
   b. or an approved equal

D. Butterfly Valves:

1. Valves shall be a flanged AWWA C504 or Bray Series 31 Lugged Style with buried service gear side actuator.
2. Modulating valves shall be the following:
   a. High performance
   b. Carbon steel body
   c. Lug style
   d. Stainless steel disc
   e. Seat material – Resilient
   f. Bray Model 41-466 or an approved equivalent

E. Gate Valves:

1. Gate valves 4 inches and larger shall be resilient wedge AWWA C509 manufactured by Clow Valve Company or an approved equal and shall be coated per Section 09 96 56 Protective Pipe Coatings and AWWA C550.

F. Combination Air Valves:

1. Combination air valves shall be manufactured by APCO 140 C per RLECWD standards, or an approved equal.

G. Check Valves

1. Furnish and install 12-inch check valve as shown on the drawings and as specified herein.
2. Check valves shall be VAG GA Figure 250DS-P2 AWWA C508 Lever & Weight Air Cushioned Swing Check Valve, or equivalent, complete with cast iron body and disc, ductile iron disc arm, steel cover, 316 stainless steel body seat, Buna-N disc seat and seals, teflon shaft packing, 303 stainless steel keyed shaft, Carboline 891 NSF-61 certified epoxy coated interior and exterior, minimum 6 mil DFT, 316 stainless steel external fasteners, FF&D 125 ANSI Flanges.

2.05 FITTINGS

A. General Requirement for Fittings:

1. All below grade fittings smaller than 4 inches shall be PVC schedule 80 glue fittings.
2. All below grade fittings 4 inches and larger shall be cast iron mechanical joint type (restrained) with thrust blocks sized by the Contractor.
3. All above grade bends and tees shall be standard long radius welded fittings.
4. All tapping sleeves shall be full wrap and stainless steel.

2.06 FLANGE ASSEMBLIES

A. Flanges:

1. General:
   a. Flanges shall either be flat flanges or convoluted ring flanges as specified in the following paragraphs.
2. Flat Flanges:
   a. Cast iron flanges shall be faced in accordance with ANSI B 16.1. Where companion flanges are used, the flanges on pipe shall be refaced to be flush with the companion flange face.
   b. Class 150 and Class 300 forged steel flanges shall be raised face conforming to ANSI BI6.5. Lightweight slip-on flanges shall be plain face conforming to AWWA C207, Class B and ANSI BI6.5.
   c. Unless otherwise specified, steel flanges shall be ANSI BI6.5, Class 150 or AWWA C207, Class D. Class E AWWA flanges shall be provided where test pressure exceeds 175 psi. Plain faced flanges shall not be bolted to raised face flanges.

B. Gaskets:

1. Gasket material shall be as specified in paragraph 15085-2.03. Gaskets for plain faced flanges shall be the full face type. Thickness shall be 1/16 inch for pipe 10 inches and less in diameter and 1/8 inch for pipe 12 inches and larger in diameter. Unless otherwise specified, gaskets for raised face flanges shall match the raised face and shall be 1/16 inch thick for pipe 3-1/2 inches and less in diameter and 1/8 inch thick for pipe 4 inches and larger.

C. Bolts:

1. Flange assembly bolts shall be ANSI B 18.2.1 standard square or hexagon head bolts with ANSI B 18.2.2 standard hexagon nuts. Threads shall be ANSI B1.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B 16.5.

2. Unless otherwise specified, bolts shall be carbon steel machined bolts with hot pressed hexagon nuts. Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04 or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, 1ow-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.

2.07 BACKFLOW PREVENTION DEVICES

A. Backflow prevention devices will be a reduced pressure principle device (RPP).

B. The approved list of backflow prevention assemblies is available from the University of Southern California's Foundation for Cross-Connection Control and Hydraulic Research website located at fccchr.usc.edu/_downloads/List/list.pdf.

C. A 1-inch RPP Backflow Prevention Device shall be used on the water service to the chemical building.

D. A 1-inch RPP Backflow Prevention Device shall be used for irrigation service to frontage landscaping.

2.08 FREEZE PROTECTION

A. Backflow Prevention Devices

1. Backflow prevention devices shall have an insulation blanket installed for freeze protection
2. Insulation blankets shall be manufactured by
   a. Dale's Canvas
   b. or an approved equivalent
3. Color to be green

B. 2-inch or Smaller Exterior Above Grade Piping

1. Piping shall be required to have freeze protection
2. Freeze protection shall consist of elastomeric pipe insulation wrapped with poly tape by K-Flex or an approved equivalent

**** END OF SECTION ****

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SECTION 33 12 23
VERTICAL TURBINE PUMP

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies materials, testing and installation of variable speed, water lubricated vertical turbine pumps.

1.02 REFERENCES

A. The vertical turbine pump and its accessories shall be furnished, installed and disinfected per the American Water Works Association standards latest edition.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 13.

B. Submit shop drawings and Product Data: Submit the following as a single complete initial submittal:

1. Product data to demonstrate that the equipment conforms to the Specifications
2. Pump maintenance manuals and requirements
3. Motor data
4. Pump layouts and dimensions
5. Pump performance curves
6. Bearing life calculations
7. Critical speed calculations

C. Performance Testing: Submit certified non-witnessed factory performance test

D. Manuals: Furnish manufacturer’s installation, lubrication, operations and maintenance manuals, bulletins, and spare parts lists.

E. Manufacturer's certification of compliance with AWWA E101.

F. As part of the final test procedure for the pump, record measurements for impeller adjustment and total lateral shaft deflection (shaft runout) above the stuffing box.

G. Affidavits: Submit affidavit from the manufacturer stating that the equipment has been properly installed, adjusted, and tested and is ready for full time operation. This will require that the manufacturer provide a certified trained technician to be on the construction site for two 8-hour days during installation of the vertical turbine pump and equipment and two 8-hour days during start-up, which will include trouble shooting with defect corrections, and training the District’s operational staff on the proper operation and maintenance of the pump, motor and appurtenances.

H. Field pump performance tests results.

1.04 QUALITY ASSURANCE

A. Equipment furnished under this Section shall be supplied by a single manufacture who has been regularly engaged in the design and manufacture of this equipment at least ten years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pumps: Weir Floway, Flowserve or approved equal

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. The following criteria shall be used for pump selection:

1. Pump head shall continuously decrease with increasing flow.
2. Rotation of the pump's line shaft and impellers shall be counter-clockwise when viewed from above.
3. All alternative pump selections shall meet or exceed the efficiency of the recommended pump selections.

2.03 EQUIPMENT

A. Provide a vertical turbine pump including the bowl assembly, column, pipeline shaft and guides, discharge head and electric motor. Comply with construction features of AWWA E101 except where indicated differently in this Specification. Pump can coating shall comply with ANSI/NSF 61 requirements.

B. Pump Construction:

1. Discharge Assembly:
   a. Provide a fabricated steel discharge assembly with a surface seal flange. The discharge assembly shall have bolted register or rabbet-fit connections for the motor. Discharge assembly shall have connections for the pump column and discharge piping and shall support the loadings which they impose as well as section and pipe load, hydrostatic and hydrodynamic heads. The discharge head shall be machined as one unit.
   b. Access to the stuffing box shall be through windows placed 90 degrees from the discharge. Fit hand holes and/or windows with Type 304 stainless steel expanded metal hinged guards to protect the exposed shaft and coupling.
   c. The discharge shall be flanged with a 12-inch Class 150 flange for connection to the discharge piping.
   d. A ½-inch threaded connection for a ½-inch gate valve and air release valve to remove air accumulating in the pump can.
   e. Provide for lifting the discharge head by means of heavy duty lifting eyes that are capable of sustaining the weight of the complete unit less the motor.
2. Stuffing Box:
   a. The design of the stuffing box shall provide space and clearance for removal and service of the packing without moving or disconnecting the motor. The packing will be five rings (minimum) of packing plus a lantern ring, throttle bushing, and repacking space.
3. Packing: Regular braid, square cross-section, graphite-lubricated and impregnated non-asbestos packing such as Garlock Style 8909 or equal.
4. Lubrication: The pump shall have an open line shaft that is water lubricated.
5. Close Coupled Pump: The pump shall be close coupled with the pump shaft extending through the stuffing box and coupled to the motor shaft. The pump shaft shall be made of 416 stainless steel. The pump and motor shafts shall be of a two piece design with a coupling located between the pump and motor for ease of installation. The coupling shall be centered in the middle of the discharge head.

6. Shafts:
    a. Shafting shall be polished over its full length. Support the shafting by bearings at intervals no greater than 10 feet.
    b. The bearings shall be bronze water lube spiders Alloy C-844 Bronze (sand cast) and FSB rubber inserts SBR compound (Equal to commercial grade neoprene) shore hardness is 65-75 with a temperature range of up to 170°F.
    c. Total lateral deflection of the shaft (runout) above the stuffing box shall not exceed 0.003-inch total indicator reading. Shaft couplings shall be threaded. The ends of the shaft will be machined perpendicular to the axis of the line shaft.
7. Bowl assembly
    a. The bowl assembly shall consist of the bowl, impeller and impeller shafting, and bearings. Bearings shall be located above and below the impeller. Impellers shall be statically balanced.
    b. The pump bowl shall be of the material listed under the subsection on "Pump Materials of Construction." The bowl shall be sufficiently rigid to prevent adverse changes in bearing alignment and to maintain the running clearance of seal rings. Waterways and the diffusion vanes shall be smooth and free from nodules, bumps, and dips. For enclosed impellers only, provide the bowls with a renewable wear ring adjacent to the impeller, made of bronze as indicated under "Pump Materials of Construction."
8. Impellers
    a. Pump impellers shall be of the open, semi open or enclosed type made of the material listed in the subsection on "Pump Materials of Construction" and shall be cast in one piece. Machine to fit the contour of the bowl, hand file in the waterways, and equip with replaceable wearing rings or with wearing-ring hubs for mounting wear rings in future repair cycles (enclosed type only). Attach impellers to the shaft in such a manner that they cannot become loose under any operating condition or under reverse rotation. Provide for adjustment of the axial position of the impeller at the motor connection to the head shaft so that proper clearance between bowls and impellers may be maintained.
9. Vortex suppressor: A vortex suppressor shall be installed on the suction of the pump to prevent water vortexing in the pump suction can.

C. Vibration

1. A Reed Critical Frequency (RCF) calculation on the discharge head and motor is required to verify that the discharge head design does not have a critical frequency within 20 percent of the operating range. The calculation shall be a part of the pump submittal prior to fabrication of the discharge head.
2. The maximum vibration level measured on the top motor bearing housing at the rated pump speed (+10%) and at any total head for which efficiencies are shown on the manufacturer's published performance curve shall not exceed that shown in Figure 77 of the Hydraulic Institute Standards.

D. Pump materials of construction

1. Materials of construction shall conform to the requirements listed below. Materials of construction for components not listed below shall conform to AWWA E101, Part A, Table 1, except that the materials shall be considered required, not typical.

Component	Material
Pump head shaft and couplings	Stainless steel, Type 416
Bearing retainers	Bronze
Impellers	Bronze;
Impeller wear ring	Bronze; (enclosed only)
Bowl wear ring	Bronze; (enclosed only)
Lantern ring	Bronze; see Paragraph 2 below
Bowl discharge case	Ductile iron
Bowl suction case	Ductile iron
Intermediate Bowls	Cast Iron, Class 30
Pump bowl bolts	Stainless steel, Type 630
Bowl bearings	Bronze; see Paragraph 2 below
Lineshaft bearings	Neoprene
Lineshaft sleeves	Stainless steel, Type 416
Discharge head	Fabricated steel
Vortex Suppressor	Type 316 Stainless Steel
Line shaft	Type 416 Stainless Steel
Bolts and nuts for discharge head	Bolts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M, with tensile strength of 139,000 psi and yield of 106,000 psi Nuts shall be type 316 stainless steel conforming to ASTM A194, Grade 8M
Gland bolts and nuts	Stainless steel, Type 316
Any bronze components in contact with water	See Paragraph 2 below

2. For enclosed impellers, the impeller wear ring shall be bronze.

E. Motor:

1. Provide hollow shaft vertical motors for outdoor service, suitable for operation at 480 volts, Nameplate motor horsepower shall not be exceeded at any flow on the pump curve excluding the service factor. The pump motor shall be suitable for operation with a variable frequency drive (VFD).
2. The motor bearing shall withstand any momentary up thrust.

PART 3 - EXECUTION

3.01 SERVICE CONDITIONS

A. There will be one (1) Vertical Turbine Booster Pumps each designed as follows:

B. Design Flow: 1,500 gpm at 335-ft total dynamic head with a minimum efficiency of 81%.

C. Minimum Flow: 400 gpm at 650-ft total dynamic head

D. Liquid pumped: Potable Water

E. Maximum pump speed: 1,770 rpm

F. Motor horsepower: 200 HP

G. Pump lubrication: open line shaft

H. Discharge flange rating: Class 150

I. Discharge Head: Class 150 discharge flange

J. Bearing lubrication: Water

K. Pump model:

1. Weir Floway Model 14DKL
2. Or an approved equal

3.02 INSTALLATION

A. Verify that the installed pump is fully self-supporting before bolting pipe flanges, so that no strain is imparted on the flanges, pipes, or pipe supports from the pump assembly. Adjust the position of the pump assembly so that the pump flanges are plumb and aligned with the adjacent pipe flanges. Do not use temporary shims or jacking nuts for leveling, aligning, or supporting equipment.

B. Provide continuous protection of the installed equipment from the elements, dust, debris, paint spatter, or other conditions which will adversely affect the unit's operation or appearance until such time as the equipment is scheduled for start-up testing.

C. The pump and motor installation shall be done by a qualified contractor with a State of California A, C61, D21 contractor license.

3.03 FIELD TESTING

A. With Engineer on-site, bump motor to ensure that motor has been connected for proper counterclockwise rotation.

B. Perform field tests on the installed pump to demonstrate that it performs according to the specified service conditions. If the measured flows are more than 5% below the specified service conditions adjust the impellers or provide new impellers or otherwise repair or replace the pump.

C. Conduct vibration level tests with the pump operating at motor speeds from the manufacturer’s recommended minimum speed to 100 percent. Adjust or replace the pump if it exceeds the maximum vibration levels.

D. Test the pump system to determine its overall efficiency. This test shall consist of measuring flow, discharge pressure, pumping level, and electrical input kilowatts to the motor at the operating service point on the pump curve and determine the ratio of power input to the water to the electrical input power to the motor ("wire-to-water efficiency"). Results of this test to be submitted to the Engineer.

**** END OF SECTION ****

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SECTION 44 44 13

CHEMICAL TREATMENT EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the chemical treatment equipment and appurtenances for feeding sodium hypochlorite (chlorine).

B. The Contractor shall furnish and connect the following chemical feed equipment to operate as intended by these specifications and as shown on the drawings:

C. Chlorine Feed System:

1. The chlorine feed system will feed liquid sodium hypochlorite paced from the flow from Well 16. The purpose of the feed system is to provide chlorine disinfection for the well water. The system shall consist of at least the following:
   a. One chlorine metering pump with accessories.
   b. 400-gallon chemical storage tank to store chlorine. The chemical storage tank will feed the chemical feed system.
   c. 2-inch PVC conduit with long radius sweeps will be installed with 3/8-inch polyethylene solution tube from the chlorine feed pump to the chlorine injection point as shown on the drawings. There is also a 3/8-inch polyethylene solution tube from the chlorine tank to the chlorine feed pump. The solution tube must have a pressure rating of 125 psi.
   d. 3/8-inch corporation stop with diffuser tube and check valve at injection location.
   e. Control panel with separate I/O, indicators, and HOA switch.

D. Eye Wash – Chemically resistant to chlorine

E. Chemical sump – Chemically resistant to chlorine.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 13 Submittals the following for the chemical treatment equipment and all associated equipment:

1. Chlorine system layouts with accessories
2. Wiring and connection diagrams indicating all electrical connections
3. Piping connections, locations, sizes, and details for all fittings
4. Proposed on-site installation, testing, and start-up procedures
5. Catalog information and materials list
6. Operation and maintenance information

1.03 ENVIRONMENTAL CONDITIONS

A. The equipment will be located inside a ventilated chemical room that is a corrosive environment due to the off gasses of sodium hypochlorite.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. The following is a list of the equipment to be provided as part of this project. Some equipment is listed as sole source and no alternative will be accepted. Other

equipment will be open to alternative manufacturers and will be specified with an “or an approved equal”.

B. Well 16 Chlorine Feed System:

1. Prominent pre-engineered skid mounted chemical feed system. The system includes one cord and plug chemical feed pump (ProMinent gamma/X) designed to produce 13 gpd, 4-20 mA variable speed and provisions to support the control panel from the skid.
2. Custom engineered control panel supplied by the manufacturer of the chemical pumps with 120V controls for the following:
    a. Hand-Off-Auto for the pump – in hand the pump shall run as configured on the pump, in off the pump shall not run, in auto the pump shall run as paced off the flow signal from the PLC with start signal (see below) present
    b. Terminals for the 4-20mA flow signal for the pump from the PLC and provisions to pass the signal to the pump
    c. Terminals to interconnect the pump to the control panel with waterproof, quick connect style connectors
    d. NEMA 4X non-metallic enclosure
    e. Dry contacts for the PLC to monitor auto status of the pump
    f. Provisions to remotely monitor a dry contact start signal from the PLC for the pump, start signal shall only affect pump operation when the HOA is in auto, and when the start signal contact is closed the pump shall pace off the flow signal and when not closed the pump shall not run
    g. 6-foot grounded cord and plug for power

C. Chlorine Storage Tank:

1. Tank material to be polyethylene and double contained
2. 400-gallon storage capacity of chlorine
3. Approximate dimensions:
4. One 3/8-inch PVC flanged tank outlet with one 3/8-inch PVC flanged ball valve located on the shell near the bottom of the tank
5. One 3/8-inch flanged adapter to connect 3/8-inch tubing to tank outlet flange. 3/8-inch tubing to be split and connected to both chemical feed pump stations.
6. One 1-inch PVC flanged roof connection for ultrasonic chemical level transducer
7. One 2-inch PVC flanged roof tank inlet with an extension and quick connect coupling for tank filling
8. One 1-inch for tank to be vented outside
9. One corrosion resistant site glass for tank chlorine level with associated tank shell connections
10. Tank Restraint System
11. Metal components to be stainless steel
12. Seismic restraint system to be designed to meet the seismic requirements for Rio Linda, CA per Section 22 05 48 Seismic Requirements

D. Eye Wash

1. Bradley Shower and Eye Wash Model S19314UU
2. Haws
3. or an approved equal.

E. Chemical Containment Sump

1. The chemical containment sump will be made out of 4-ft diameter concrete pipe that is 5 ft deep and sealed at the bottom. The chemical room will be piped to drain in the sump if there is a chemical spill. An aluminum pedestrian rated cover with 2-ft by 2-ft hatch will cover the containment sump.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Well 16 Chlorine Feed System:

1. The contractor shall connect the chlorine tank to the chlorine feed system with ½-inch tubing. For the chemical feed pump discharge, a ½-inch tubing will be pulled through the 2-inch PVC and connect the chemical feed pumps to Well 16's injection point with a check valve, corporation valve and diffuser.

B. All chemical feed equipment shall be aligned, connected, and installed in accordance with manufacturer's written recommendations and located as shown on the drawings.

3.02 TESTING

A. After completion of installation, the chemical feed equipment shall be tested to demonstrate compliance with operating requirements as specified by a representative of the chemical feed pump supplier. The representative shall be regularly engaged in testing, troubleshooting and maintaining chemical feed pumps.

3.03 TRAINING

A. A minimum of four hours of training shall be provided by the chemical feed pump manufacturer.

3.04 WARRANTY

A. The pump manufacturer shall warrant the units against defects in materials and workmanship for a period of two years.

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APPENDIX A

Geotechnical Report by
Youngdahl Consulting Group

GEOTECHNICAL ENGINEERING STUDY
FOR
RIO LINDA – ELVERTA WELL 16
U Street
Rio Linda, California

Project No. E19078.000
May 2019

YOUNGDAHL
CONSULTING GROUP, INC.
Building Innovative Solutions

YOUNGDAHL CONSULTING GROUP, INC.
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35 YEARS

Domenichelli and Associates, Inc.
1101 Investment Boulevard, Suite 115
El Dorado Hills, CA 95762

Project No. E19078.000
24 May 2019

Attention: Ms. Christine Rice

Subject: **RIO LINDA – ELVERTA WELL 16**
U Street, Rio Linda, California
GEOTECHNICAL ENGINEERING STUDY

References:
1. Conceptual Well 16 Site Plan and Connection to Distribution System, prepared by EKI Environment and Water, dated December 2018 (EKI B80131.00).
2. Subconsultant Agreement between Youngdahl Consulting Group, Inc. and Domenichelli and Associates, Inc., dated 6 March 2019.
3. Change Order No. 1 to Subconsultant Agreement between Youngdahl Consulting Group, Inc. and Domenichelli and Associates, Inc., dated 1 April 2019.

Dear Ms. Rice:

In accordance with your authorization of the referenced subconsultant agreement and change order (Ref. Nos. 1 and 2), Youngdahl Consulting Group, Inc. has performed a Geotechnical Engineering Study for the Rio Linda - Elverta Well 16 project located on U Street in Rio Linda, California. The purpose of this study was to perform a subsurface exploration and evaluate the surface and subsurface conditions at the site and provide geotechnical information and design criteria for the proposed project. Our scope was limited to a subsurface investigation, laboratory testing, and preparation of this report per the referenced proposal.

Based upon our site reconnaissance and subsurface exploration program, it is our opinion that the primary geotechnical issue to be addressed is the presence of expansion potential of the near-surface soils; however, other geotechnical issues may become more apparent during grading operations which are not listed above. The descriptions, findings, conclusions, and recommendations provided in this report are formulated as a whole; specific conclusions or recommendations should not be derived or used out of context. Please review the limitations and uniformity of conditions section of this report.

This report has been prepared for the exclusive use of Domenichelli and Associates, Inc. and their consultants, for specific application to this project, in accordance with generally accepted geotechnical engineering practice at this time. Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,
Youngdahl Consulting Group, Inc.

Kyle J. Martinez, P.E.
Project Engineer

Distribution: PDF to Client

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING STUDY
FOR
RIO LINDA – ELVERTA WELL 16

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering study performed for the proposed development of the Rio Linda - Elverta Well 16 site on U Street in Rio Linda, California. An annotated vicinity map is provided on Figure A-1 in Appendix A to identify the approximate project location.

Purpose and Scope

The purpose of this study was to explore and evaluate the surface and subsurface conditions at the site, to provide geotechnical information and design criteria, and to develop geotechnical recommendations for the proposed project. The scope of this study includes the following:

- A review of geotechnical and geologic data available to us at the time of our study;
- A field study consisting of a site reconnaissance, followed by a subsurface investigation program to observe and characterize the subsurface conditions;
- A laboratory testing program performed on representative samples collected during our field study;
- Engineering analysis of the data and information obtained from our field study, laboratory testing, and literature review;
- Development of geotechnical recommendations regarding earthwork construction including, site preparation and grading, soil moisture conditions, engineered fill criteria, underground improvements, and drainage;
- Development of geotechnical design criteria for seismic conditions, shallow foundations, thrust blocks, differential support conditions, slabs on grade, and pavements;
- Preparation of this report summarizing our findings, conclusions, and recommendations regarding the above described information.

Project Understanding

Based upon our review of the Reference 1 plan, the project is proposed to entail the development of the Rio Linda – Elverta Community Water District's Well 16 site on the north side of U Street, between Dry Creek Road and 14th Street in Rio Linda, California. We understand that site improvements will include a new water well pump and pedestal, emergency generator, concrete masonry unit (CMU) control building, asphalt concrete and Portland Cement concrete (PCC) pavement, perimeter CMU soundwall, fencing, and additional support equipment. Also as part of the project, new 8 and 12-inch diameter water mains will be installed along U Street and 14th Street and tie into the well site. We anticipate that the control building and soundwall will be supported by conventional shallow foundations; the emergency generator and other support equipment will be supported by mat slab foundations. The new water mains are anticipated to be installed via open-trench methods.

Background

Based upon our limited review of areal imagery, the well site was roughly graded between 2016 and 2018. Grading appears to have involved the placement of aggregate base within the general well site and a gravel all-weather access road from U Street.

If studies or plans pertaining to the site exist and are not cited as a reference in this report, we should be afforded the opportunity to review and modify our conclusions and recommendations as necessary.

2.0 FINDINGS

The following section describes our findings regarding the site conditions that we observed during our site reconnaissance and subsequent subsurface exploration. In addition, this section also provides the results of our laboratory testing, geologic review, and engineering assessment related to the project site.

Surface Observations

The existing rectangular well site is approximately 14,000 square feet and located on the north side of U Street, between Dry Creek Road and 14th Street. As mentioned previously, the site is surfaced with aggregate base with a gravel all-weather access road providing access from U Street. An existing well is located on eastern portion of the site. The site is relatively flat and is vegetated with tall seasonal grasses within, and beyond the limits, of the aggregate base. The areas of the planned water mains are located within paved portions of U Street and 14th Street.

Subsurface Conditions

Our field study included a site reconnaissance by a representative of our firm followed by a subsurface exploration program conducted on 3 May 2019. The exploration program included the drilling of four borings with a truck-mounted CME 45 and track-mounted CME 55 drill rigs. The borings were drilled to a maximum depth of 21.5 feet below the existing ground surface at the approximate locations shown on Figure A-2, in Appendix A. A description of the field exploration program is provided in Appendix A.

Subsurface soil conditions were generally similar throughout the extent of the site, consisting of cemented lenses of CLAY, SILT and SAND. The fine grained (clay and silt) soils were logged as being in a medium stiff to hard condition, while the coarse grained (sand) was logged as being medium dense to very dense; all soils were found to be slightly moist to moist at the time of drilling.

A more detailed description of the subsurface conditions encountered during our subsurface exploration is presented graphically on the “Exploratory Boring Logs", Figures A-3 through A-5, Appendix A. These logs show a graphic interpretation of the subsurface profile, and the location and depths at which samples were collected.

Groundwater Conditions

Groundwater conditions were not observed within any of the exploratory borings. Our review of the California Department of Water Resources website indicates that groundwater is likely in excess of 50 feet below the ground surface. This report was prepared to evaluate support of the proposed surface improvements and did not include an evaluation for water depth or quality.

Geologic Conditions

The geologic portion of this report included a review of geologic data pertinent to the site and an interpretation of our observations of the surface exposures and our observations in our exploratory test pits excavated during the field study.

The subject property is located in Elverta, California, which is found within the Great Valley geomorphic province. This province is an approximately 50- by 400-mile alluvial plain that drains via the Sacramento and San Joaquin Rivers into the San Francisco Bay area. This valley is filled

with sediments as thick as 20,000 to 40,000 feet and represents a fore-arc basin between the Sierra Nevada to the east and accretionary Coast Ranges to the west.

According to the Preliminary Geologic Map of the Sacramento 30' x 60' Quadrangle, California (Gutierrez, 2011), the subject property and vicinity are underlain by the middle member of the Pleistocene age Riverbank Formation (map symbol Qr_2). This formation consists primarily of arkosic sediment (weathered gravel, sand, and silt) derived mainly from the interior of the Sierra Nevada and deposited between 0.13 Ma and 0.45 Ma (Marchand and Allwardt, 1981). The middle unit is associated with a broad alluvial surface consisting of westward-thickening sandy alluvium over eroded Turlock Lake Formation (Marchand & Allwardt, 1977).

Seismicity

According to the Fault Activity Map of California and Adjacent Areas (Jennings, 2010) and Alquist-Priolo Regulatory Fault Map, no active faults or Earthquake Fault Zones (Special Studies Zones) are located on the project site. Additionally, no evidence of recent or active faulting was observed during our field study. The nearest mapped potentially active and active faults pertinent to the site are summarized in the following table.

Table 1: Local Active and Potentially Active Faults

Activity	Fault Name	Distance, Direction
Historic	Cleveland Hill Fault	81 km N
Historic	Green Valley Fault Zone	78 km SW
Historic	Concord Fault	93 km SW
Historic	West Napa Fault	90 km SW
Active	Cordelia Fault	80 km SW
Active	Hunting Creek Fault	84 km NW
Active	Clayton Fault	94 km SW
Active	Dunnigan Hills	47 km W
Potentially Active	Highway 49 Fault	44 km NE
Potentially Active	Rescue Fault	40 km ENE
Potentially Active	Dewitt Fault	38 km NE
Potentially Active	Deadman Fault	36 km NE
Potentially Active	Giant Gap Fault	80 km NE
Potentially Active	Spenceville Fault	37 km NE
Potentially Active	Ione Fault	61 km SE
Potentially Active	Poorman Gulch Fault	75 km SE
Potentially Active	Vaca Fault	62 km SW
Potentially Active	Soda Creek Fault	83 km SW

Based on our literature review of shear-wave velocity characteristics of geologic units in California (Wills and Silva; August 1998: Earthquake Spectra, Volume 14, No. 3) and subsurface interpretations, we recommend that the project site be classified as Site Class D in accordance with Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10.

Earthquake Induced Liquefaction, Surface Rupture Potential, and Settlement

Liquefaction is the sudden loss of soil shear strength and sudden increase in porewater pressure caused by shear strains, as could result from an earthquake. Research has shown that saturated,

loose to medium-dense sands with a silt content less than about 25 percent and located within the top 40 feet are most susceptible to liquefaction and surface rupture/lateral spreading.

Due to the absence of permanently elevated groundwater table, the relatively low seismicity of the area and the very dense/hard condition of the subsurface soils, the potential for seismically induced damage due to liquefaction, surface ruptures, and settlement is considered negligible. For the above-mentioned reasons mitigation for these potential hazards is not considered necessary for the development of this project.

Laboratory Testing

Laboratory testing of the collected samples was directed towards determining the physical and engineering properties of the soil underlying the site. A description of the tests performed for this project and the associated test results are presented in Appendix B. In summary, the following tests were performed for the preparation of this report:

Table 2: Laboratory Tests

Laboratory Test	Test Standard	Summary of Results	
Direct Shear	ASTM D3080	B-2: 0-5’	Φ = 36.6°, c = 301 psf (90% RC)
Maximum Dry Density	ASTM D1557	B-2: 0-5’	DD = 127.3 pcf, MC = 9.5 %
Expansion Index	ASTM D4829	B-3: 0-5’	EI = 44
Resistance “R” Value	CTM 301	B-1 & B-3: 0-5’	“R” Value = 27

Soil Expansion Potential

Plastic materials (clay soils) were encountered within three of the exploratory borings drilled at the site. The lenses were found within the uppermost 2 to 3 feet below the existing ground surface. Expansion index testing was performed on a sample of the clay and resulted in a value of 44. Based upon the expansion index test results, and per Section 1803.5.3 of the 2016 CBC, the clay encountered at the site is considered to be expansive. In concentrated amounts, such clays can cause distress of concrete slabs and foundations if present within the upper 5 feet of structural improvement areas. To reduce the potential for damage related to expansive soils, some focused excavations of the clay may be necessary.

3.0 DISCUSSION AND CONCLUSIONS

General

Based upon the results of our field explorations, findings, and analysis described above, it is our opinion that construction of the proposed improvements is feasible from a geotechnical standpoint, provided the recommendations contained in this report are incorporated into the design plans, specifications, and implemented during construction.

Foundations

In our opinion, conventional shallow foundations such as continuous footings and mat slabs will provide adequate support for the proposed improvements if the site grades are properly prepared as described in Section 4.0 of this report. Recommendations regarding foundation design parameters, including allowable bearing capacity, lateral resistance, and foundation configuration are provided in Section 5.0 of this report.

4.0 SITE GRADING AND EARTHWORK IMPROVEMENTS

Site Preparation

Preparation of the project site should involve site drainage controls, dust control, clearing and stripping, expansive soil mitigation, overexcavation and recompaction, and exposed grade compaction considerations. The following paragraphs state our geotechnical comments and recommendations concerning site preparation.

Site Drainage Controls: We recommend that initial site preparation involve intercepting and diverting any potential sources of surface or near-surface water within the construction zones. Because the selection of an appropriate drainage system will depend on the water quantity, season, weather conditions, construction sequence, and methods used by the contractor, final decisions regarding drainage systems are best made in the field at the time of construction. All drainage and/or water diversion performed for the site should be in accordance with the Clean Water Act and applicable Storm Water Pollution Prevention Plan.

Dust Control: Dust control provisions should be provided for as required by the local jurisdiction's grading ordinance (i.e. water truck or other adequate water supply during grading).

Clearing and Stripping: Clearing and stripping operations should include the removal of all organic laden materials including trees, bushes, root balls, root systems, and any soft or loose soil generated by the removal operations. Surface grass stripping operations are necessary based upon our observations during our site visit. Short or mowed dry grasses may be pulverized and lost within fill materials provided no concentrated pockets of organics result. It is the responsibility of the grading contractor to remove excess organics from the fill materials. **No more than 2 percent of organic material, by weight, should be allowed within the fill materials at any given location.**

General site clearing should also include removal of any loose or saturated materials within the proposed structural improvement and pavement areas. A representative of our firm should be present during site clearing operations to identify the location and depth of potential fills not disclosed by this report, to observe removal of deleterious materials, and to identify any existing site conditions which may require mitigation or further recommendations prior to site development. Preserved trees may require tree root protection which should be addressed on an individual basis by a qualified arborist.

Expansive Soil Mitigation: As discussed previously, expansive clays were encountered within the uppermost 2 to 3 feet below the existing ground surface. Therefore, focused excavations of the clay may be necessary in the foundation areas. Final determination of mitigation measures should be based on the conditions observed during grading and foundation construction.

Overexcavation and Recompaction: Following site clearing and stripping operations, areas to receive mat slab foundations should be overexcavated to a minimum depth of 12 inches below planned bottom-of-slab elevation. The uppermost 12 inches below mat slabs should consist of ¾-inch aggregate base, placed in accordance with the engineered fill criteria discussed below. If shallow continuous foundations and a slab-on-grade floor are utilized for the planned control building, the building area should be similarly overexcavated and the slab should be underlain with a minimum of 12 inches of ¾-inch aggregate base.

Exposed Grade Compaction: Exposed soil grades following initial site preparation activities should be scarified to a minimum depth of 8 inches and compacted to the requirements for engineered fill. Prior to placing fill, the exposed subgrades should be in a firm and unyielding

state. Any localized zones of soft or pumping soils observed within a subgrade should either be scarified and recompacted or be overexcavated and replaced with engineered fill as detailed in the engineered fill section below.

Soil Moisture Considerations

The near-surface soils may become partially or completely saturated during the rainy season. Grading operations during this time period may be difficult since compaction efforts may be hampered by saturated materials. Therefore, we suggest that consideration be given to the seasonal limitations and costs of winter grading operations on the site. Special attention should be given regarding the drainage of the project site.

If the project is expected to work through the wet season, the contractor should install appropriate temporary drainage systems at the construction site and should minimize traffic over exposed subgrades due to the moisture-sensitive nature of the on-site soils. During wet weather operations, the soil should be graded to drain and should be sealed by rubber tire rolling to minimize water infiltration.

Engineered Fill Criteria

All materials placed as fills on the site should be placed as “Engineered Fill" which is observed, tested, and compacted as described in the following paragraphs.

Suitability of Onsite Materials: We expect that soil generated from excavations on the site, excluding deleterious material, may be used as engineered fill.

Import Materials: If imported fill material is needed for this project, import material should be approved by our firm prior to transporting it to the project, and on an intermittent basis during import. It is preferable that import material meet the following requirements:

1. Plasticity index not to exceed 12;
2. "R"-value of equal to or greater than 27;
3. An angle of friction equal to or greater than 36 degrees following compaction;
4. Should not contain rocks larger than 6 inches in diameter;
5. Not more than 30 percent passing through the No. 200 sieve.

If these requirements are not met, additional testing and evaluation may be necessary to determine the appropriate design parameters for foundations, pavement, and other improvements.

Fill Placement and Compaction: All areas proposed to receive fill should be scarified to a minimum depth of 8 inches, moisture conditioned to, or slightly above optimum moisture content, and compacted to at least 90 percent of the maximum dry density based on the ASTM D1557 test method. The fill should be placed in uniform horizontal lifts not to exceed 8 inches in uncompacted thickness. The fill should be moisture conditioned to, or slightly above optimum moisture content, and compacted to a relative compaction of not less than 90 percent based on the ASTM D1557 test method. The upper 8 inches of fills placed under proposed pavement areas should be compacted to a relative compaction of not less than 95 percent based on the ASTM D1557 test method.

Fill soil compaction should be evaluated by means of in-place density tests performed during fill placement so that adequacy of soil compaction efforts may be determined as earthwork progresses.

Underground Improvements

Trench Excavation: Trenches or excavations in soil should be shored or sloped back in accordance with current OSHA regulations prior to persons entering them. The potential use of a shield to protect workers cannot be precluded.

Backfill Materials: Backfill materials for utilities should conform to the requirements of the local jurisdiction. It should be realized that permeable backfill materials will likely carry water at some time in the future.

Backfill Compaction: Backfill compaction should conform to the requirements of the local jurisdiction. Where backfill compaction is not specified by the local jurisdiction, the backfill should be compacted to a minimum of 90 percent relative compaction per the ASTM D1557 test method; trench backfill located within the planned pavement area should be compacted to a minimum of 95 percent. Compaction should be accomplished using lifts which do not exceed 8 inches when compacting with a backhoe or larger equipment equipped with a compaction wheel. However, thickness of the lifts should be determined by the contractor. If the contractor can achieve the required compaction using thicker lifts, the method may be judged acceptable based on field verification by a representative of our firm using standard density testing procedures. Lightweight compaction equipment may require thinner lifts to achieve the required densities.

5.0 DESIGN RECOMMENDATIONS

Seismic Criteria

Based on the 2016 California Building Code, Chapter 16, and our site investigation findings, the following seismic parameters are recommended from a geotechnical perspective for structural design. The final choice of design parameters, however, remains the purview of the project Structural Engineer.

Table 3: Seismic Design Parameters

2016 CBC	ASCE 7-10	Seismic Parameter	Recommended Value
	Table 20.3-1	Site Class	D
Figure 1613.3.1(1)		Short-Period MCE at 0.2s, S_S	0.589g
Figure 1613.3.1(2)		1.0s Period MCE, S_1	0.273g
Table 1613.3.3(1)		Site Coefficient, F_a	1.329
Table 1613.3.3(2)		Site Coefficient, F_v	1.854
Equation 16-37		Adjusted MCE Spectral Response Parameters, $S_{MS} = F_a S_s$	0.783g
Equation 16-38		Adjusted MCE Spectral Response Parameters, $S_{M1} = F_v S_1$	0.506g
Equation 16-39		Design Spectral Acceleration Parameters, $S_{DS} = ⅔ S_{MS}$	0.522g
Equation 16-40		Design Spectral Acceleration Parameters, $S_{D1} = ⅔ S_{M1}$	0.337g
Table 1613.3.5(1)		Seismic Design Category (Short Period), Occupancy I to III	D
Table 1613.3.5(1)		Seismic Design Category (Short Period), Occupancy IV	D
Table 1613.3.5(2)		Seismic Design Category (1-Second Period), Occupancy I to IV	D
	Figure 22-7	Maximum Considered Earthquake Geometric Mean (MCEg) PGA	0.198g
	Table 11.8-1	Site Coefficient F_{PGA}	1.403
	Equation 11.8-1	$PGA_M = F_{PGA}$ PGA	0.278g

*Based on the online calculator available at https://seismicmaps.org/

Shallow Conventional Foundations

We offer the following comments and recommendations for purposes of design and construction of shallow continuous and mat slab foundations. The provided minimums do not constitute a structural design of foundations which should be performed by the structural engineer. Our firm should be afforded the opportunity to review the project grading and foundation plans to confirm the applicability of the recommendations provided below. Modifications to these recommendations may be made at the time of our review. In addition to the provided recommendations, foundation design and construction should conform to applicable sections of the 2016 California Building Code.

Continuous Foundation Bearing Capacity: An allowable dead plus live load bearing pressure of 2,000 psf may be used for design of conventional shallow foundations based on firm native soil or engineered fill. The allowable pressures are for support of dead plus live loads and may be increased by 1/3 for short-term wind and seismic loads.

Mat Slab Foundation Bearing Capacity: Provided that mat slabs are underlain with 12 inches of properly compacted aggregate base as discussed in Section 4.0 of this report, an allowable dead plus live load bearing pressure of 1,800 psf and a modulus of subgrade reaction of k = 200 psi per inch may be used for design of mat slab foundations. The allowable pressures are for support of dead plus live loads and may be increased by 1/3 for short-term wind and seismic loads.

Foundation Lateral Pressures: Lateral forces on structures may be resisted by passive pressure acting against the sides of shallow footings/mat slabs, and/or friction between the foundation bearing material and the bottom of the footing/slab. For resistance to lateral loads, a friction factor of 0.35 may be utilized for sliding resistance at the base of conventional shallow foundations in firm native soil or engineered fill, and 0.45 for mat slabs in aggregate base. A passive resistance of 300 pcf equivalent fluid weight may be used against the side of conventional shallow footings and mat slabs in firm native soil or engineered fill. If friction and passive pressures are combined, the lesser value should be reduced by 50 percent.

Foundation Settlement: A total settlement of less than 1 inch is anticipated; a differential settlement of 0.5 inches in 25 feet is anticipated where continuous foundations are bearing on like materials. Assuming that mat slabs have nominal rigidity, total and differential settlement are expected to be on the order of 0.5 inches and 0.35 inches in 25 feet, respectively. The settlement criteria are based upon the assumption that foundation will be sized and loaded in accordance with the recommendations in this report.

Foundation Configuration: Conventional shallow continuous foundations should be a minimum of 12 inches wide and founded a minimum of 18 inches below the lowest adjacent soil grade. Mat slab foundations should be founded a minimum of 12 inches below the lowest adjacent soil grade.

Foundation reinforcement should be provided by the Structural Engineer. The reinforcement schedule should account for typical construction issues such as load consideration, concrete cracking, and the presence of isolated irregularities. At a minimum, we recommend that continuous footing foundations be reinforced with two No. 4 reinforcing bars, one located near the bottom of the footing and one near the top of the stem wall. Mat slab foundations should be reinforced per the requirements of the Structural Engineer.

All footings should be founded below an imaginary 2H:1V plane projected up from the bottoms of adjacent footings and/or parallel utility trenches.

Subgrade Conditions: Footings should never be cast atop soft, loose, organic, slough, debris, nor atop subgrades covered by ice or standing water. A representative of our firm should be retained to observe all subgrades during footing excavations and prior to concrete placement so that a determination as to the adequacy of subgrade preparation can be made.

Thrust Blocks

For resisting lateral loads, a coefficient of friction of 0.30 and a passive resistance of 250 pcf equivalent fluid weight may be used for thrust blocks within firm native soils or engineered fills. The frictional resistance and passive resistance may be combined provided the lesser value is reduced by 50 percent.

For resisting downward (vertical) loads, an allowable total bearing pressure of 2,000 psf may be used for design of thrust blocks acting on firm native soils or engineered fills. For resistance to upward thrust, a soil unit weight of 120 pcf may be used.

Slab-on-Grade Construction

It is our opinion that soil-supported slabs-on-grade may be used to support the planned improvements, contingent on proper subgrade preparation. Often the geotechnical issues regarding the use of slab-on-grade floors include proper soil support and subgrade preparation, proper transfer of loads through the slab underlayment materials to the subgrade soils, and the anticipated presence or absence of moisture at or above the subgrade level. We offer the

following comments and recommendations concerning support of slabs-on-grade. The slab design (concrete mix, reinforcement, joint spacing, moisture protection, and underlayment materials) is the purview of the project Structural Engineer.

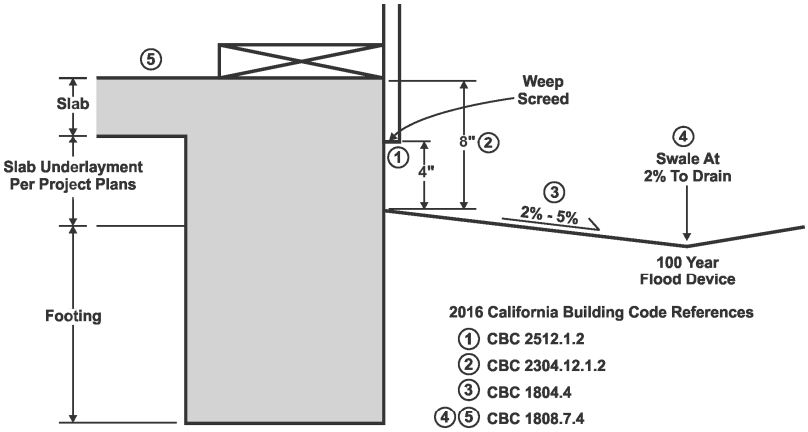
Slab Subgrade Preparation: All subgrades proposed to support slabs-on-grade should be prepared and compacted to the requirements of engineered fill as discussed in Section 4.0 of this report.

Slab Underlayment: As discussed previously, the slabs should be underlain by 12 inches of ¾-inch compacted aggregate base. An optional 1-inch thick blotter sand layer above the aggregate base is sometimes used to aid in curing of the concrete in commercial structures. If a blotter layer is utilized, a filter fabric should be placed between the sand and the aggregate base to reduce the potential to sand to infiltrate into the aggregate base. If the blotter sand layer is omitted, special wet curing procedures will be necessary. In all cases, development of appropriate slab mix design and curing procedures remains the purview of the project structural engineer.

Slab Thickness and Reinforcement: Slab thickness and reinforcement should be per the requirements of the project structural engineer.

Vertical Deflections: Soil-supported slab-on-grade floors can deflect downward when vertical loads are applied, due to elastic compression of the subgrade. For design of concrete floors, a modulus of subgrade reaction of k = 200 psi per inch would be applicable for compacted aggregate base.

Drainage Adjacent to Slabs: All grades should provide rapid removal of surface water runoff; ponding water should not be allowed adjacent to foundations or other structural improvements (during and following construction). All soils placed against foundations during finish grading should be compacted to minimize water infiltration. Finish and landscape grading should include positive drainage away from all foundations. Section 1808.7.4 of the 2016 California Building Code (CBC) states that for graded soil sites, the top of any exterior foundation shall extend above the elevation of the street gutter at the point of discharge or the inlet of an approved drainage device a minimum of 12 inches plus 2 percent. If overland flow is not achieved adjacent to buildings, the drainage device should be designed to accept flows from a 100 year event. Grades directly adjacent to foundations should be no closer than 8 inches from the top of the slab (CBC 2304.12.1.2), and weep screeds are to be placed a minimum of 4 inches clear of soil grades and 2 inches clear of concrete or other hard surfacing (CBC 2512.1.2). From this point, surface grades should slope a minimum of 2 percent away from all foundations for at least 5 feet but preferably 10 feet, and then 2 percent along a drainage swale to the outlet (CBC 1804.4). Downspouts should be tight piped via an area drain network and discharged to an appropriate non-erosive outlet away from all foundations.



Typical 2016 California Building Code Drainage Requirements

The above referenced elements pertaining to drainage of the proposed structures is provided as general acknowledgement of the California Building Code requirements, restated and graphically illustrated for ease of understanding. Surface drainage design is the purview of the Project Architect/Civil Engineer. Review of drainage design and implementation adjacent to the building envelopes is recommended as performance of these improvements is crucial to the performance of the foundation and construction of rigid improvements.

Asphalt Concrete Pavement Design

We understand that asphalt pavements may be used as part of the well site improvements. The following comments and recommendations are given for pavement design and construction purposes. All pavement construction and materials used should conform to applicable sections of the latest edition of the California Department of Transportation Standard Specifications.

Subgrade Compaction: After installation of any underground facilities, the upper 8 inches of subgrade soils under pavements sections should be compacted to a minimum relative compaction of 95 percent based on the ASTM D1557 test method at a moisture content near or above optimum. Aggregate bases should also be compacted to a minimum relative compaction of 95 percent based on the aforementioned test method.

Subgrade Stability: All subgrades and aggregate base should be proof-rolled with a full water truck or equivalent immediately before paving, in order to evaluate their condition. If unstable subgrade conditions are observed, these areas should be overexcavated down to firm materials and the resulting excavation backfilled with suitable materials for compaction (i.e. drier native soils or aggregate base). Areas displaying significant instability may require geotextile stabilization fabric within the overexcavated area, followed by placement of aggregate base. Final determination of any required overexcavation depth and stabilization fabric should be based on the conditions observed during subgrade preparation.

Design Criteria: Critical features that govern the durability of a pavement section include the stability of the subgrade; the presence or absence of moisture, free water, and organics; the fines content of the subgrade soils; the traffic volume; and the frequency of use by heavy vehicles. Soil conditions can be defined by a soil resistance value, or “R-Value,” and traffic conditions can be defined by a Traffic Index (TI).

Design Values: The following table provides recommended pavement sections based on the R-Value test (CTM 301) performed on a bulk sample representative of the materials expected to be exposed at subgrade, as well as our experience with similar materials in the area. An R-value of 27 was determined for the sandy CLAY tested.

Design values provided are based upon properly drained subgrade conditions. Although the R-Value design to some degree accounts for wet soil conditions, proper surface and landscape drainage design is integral in performance of adjacent street sections with respect to stability and degradation of the asphalt. If clay soils are encountered and cannot be sufficiently blended with non-expansive soils, we should review pavement subgrades to determine the appropriateness of the provided sections, and provide additional pavement design recommendations as field conditions dictate. Even minor clay constituents will greatly reduce the design R-Value.

The recommended design thicknesses presented in the following table were calculated in accordance with the methods presented in the Sixth Edition of the California Department of Transportation Highway Design Manual. A varying range of traffic indices are provided for use by the project Civil Engineer for roadway design.

Table 4: Asphalt Pavement Section Recommendations

Design Traffic Indices	Alternative Pavement Sections (Inches)	
	Asphalt Concrete *	Aggregate Base **
4.5	2.5 3.0	6.0 5.0
5.0	2.5 3.0	7.0 6.0
5.5	3.0 3.5	7.5 6.5
6.0	3.0 3.5	9.0 8.0
6.5	3.5 4.0	9.5 8.5
7.0	4.0 4.5	10.5 9.5
7.5	4.5 5.0	11.0 10.0
8.0	4.5 5.0	12.5 11.5
8.5	5.0 5.5	13.0 12.0
9.0	5.5 6.0	13.5 13.0

* Asphalt Concrete: must meet specifications for Caltrans Hot Mix Asphalt Concrete
** Aggregate Base: must meet specifications for Caltrans Class II Aggregate Base (R-Value = minimum 78)

Due to the redistribution of materials that occurs during mass grading operations, we should review pavement subgrades to determine the appropriateness of the provided sections.

Portland Cement Concrete Pavement Design

We understand that Portland cement concrete pavements may be considered for various aspects of exterior paving for the site. The American Concrete Institute (ACI) Concrete Pavement Design method (ACI 330R-08) was used for design of the exterior concrete (rigid) pavements at the site.

The pavement thicknesses were evaluated based on the soil design parameters provided in the following table.

Table 5: Soil Parameters

Subgrade Soil Description	k, Modulus of Subgrade Reaction*	Base Course
Sandy CLAY	120 pci	6 inches

* Based on an R-Value of 27 as recommended above and correlated to a k-Value recommended by ACI 330R.

Based on the subgrade soil parameters shown in the above table, the recommended concrete thicknesses for various traffic descriptions are presented in the table below. The recommended thicknesses provided below assume the use of plain (non-reinforced) concrete pavements.

We recommend that the rigid pavement be placed on at least 6 inches of aggregate base compacted to at least 95 percent of the maximum dry density per the ASTM D 1557 test method. From a geotechnical perspective, contraction joints should be placed in accordance with the American Concrete Institute (ACI) recommendations which include providing a joint spacing about 30 times the slab thickness up to a maximum of 10 feet. The joint patterns should also divide the slab into nearly square panels. If increased joint spacing is desired, reinforcing steel should be installed within the pavement in accordance with ACI recommendations. Final determination of steel reinforcement configurations (if used within the pavements) remains the purview of the Project Structural Engineer.

Table 6: Concrete Pavement Section Recommendations

Category	ADTT*	Pavement Traffic Description	Thickness (inches)	
			3000 psi**	4000 psi**
A	1	Car parking areas and access lanes	4.5	4.5
A	10	Autos, pickups, and panel trucks only	5.0	5.0
B	25	Shopping center entrance and service lanes	6.0	5.5
B	300	Bus parking areas and interior lanes Single-unit truck parking areas and interior lanes	6.5	6.0
C	100	Roadway Entrances and Exterior Lanes	6.5	6.5
C	300		7.0	6.5
C	700		7.0	7.0

* Average Daily Truck Traffic
** 28-day concrete compressive strength

Drainage

In order to maintain the engineering strength characteristics of the soil presented for use in this Geotechnical Engineering Study, maintenance of the improvement area will need to be performed. This maintenance generally includes, but is not limited to, proper drainage and control of surface and subsurface water which could affect structural support and fill integrity. A difficulty exists in determining which areas are prone to the negative impacts resulting from high moisture conditions due to the diverse nature of potential sources of water; some of which are outlined in the paragraph below. We suggest that measures be installed to minimize exposure to the adverse effects of moisture, but this will not guarantee that excessive moisture conditions will not affect the structure.

Some of the diverse sources of moisture could include water from annual rainfall, offsite construction activities, runoff from impermeable surfaces, and collected and channeled water. Some of these sources can be controlled through drainage features installed either by the owner

or contractor. Others may not become evident until they, or the effects of the presence of excessive moisture, are visually observed on the property.

Some measures that can be employed to minimize the buildup of moisture include, but are not limited to proper backfill materials and compaction of utility trenches within the footprint of proposed structures; grout plugs at foundation penetrations; collection and channeling of drained water from impermeable surfaces (i.e. roofs, concrete or asphalt paved areas); installation of subdrain/cut-off drain provisions; utilization of low flow irrigation systems.

6.0 DESIGN REVIEW AND CONSTRUCTION MONITORING

The design plans and specifications should be reviewed and accepted by Youngdahl Consulting Group, Inc. prior to contract bidding. A review should be performed to determine whether the recommendations contained within this report are still applicable and/or are properly reflected and incorporated into the project plans and specifications.

Construction Monitoring

Construction monitoring is a continuation of the findings and recommendations provided in this report. It is essential that our representatives be involved with all grading activities in order for us to provide supplemental recommendations as field conditions dictate. Youngdahl Consulting Group, Inc. should be notified at least two working days before site clearing or grading operations commence, and should observe the stripping of deleterious material, overexcavation of existing fills or loose/soft soils and provide consultation to the Grading Contractor in the field. At a minimum, Youngdahl Consulting Group, Inc. should be retained to provide services listed in Table 7 below.

Low Impact Development Standards

Low Impact Development (LID) standards have become a consideration for many projects in the region. LID standards are intended to address and mitigate urban storm water quality concerns. These methods include the use of Source Controls, Run-off Reduction and Treatment Controls. For the purpose of this report use of Run-off Reduction measures and some Treatment Controls may impact geotechnical recommendations for the project.

Youngdahl Consulting Group, Inc. did not perform any percolation or infiltration testing for the site as part of the Geotechnical Investigation. A review of soil survey and the data collected from test pits indicate that soils within the project are Hydrologic Soil Group D (low permeability). Based on this condition, use of infiltration type LID methods (infiltration trenches, dry wells, infiltration basins, permeable pavements, etc.) should not be considered without addressing applicable geotechnical considerations/implications. As such, use of any LID measure that would require infiltration of discharge water to surfaces adjacent to structures/pavement or include infiltration type measures should be reviewed by Youngdahl Consulting Group, Inc. during the design process.

7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. This report has been prepared for the exclusive use of Domenichelli and Associates, Inc. for specific application to the Rio Linda – Elverta Well 16 project located on U Street in Rio Linda, California. Youngdahl Consulting Group, Inc. has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Youngdahl Consulting Group, Inc. makes no other warranty, either express or implied.

2. As of the date of this report, the findings of this report are valid for the property studied. With the passage of time, changes in the conditions of a property can occur whether they be due

to natural processes or to the works of man on this or adjacent properties. Legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may cause this report to be invalid, wholly or partially. Therefore, this report should not be relied upon after a period of three years without our review nor should it be used or is it applicable for any properties other than those studied.

3. Section [A] 107.3.4 of the 2016 California Building Code states that, in regard to the design professional in responsible charge, the building official shall be notified in writing by the owner if the registered design professional in responsible charge is changed or is unable to continue to perform the duties.

   WARNING: Do not apply any of this report's conclusions or recommendations if the nature, design, or location of the facilities is changed. If changes are contemplated, Youngdahl Consulting Group, Inc. must review them to assess their impact on this report's applicability. Also note that Youngdahl Consulting Group, Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analyses without the express written authorization of Youngdahl Consulting Group, Inc.

4. The analyses and recommendations contained in this report are based on limited windows into the subsurface conditions and data obtained from subsurface exploration. The methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. Should any variations or undesirable conditions be encountered during the development of the site, Youngdahl Consulting Group, Inc. will provide supplemental recommendations as dictated by the field conditions.

5. The recommendations included in this report have been based in part on assumptions about strata variations that may be tested only during earthwork. Accordingly, these recommendations should not be applied in the field unless Youngdahl Consulting Group, Inc. is retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method. Youngdahl Consulting Group, Inc. cannot assume responsibility or liability for the adequacy of its recommendations when they are used in the field without Youngdahl Consulting Group, Inc. being retained to observe construction. Unforeseen subsurface conditions containing soft native soils, loose or previously placed non-engineered fills should be a consideration while preparing for the grading of the property. It should be noted that it is the responsibility of the owner or his/her representative to notify Youngdahl Consulting Group, Inc., in writing, a minimum of 48 hours before any excavations commence at the site.

Table 7: Checklist of Recommended Services

	Item Description	Recommended	Not Anticipated
1	Provide foundation design parameters	Included	
2	Review grading plans and specifications	✓	
3	Review foundation plans and specifications	✓	
4	Observe and provide recommendations regarding demolition		✓
5	Observe and provide recommendations regarding site stripping	✓	
6	Observe and provide recommendations on moisture conditioning removal, and/or recompaction of unsuitable existing soils	✓	
7	Observe and provide recommendations on the installation of subdrain facilities		✓
8	Observe and provide testing services on fill areas and/or imported fill materials	✓	
9	Review as-graded plans and provide additional foundation recommendations, if necessary	✓	
10	Observe and provide compaction tests on storm drains, water lines and utility trenches	✓	
11	Observe foundation excavations and provide supplemental recommendations, if necessary, prior to placing concrete	✓	
12	Observe and provide moisture conditioning recommendations for foundation areas and slab-on-grade areas prior to placing concrete		✓
13	Provide design parameters for retaining walls		✓
14	Provide finish grading and drainage recommendations	Included	
15	Provide geologic observations and recommendations for keyway excavations and cut slopes during grading		✓
16	Excavate and recompact all test pits within structural areas		✓

APPENDIX A

Field Study

Vicinity Map
Site Plan
Logs of Exploratory Borings
Soil Classification Chart and Log Explanation

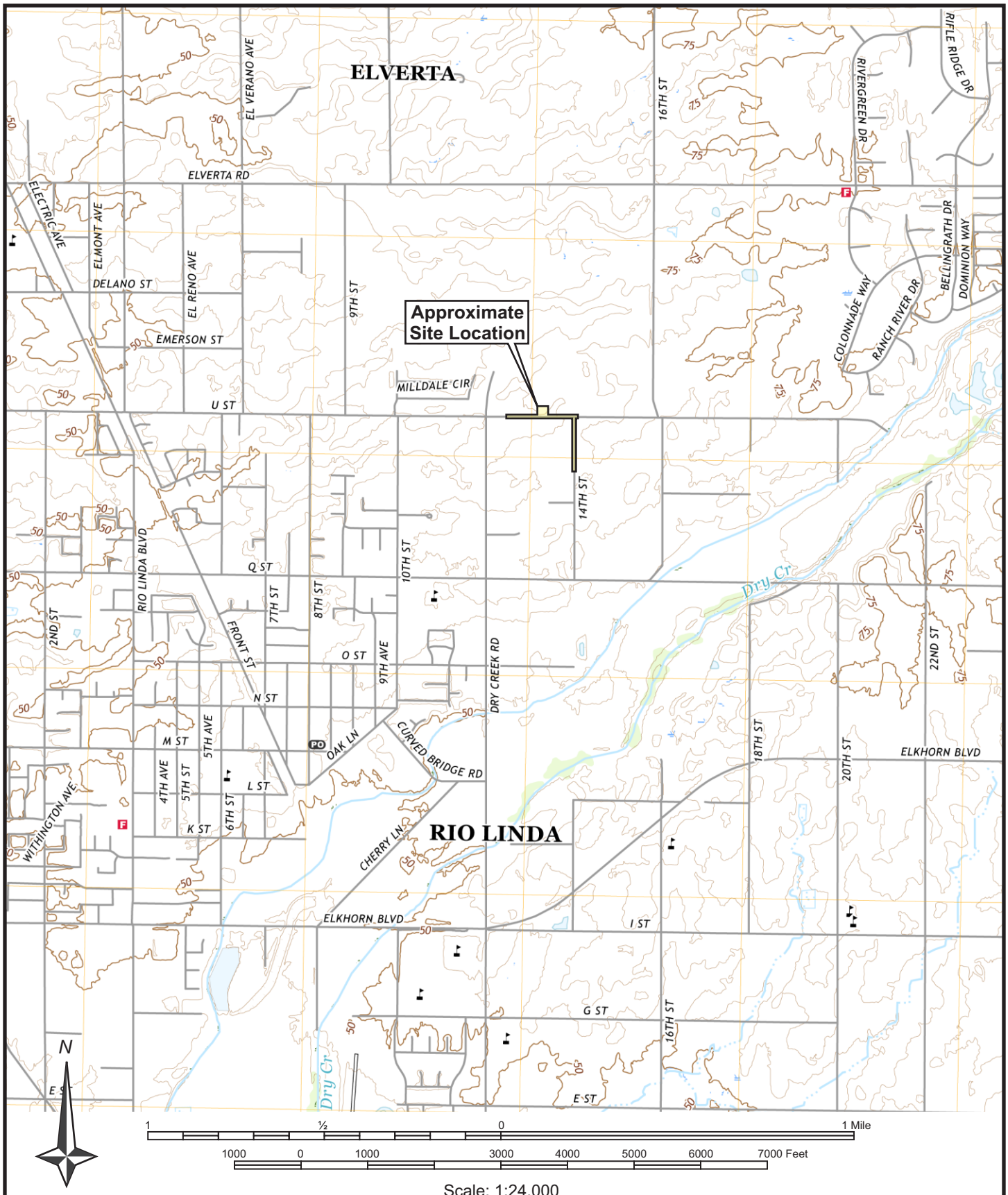
Introduction

The contents of this appendix shall be integrated with the Geotechnical Engineering Study of which it is a part. They shall not be used in whole or in part as a sole source for information or recommendations regarding the subject site.

Our field study included a site reconnaissance by a Youngdahl Consulting Group, Inc. representative followed by a subsurface exploration program conducted on 3 May 2019, which included the advancement of three borings under his direction at the approximate locations shown on Figure A-2, this Appendix. Drilling of the exploratory borings was accomplished with a truck-mounted CME 45 and track-mounted CME 55 drill rigs.

Throughout the drilling operation, soil samples were obtained at 5-foot depth intervals by means of a Modified California Sampler or Standard Penetrometer. This testing and sampling procedure consists of driving the steel sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval is counted, and the total number of blows struck during the final 12 inches is recorded. If a total of 50 blows are struck within any 6-inch interval, the driving is stopped and the blow count is recorded as 50 blows for the actual penetration distance.

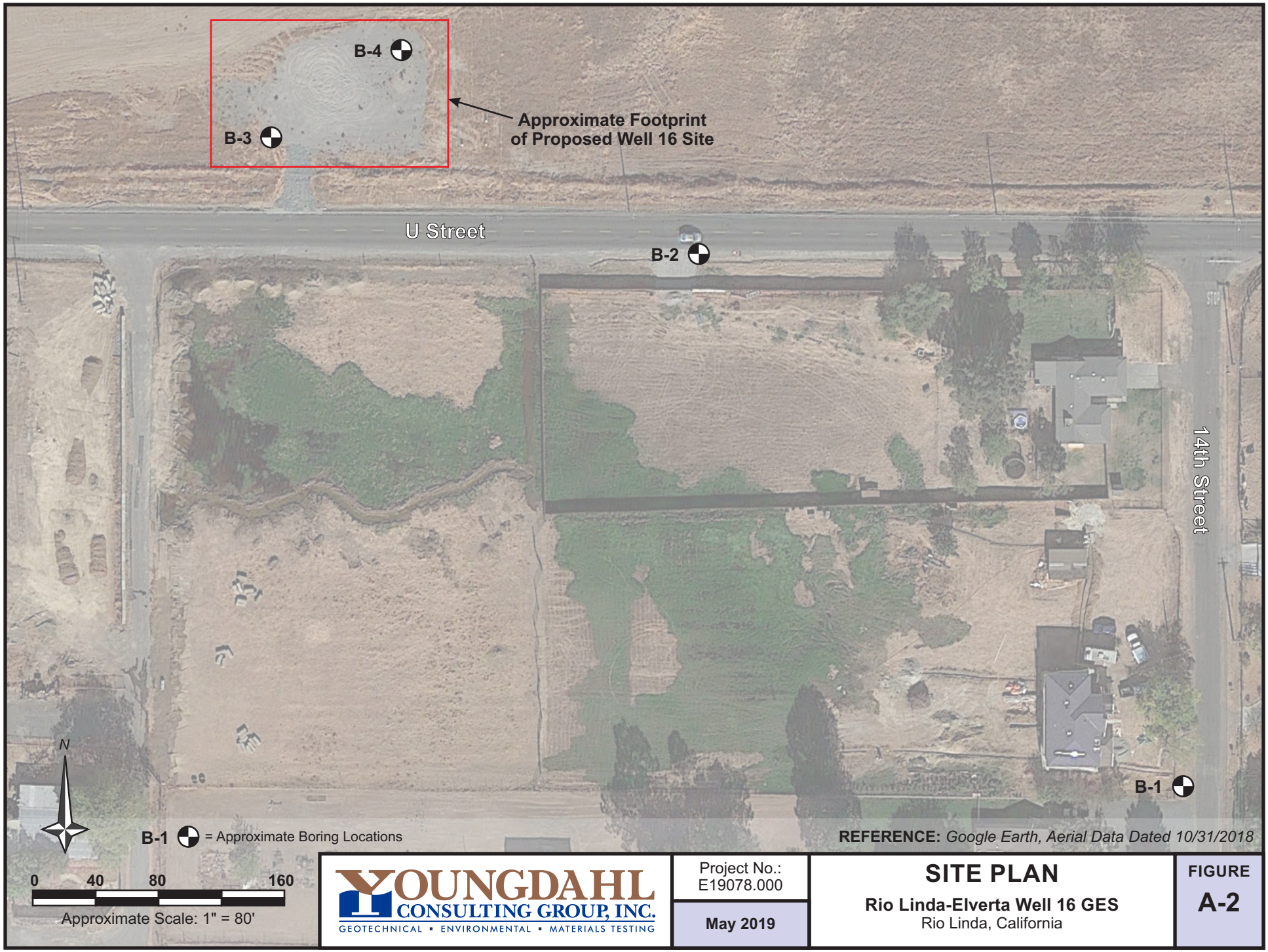
The subsurface conditions encountered were logged during drilling and provide the basis for the "Boring Logs," Figures A-3 through A-6, this Appendix. The enclosed Boring Logs describe the vertical sequence of soils and materials encountered in each boring, based primarily on our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.



Scale: 1:24,000

BASE MAP REFERENCE: *U.S.G.S. 7.5 Minute Topographic Series, Rio Linda Quadrangle, Dated 2018*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E19078.000 **May 2019**	**VICINITY MAP** **Rio Linda-Elverta Well 16 GES** Rio Linda, California	**FIGURE** **A-1**



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Project No.: E19078.000

May 2019

SITE PLAN

Rio Linda-Elverta Well 16 GES
Rio Linda, California

FIGURE
A-2

Logged By: **MRG**	Date: **3 May 2019**	Lat / Lon: **~N° / ~W°**	Boring No. **B-1**
Equipment: **CME 45**		Elevation: **~**	

Depth (Feet)	Graphic Log	Ground Water	Geotechnical Description & Unified Soil Classification	Sample	Blow Counts	Pocket Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Tests & Comments
1			3" AC Brown **CLAY (CL)** with sand, stiff, moist						**Bulk B-1** @ 0' - 5'
2			Yellow brown silty **SAND (SM)**, dense, slightly moist						
3									
4			*Grades with trace clay, moderately cemented, very dense*						
5									**Bag B-1** @ 5' - 5.5'
6					50/6				
7			*Grades without clay*						
8									
9									
10									**Bag B-1** @ 10' - 11.5'
11					50/6				
12			Boring terminated at 11.5' No groundwater encountered						
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Note: The boring log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations. Note, too, that the passage of time may affect conditions at the sampling locations.

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EXPLORATORY BORING LOG

Rio Linda-Elverta Well 16 GES
Rio Linda, California

FIGURE **A-3**

Logged By: **MRG**	Date: **3 May 2019**	Lat / Lon: **~N° / ~W°**	Boring No. **B-2**
Equipment: **CME 45**		Elevation: **~**	

Depth (Feet)	Graphic Log	Ground Water	Geotechnical Description & Unified Soil Classification	Sample	Blow Counts	Pocket Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Tests & Comments
1			6" AC Brown sandy **CLAY (CL)**, stiff, moist						**Bulk B-2** @ 0' - 5'
2									
3			Yellow brown silty **SAND (SM)**, dense, slightly moist						
4									
5			*Grades brown* *Grades red brown, with trace silt and clay, moderately cemented, very dense*						**Bag B-2** @ 5' - 6.5'
6					50/6				
7									
8									
9									
10			Olive **SILT (ML)**, moderately cemented, hard, slightly moist						**Bag B-2** @ 10' - 11.5'
11					50/4				
12			Boring terminated at 11.5' No groundwater encountered						
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Note: The boring log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations. Note, too, that the passage of time may affect conditions at the sampling locations.

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Project No.: E19078.000

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EXPLORATORY BORING LOG

Rio Linda-Elverta Well 16 GES
Rio Linda, California

FIGURE **A-4**

Logged By: **MRG**	Date: **3 May 2019**	Lat / Lon: **~N° / ~W°**	Boring No. **B-3**
Equipment: **CME 45**		Elevation: **~**	

Depth (Feet)	Graphic Log	Ground Water	Geotechnical Description & Unified Soil Classification	Sample	Blow Counts	Pocket Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Tests & Comments
1			Brown **CLAY (CL)**, medium stiff, moist						**Bulk B-3** @ 0' - 5'
2									
3			Yellow brown silty **SAND (SM)** with silt, dense, slightly moist						
4									
5									
6			Red brown clayey **SAND (SC)**, moderately cemented, very dense, slightly moist		50/4				
7									
8									
9			Red brown silty **SAND (SM)** with trace clay, moderately cemented, very dense, slightly moist						
10									No Recovery
11					56				No Recovery
12					14				
13					27				
14									
15									
16					50/6				
17									
18									
19									
20									
21					50/5				
22			Boring terminated at 21.5' No groundwater encountered						
23									
24									
25									

Note: The boring log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations. Note, too, that the passage of time may affect conditions at the sampling locations.

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EXPLORATORY BORING LOG

Rio Linda-Elverta Well 16 GES
Rio Linda, California

FIGURE **A-5**

Logged By: **MRG**	Date: **3 May 2019**	Lat / Lon: **~N° / ~W°**	Boring No. **B-4**
Equipment: **CME 55**		Elevation: **~**	

Depth (Feet)	Graphic Log	Ground Water	Geotechnical Description & Unified Soil Classification	Sample	Blow Counts	Pocket Pen (tsf)	Dry Density (pcf)	Moisture Content (%)	Tests & Comments
0			Grey sandy **GRAVEL (GP)**, dense, dry						**Bulk B-4** @ 0' - 5'
1–4			Yellow brown silty **SAND (SM)** with clay and trace gravel, dense, slightly moist						
5			Olive sandy **SILT (ML)** with clay, weakly cemented, very stiff, slightly moist		50/5				
6–9									
10			*Grades red brown and mottled black, moderately cemented, hard*						No Recovery
11					76				
12									
13			Brown sandy **CLAY (CL)**, moderately cemented, very stiff, moist						
14–15									
16			Red brown silty **SAND (SM)**, very dense, moist						
			Brown **SILT (ML)** with clay and sand, moderately cemented, hard, moist		51				
17									
18			Brown sandy **CLAY (CL)**, moderately cemented, hard, moist						
19									
20			Brown silty **SAND (SM)**, medium dense, moist						
21					28				
22			Boring terminated at 21.5'						
23			No groundwater encountered						
24–25									

Note: The boring log indicates subsurface conditions only at the specific location and time noted. Subsurface conditions, including groundwater levels, at other locations of the subject site may differ significantly from conditions which, in the opinion of Youngdahl Consulting Group, Inc., exist at the sampling locations. Note, too, that the passage of time may affect conditions at the sampling locations.

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Project No.: E19078.000

May 2019

EXPLORATORY BORING LOG

Rio Linda-Elverta Well 16 GES
Rio Linda, California

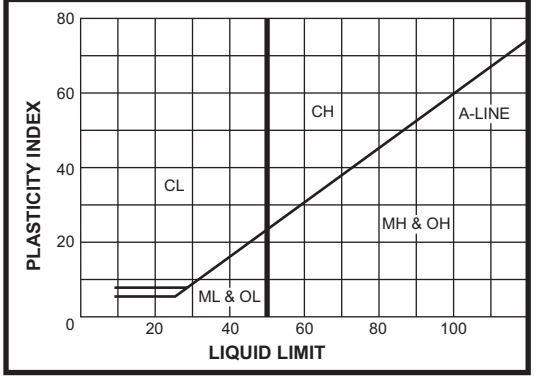
FIGURE **A-6**

UNIFIED SOIL CLASSIFICATION SYSTEMS

MAJOR DIVISION			SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS Over 50% > #200 sieve	**GRAVELS** Over 50% > #4 sieve	Clean **GRAVELS** With Little Or No Fines	GW	Well graded **GRAVELS**, **GRAVEL-SAND** mixtures
			GP	Poorly graded **GRAVELS**, **GRAVEL-SAND** mixtures
		GRAVELS With Over 12% Fines	GM	Silty **GRAVELS**, poorly graded **GRAVEL-SAND-SILT** mixtures
			GC	Clayey **GRAVELS**, poorly graded **GRAVEL-SAND-CLAY** mixtures
	SANDS Over 50% < #4 sieve	Clean **SANDS** With Little Or No Fines	SW	Well graded **SANDS**, gravelly **SANDS**
			SP	Poorly graded **SANDS**, gravelly **SANDS**
		SANDS With Over 12% Fines	SM	Silty **SANDS**, poorly graded **SAND-SILT** mixtures
			SC	Clayey **SANDS**, poorly graded **SAND-CLAY** mixtures
FINE GRAINED SOILS Over 50% < #200 sieve	**SILTS & CLAYS** Liquid Limit < 50		ML	Inorganic **SILTS**, silty or clayey fine **SANDS**, or clayey **SILTS** with plasticity
			CL	Inorganic **CLAYS** of low to medium plasticity, gravelly, sandy, or silty **CLAYS**, lean **CLAYS**
			OL	Organic **CLAYS** and organic silty **CLAYS** of low plasticity
	SILTS & CLAYS Liquid Limit > 50		MH	Inorganic **SILTS**, micaceous or diamacious fine sandy or silty soils, elastic **SILTS**
			CH	Inorganic **CLAYS** of high plasticity, fat **CLAYS**
			OH	Organic **CLAYS** of medium to high plasticity, organic **SILTS**
HIGHLY ORGANIC CLAYS			PT	PEAT & other highly organic soils

PLASTICITY CHART

USED FOR CLASSIFICATION OF FINE GRAINED SOILS

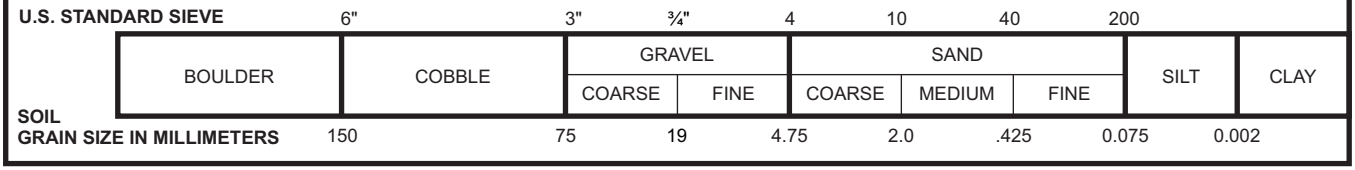


SAMPLE DRIVING RECORD

BLOWS PER FOOT	DESCRIPTION
25	25 Blows drove sampler 12 inches, after initial 6 inches of seating
50/7"	50 Blows drove sampler 7 inches, after initial 6 inches of seating
50/3"	50 Blows drove sampler 3 inches during or after initial 6 inches of seating

Note: To avoid damage to sampling tools, driving is limited to 50 blows per 6 inches during or after seating interval.

SOIL GRAIN SIZE



KEY TO PIT & BORING SYMBOLS

- Standard Penetration test
- 2.5" O.D. Standard California Sampler
- 3" O.D. Modified California Sampler
- Shelby Tube Sampler
- 2.5" Hand Driven Liner
- Bulk Sample
- Water Level At Time Of Drilling
- Water Level After Time Of Drilling
- P — Perched Water

KEY TO PIT & BORING SYMBOLS

- Joint
- Foliation
- Water Seepage
- NFWE — No Free Water Encountered
- FWE — Free Water Encountered
- REF — Sampling Refusal
- DD — Dry Density (pcf)
- MC — Moisture Content (%)
- LL — Liquid Limit
- PI — Plasticity Index
- PP — Pocket Penetrometer
- UCC — Unconfined Compression (ASTM D2166)
- TVS — Pocket Torvane Shear
- EI — Expansion Index (ASTM D4829)
- Su — Undrained Shear Strength

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SOIL CLASSIFICATION CHART AND LOG EXPLANATION
Rio Linda-Elverta Well 16 GES
Rio Linda, California

FIGURE A-7

APPENDIX B

Laboratory Testing

Direct Shear Test
Modified Proctor Test
Expansion Index Test
R-Value Test

Introduction

Our laboratory testing program for this evaluation included numerous visual classifications, direct shear, modified proctor, expansion index, and resistance value. The following paragraphs describe our procedures associated with each type of test. Graphical results of certain laboratory tests are enclosed in this appendix. The contents of this appendix shall be integrated with the Type of Project of which it is a part. They shall not be used in whole or in part as a sole source for information or recommendations regarding the subject site.

Laboratory Testing Procedures

Visual Classification: Visual soil classifications were conducted on all samples in the field and on selected samples in our laboratory. All soils were classified in general accordance with the Unified Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs in Appendix A.

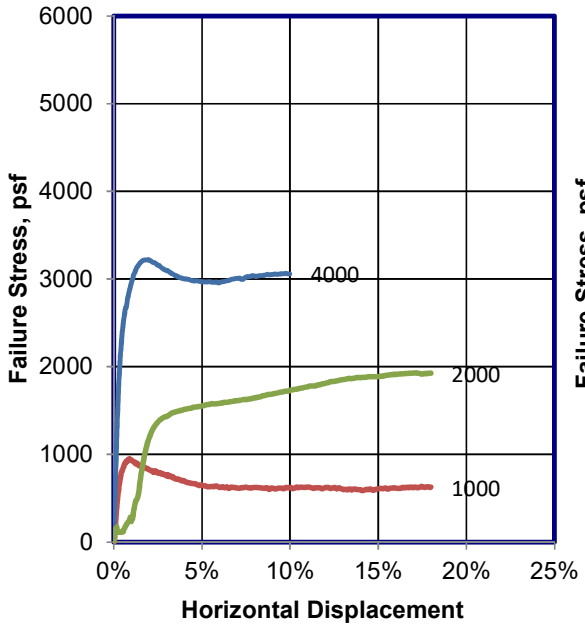
Soil Strength Determination: The strength parameters of the foundation soils were based on direct shear tests (ASTM D3080) performed on a representative remolded sample of the near-surface soils. The results of this test are presented on Figure B-1, this Appendix.

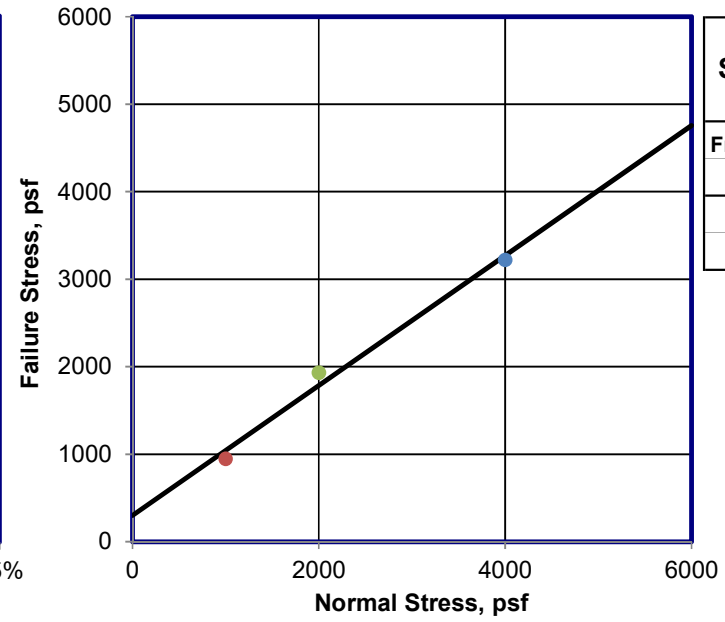
Maximum Dry Density Determination: A modified proctor test (ASTM D1557) was conducted to provide the optimum moisture and maximum dry density on the near surface material. The results of this test are presented on Figure B-2, this Appendix.

Expansion Index Test: An expansion index test (ASTM D4829) was performed to provide an indication of swelling potential of compacted soils. The results of this test are presented in Figure B-3, this Appendix.

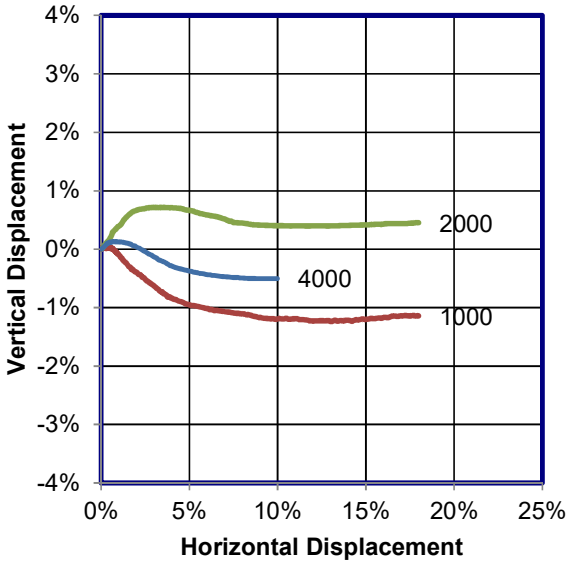
Resistance Value Determination: An R-Value test (California Test Method 301 or ASTM D2844) was performed to obtain asphalt concrete pavement design parameters. The results of this test are presented on Figure B-4, this Appendix.

Direct Shear Test of Soils Under Consolidated Drained Conditions, ASTM D3080





Direct Shearbox Results
Friction Angle
36.6°
Cohesion
301 psf



Test No.		1	2	3
Initial	Wet Density, pcf	125.8	125.8	125.8
	Dry Density, pcf	114.6	114.6	114.6
	Moisture Content, %	9.8	9.8	9.8
	Diameter, in	2.50	2.50	2.50
	Height, in	1.00	1.00	1.00
Pre Shear	Wet Density, pcf	138.5	142.6	139.8
	Dry Density, pcf	116.5	122.0	117.8
	Moisture Content, %*	18.9	16.9	18.7
	Diameter, in	2.50	2.50	2.50
	Height, in	0.98	0.94	0.97
Normal Stress, psf		1000	2000	4000
Failure Stress, psf		946	1930	3220
Failure Strain, %		0.84	17.11	1.97
Rate, in/min			0.002	

*Based on post shear moisture content

Sample Type: Remolded to 90% RC

Material Description: **Yellow Brown Silty SAND**

Source:

Notes:

Sample No./Depth:	B-2 @ 0-5'	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled:	5/3/2019					
Date Test Started:	5/17/2019				0	

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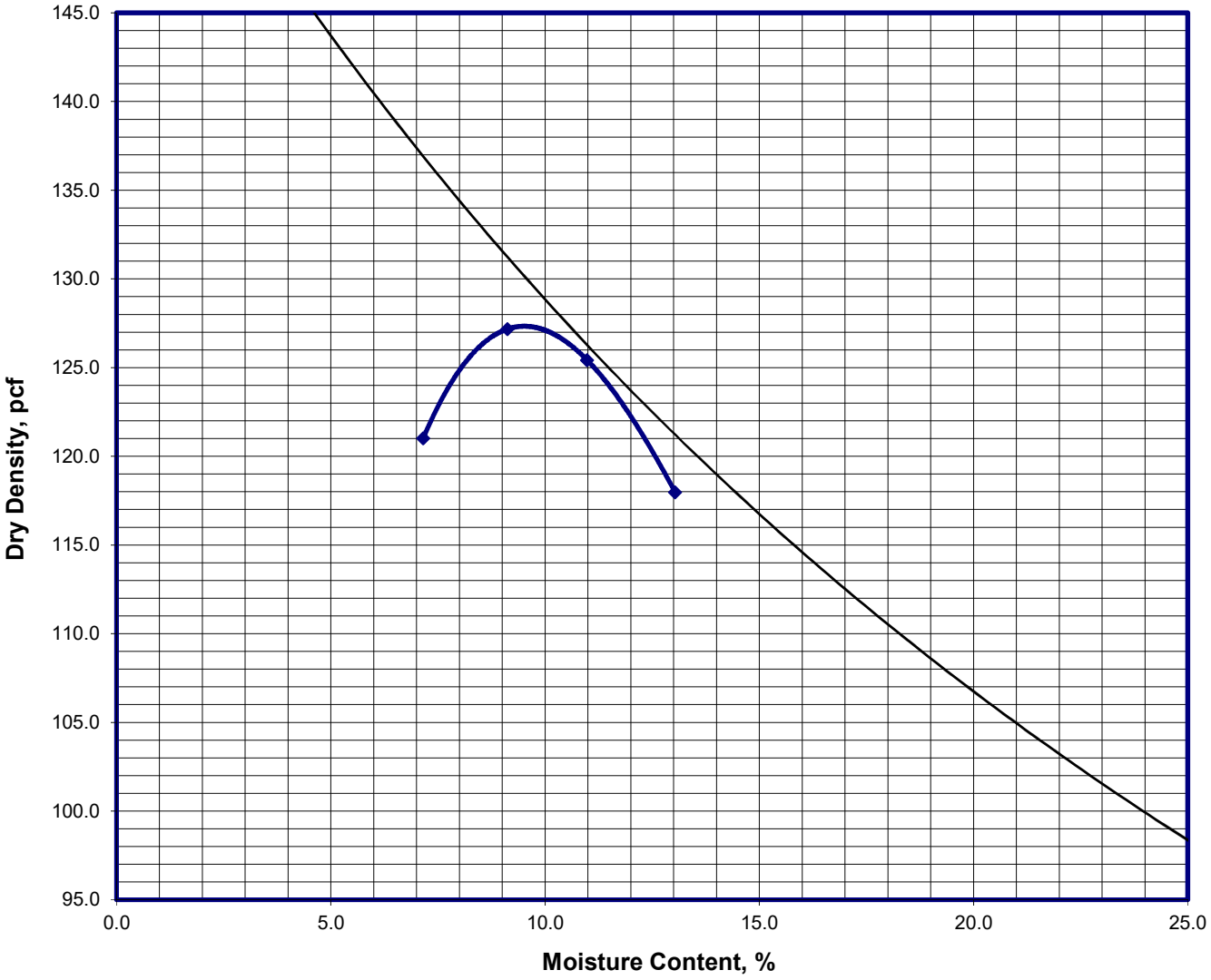
Figure B-1

Reviewed By: DN Date: 5/22/2019

Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 lf-lbf/ft3), ASTM D1557, Method A



Maximum Dry Density, pcf:	**127.3**	Optimum Moisture Content, %:	**9.5**
Material Description:	**Yellow Brown Silty SAND**		
Source:			
Notes:			

Sample No./Depth:	B-2 @ 0-5'	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4 :	% Less than No. 200
Date Sampled:	5/3/2019					
Date Test Started:	5/16/2019				0	

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Project No.:	**E19078.000**		Figure
Reviewed By:	NPM	Date: 5/17/2019	B-2

Expansion Index of Soils, ASTM D4829

Test Results

Expansion Index	44
Dry Density, as molded, pcf	106.4
Moisture Content, as molded, %	10.4
Final Moisture Content, %	24.7
Initial Saturation, as molded, %	48.4

Classification of Potentially Expansive Soil

Expansion Index, EI	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	Very High

Material Description: **Brown Sandy CLAY with Gravel**

Source:

Notes: Gravel removed from test sample.

Sample No./Depth:	B-3 @ 0-5'			USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled:	5/3/2019	Date Test Started:	5/15/2019				13	

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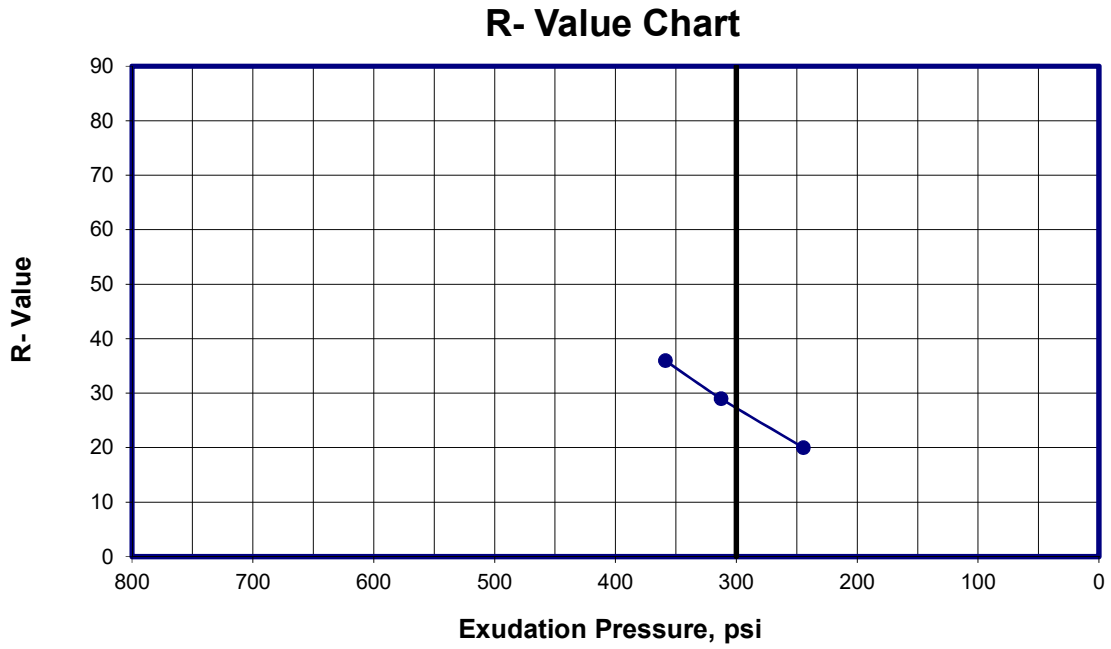
Figure B-3

Reviewed By: DN Date: 5/22/2019

Resistance "R" Value of Soil and Soil-Aggregate Mixtures, CTM 301



Test Specimen No.:	1	2	3
Moisture Content at Test, %	13.1	14.0	15.1
Dry Density at Test, pcf	119.4	118.7	117.1
Expansion Pressure, psf	160	82	26
Exudation Pressure, psi	359	313	245
Resistance "R" Value	36	29	20
"R" Value at 300 psi Exudation Pressure			**27**

Material Description: **Brown Sandy CLAY with Gravel**

Source:

Notes:

Sample No./Depth:	B-3 @ 0-5'	USCS Class.	Liquid Limit	Plasticity Index	% Greater than No. 4	% Less than No. 200
Date Sampled: 5/3/2019	Date Test Started: 5/16/2019				13	

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Project: **Rio Linda - Elverta Well 16**

Project No.: **E19078.000**

Figure B-4

Reviewed By: JLC Date: 5/22/2019

APPENDIX B

Well Summary Report By Wood Rodgers

WOOD RODGERS

June 12, 2018 Job No. 8499006

Mr. Tim Shaw
General Manager
Rio Linda/Elverta Community Water District
730 L Street
Rio Linda, California 95673

Dear Mr. Shaw:

Subject: Rio Linda/Elverta Community Water District – Well 16 Construction Summary Report

In accordance with our contract, Wood Rodgers, Inc. is pleased to provide the Rio Linda/Elverta Community Water District (District) with this Well Construction Summary Report for the Site 16 Production Well (Well 16). The Well 16 site (site) is located on U Street, approximately 500 feet west of the intersection with 14th Street in Rio Linda, California, as shown in Figure 1. This report summarizes Wood Rodgers' site exploration, municipal well construction, well and aquifer testing, and water quality analysis.

Site Exploration and Well Design

In 2016, Wood Rodgers designed an exploratory drilling program (to a total depth of 720 feet below ground surface [bgs]) to assess the aquifers of the Laguna Formation and upper Mehrten Formation at this location. Three clustered single-completion monitoring wells were drilled, constructed, and tested on the site. Testing of the aquifers between 315 and 632 feet depth indicated that a municipal supply well was feasible at this site in regard to production capability and water quality. The deeper aquifer was not selected due to increasing manganese concentrations with depth at this location, and indication that this formation was cemented and not as productive as the upper two formations.

Wood Rodgers designed Well 16 to target the intermediate aquifers of the Laguna Formation between 317 feet and 507 feet depth, with a design capacity of 1,500 gpm. Per the District's request, the design included components for future conversion to Aquifer Storage and Recovery (ASR) use. A detailed summary of the site exploration program is provided in Wood Rodgers' report titled *Rio Linda/Elverta Community Water District – Well 16 – Design Report*, dated July 5, 2017 (provided as an Appendix).

Production Well Construction

Wood Rodgers, in collaboration with Affinity Engineering, prepared biddable plans and specifications for the construction and testing of Well 16, and competitively bid the project. Nor-Cal Pump & Well Drilling, Inc. (Nor-Cal) of Yuba City, California, was selected and awarded the contract.

Conductor Casing Installation

The project began on October 18, 2017, with the drilling of a 48-inch diameter borehole to a depth of 55 feet. On October 19, 2017, Nor-Cal installed a 36-inch O.D. (outside diameter) mild steel conductor casing in the borehole and pumped a sand/cement sanitary seal under pressure via tremie pipe from a depth of 55 feet to ground surface.

Borehole Drilling and Geophysical Logging

Nor-Cal mobilized a reverse rotary drilling rig over the conductor casing and began drilling a 17.5-inch diameter pilot borehole on October 21, 2017. On October 22, 2017, the borehole was advanced to 530 feet, per design, and geophysical surveys were conducted in the pilot borehole by Pacific Surveys, LLC of Claremont, California. The suite of geophysical surveys included measurements of resistivity (16-inch and 64-inch), spontaneous potential (SP), and gamma ray. Following geophysical surveys, a deviation survey was performed in the pilot borehole. The borehole met deviation requirements, and Wood Rodgers made final adjustments to the well design based on lithology encountered in the borehole. Nor-Cal proceeded with reaming of the borehole to 34-inch diameter from 55 feet to 285 feet, and 30-inch diameter from 285 feet to 530 feet. On October 24, 2017, Pacific Surveys, LLC performed a caliper survey of the completed borehole, and Wood Rodgers recommended borehole acceptance.

Well Construction and Well Development

Well construction commenced on October 25, 2017. A well casing assembly consisting of 18.625-inch O.D. stainless steel and copper-bearing (0.2-percent) steel and stainless steel wire-wrapped well screen was installed to a total depth of 518 feet. Well screen intervals from 317 to 357 feet and 457 to 507 feet were installed per design. A gravel envelope consisting of 6x12 CEMEX was installed from 530 to 242 feet, with an intermediate bentonite seal from 370 to 375 feet and a fine sand transition seal from 240 to 242 feet. On October 28, 2017, well construction was completed with installation of a sand/cement grout annular seal from 240 feet to ground surface, pumped under pressure via tremie pipe. An as-built well profile is shown in Figure 2.

Well development began on October 30, 2017, with a multi-stage process beginning with initial open-ended airlifting, followed by swab-airlift development (including surfactant treatment), test pump development, and final open-ended airlifting. The Contractor directed all airlift pumping and test pump development water to the ground surface in designated berm areas north and west of the site. All test pumping water was discharged to the drainage ditch system to the west of the site, following the requirements outlined in the District's National Pollutant Discharge Elimination System (NPDES) permit.

Nor-Cal installed the test pump to a depth of 300 feet and began final well development with the test pump on November 11, 2017. Final development consisted of alternately pumping and surging at increasing flow rates until the well met the performance requirements of the contract.

Final well development pumping was conducted at a flow rate up to 2,250 gpm, and was completed on November 14, 2017.

Production Well Testing and Water Quality

Well and Aquifer Testing

Constant rate pumping tests were conducted to determine the well's hydraulic properties and to determine the operational flow rate for the well. Well testing consisted of three short-term (3-hour) constant rate pumping tests and one long-term (8-hour) constant rate pumping test. The short-term tests were conducted on November 17, 2017, at flow rates of approximately 900 gpm, 1,200, and 1,800 gpm. The static water level was measured 95 feet bgs prior to the well testing. The drawdown data and pumping water levels projected to 24 hours for the three short-term constant rate tests are shown in Figure 3.

A long-term (8-hour) constant rate pumping test was conducted on November 21, 2017, at a flow rate of approximately 1,500 gpm. The static water level was measured 94.5 feet bgs prior to the well test. The drawdown data and pumping water level projected to 24 hours are shown in Figure 4. That data indicate that under current hydrogeologic conditions and near the design capacity of 1,500 gpm, Well 16 has a calculated 24-hour specific capacity of 23 gpm per foot (gpm/foot) of drawdown, with a projected pumping water level of approximately 162 feet.

Water Quality

On November 21, 2017, the District collected water quality samples from the well at approximately four hours of pumping duration into the long-term constant rate test. The samples were delivered to BSK Associates Laboratory and analyzed for the complete Title 22 water quality suite. Water quality data indicate that water produced from Well 16 meets all State of California – Division of Drinking Water (DDW) primary and secondary drinking water quality standards. For the constituents of concern in this area, Well 16 produces water with 3.5 micrograms per liter (µg/L) of arsenic, 6.3 µg/L of hexavalent chromium, and manganese was not detected at or above the laboratory detection limit of 10 µg/L. Table 1 provides a summary of the water quality data, and the complete laboratory water quality report is included in the Appendix.

Final Well Surveys and Disinfection

Pacific Surveys conducted a well video survey on December 1, 2017; however, visibility was poor and the well video inspection was rejected. Immediately following the video survey attempt, Pacific Surveys performed a gyroscopic survey, which was conducted within the completed well to confirm plumbness and alignment of the well casing. The gyroscopic survey confirms Well 16 was constructed per specification. Immediately following the gyroscopic survey, Nor-Cal performed final well disinfection.

On December 13, 2017, Nor-Cal performed open-ended airlift to remove sediment from the well sump, and flushed the well with potable water.

Pacific Surveys successfully completed inspection of the well with a video survey on December 15, 2017. The well video survey confirms Well 16 was constructed per specification. The well casing was secured with a steel plate cover.

Well Performance Testing

The well drilling, construction, development, and testing all proceeded in accordance with the well specifications. Well 16 meets all of the performance requirements of the contract at the design capacity of 1,500 gpm. Water produced from this well during testing met sand production and turbidity requirements. The plumbness and alignment surveys indicate that the well meets the contract requirements.

Aquifer Storage and Recovery (ASR) Feasibility

Aquifer Storage and Recovery (ASR) is a process to store water in aquifers for later extraction. As designed and constructed, Well 16 can be used for ASR; however, it is important to note that maintenance and well rehabilitation of ASR wells are much more frequent than conventional extraction wells. Injection rates are normally estimated at approximately one-half of the design capacity of a well. For this site, Well 16 will likely support an injection of approximately 600 gpm of water through the 3-inch diameter stainless steel injection pipe.

Conclusions

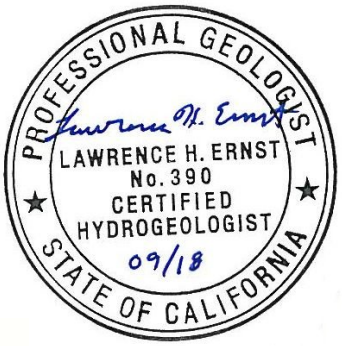
- Well 16 meets all of the District's project objectives for yield, capacity, and water quality. Well 16 meets all DDW primary and secondary drinking water quality standards.
- The well also meets all of the performance requirements of the contract, and Nor-Cal has completed all of the contract items for the project. Wood Rodgers recommends acceptance of Well 16.

We look forward to continue working with you and the Rio Linda/Elverta Community Water District. If you have any questions or require additional information, we would be pleased to respond.

Sincerely,

Lawrence H. Ernst

Lawrence H. Ernst, PG, CEG, CHG
Principal Hydrogeologist



Julie A. Reische

Julie A. Reische, PG
Project Geologist

Enclosures

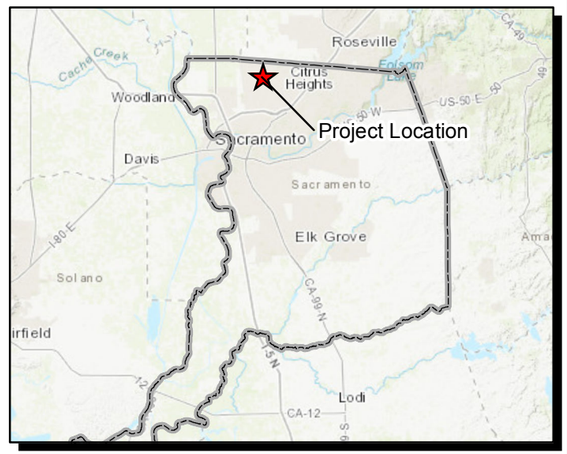
WELL 16 SITE LOCATION MAP

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT

SACRAMENTO COUNTY, CA

JUNE, 2018

- Production Well 16
- Site 16 Monitoring Well
- Wetland Areas (Approximate)
- Well 16 Site (Approximate)
- Sacramento County



NOTES: Project Boundary and Well locations are approximate.

WOOD RODGERS

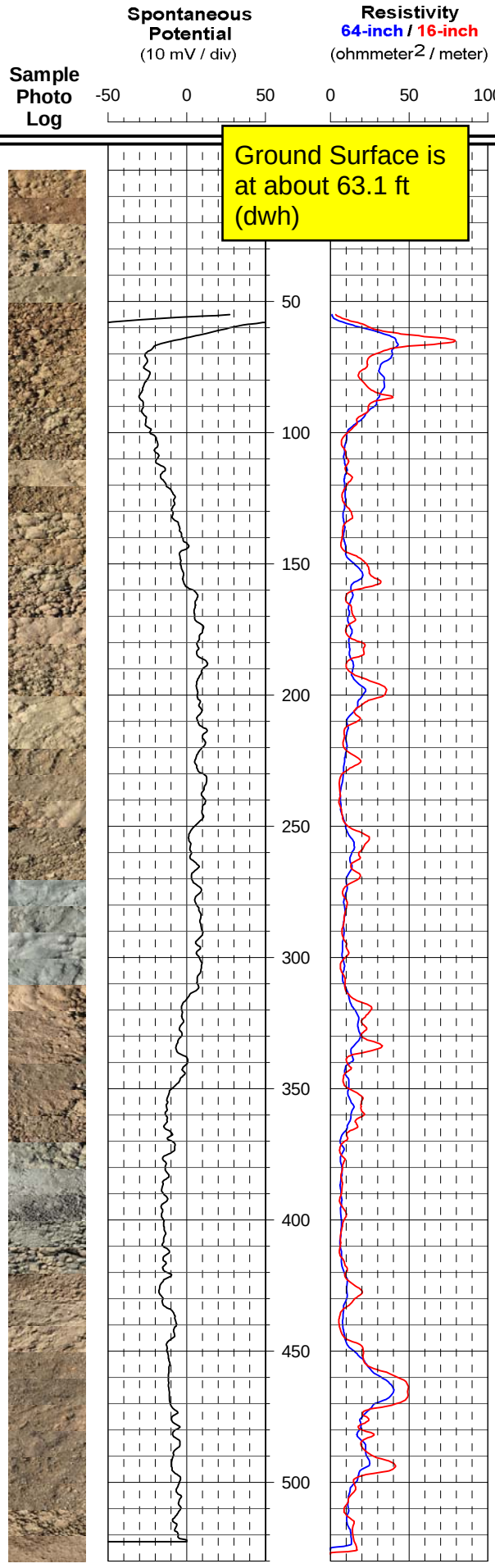
J:\Jobs\8499_RLECWD\8499.006_RioLinda_On-Call\GIS\Tasks\F1_Site_16_Location_Map_20180611.mxd 6/11/2018 11:19:19 AM jreische

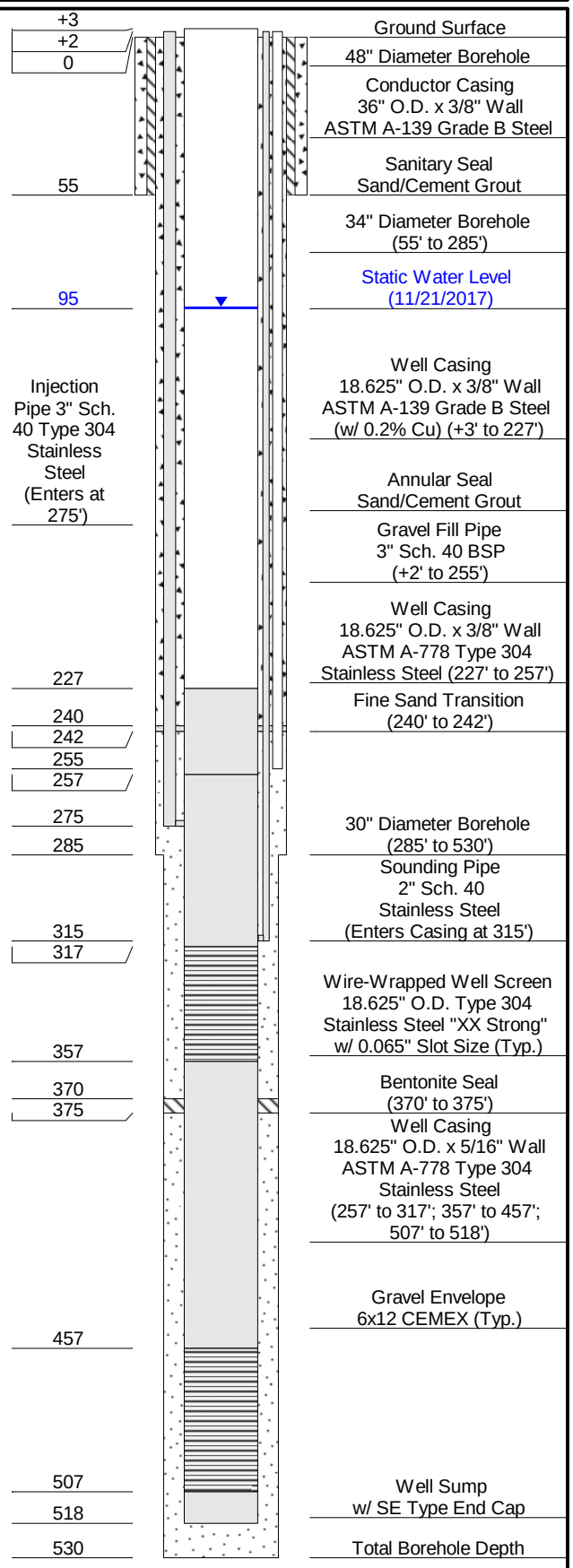
FIGURE 1

WELL 16
AS-BUILT WELL PROFILE

BOREHOLE DATA

Lithology	USCS Field Classification	Sample Photo Log
Sand | Reddish Brown | Fine to Coarse w/ some Fine Gravel	SW	
Silty Clay | Dark Reddish Brown | Low Plastic w/ Silt	CL	
Silty Clay | Dark Reddish Brown | High Plastic w/ Silt	CH	
Sandy Clay | Gray Brown | High Plastic w/ Fine Sand & Silt	CH	
Silty Clay | Reddish Brown | Medium to High Plastic w/ Mudstone & Fine Sand Stringers	CH	
Clayey Sand | Dark Reddish Brown to Gray Brown | Fine to Coarse w/ Quartz, Feldspar & Mafics	SC	
Sandy Clay | Dark Grayish Brown | Low to Medium Plastic w/ Fine Sand Stringers	CL	
Clayey Sand | Grayish Brown | Fine to Medium | Quartz, Feldspar, and Mafics w/ Medium Plastic Clay & Mudstone	SC	
Clay | Gray Brown to Reddish Gray | High Plastic w/ Silt	CH	
Clayey Sand | Dark Greenish Gray | Fine to Coarse w/ High Plastic Clay	SC	
Clay | Dark Bluish Gray | High Plastic w/ Silt	CH	
Sand | Dark Reddish Brown | Fine to Coarse | Quartz, Feldspar & Mafics w/ Silt & Mudstone	SW	
Clayey Sand | Reddish Brown to Gray Brown | Fine to Med w/ Mudstone	SC	
Clay | Dark Blue to Greensih Gray | High Plastic	CH	
Clayey Sand | Dark Bluish Gray | Fine to Medium w/ Silt & Mudstone	SC	
Clay | Dark Grayish Brown | High Plastic	CH	
Sand | Dark Grayish Brown to Black | Fine to Coarse w/ trace Gravel, Silt & some Mudstone	SW	
Sandy Clay | Dark Grayish Brown | Low to Medium Plastic w/ Silt and Fine Sand Stringers	CL	





WELL INFORMATION (11/21/2017)

Capacity & Specific Capacity
SWL = 94.5 ft
Q = 1,512 gpm
24-Hr PWL = 161.5 ft
24-Hr Q/s = 23 gpm/ft of drawdown

Water Quality
Arsenic = 3.5 µg/L
Manganese = Below 10 µg/L
Hexavalent Chromium = 6.3 µg/L

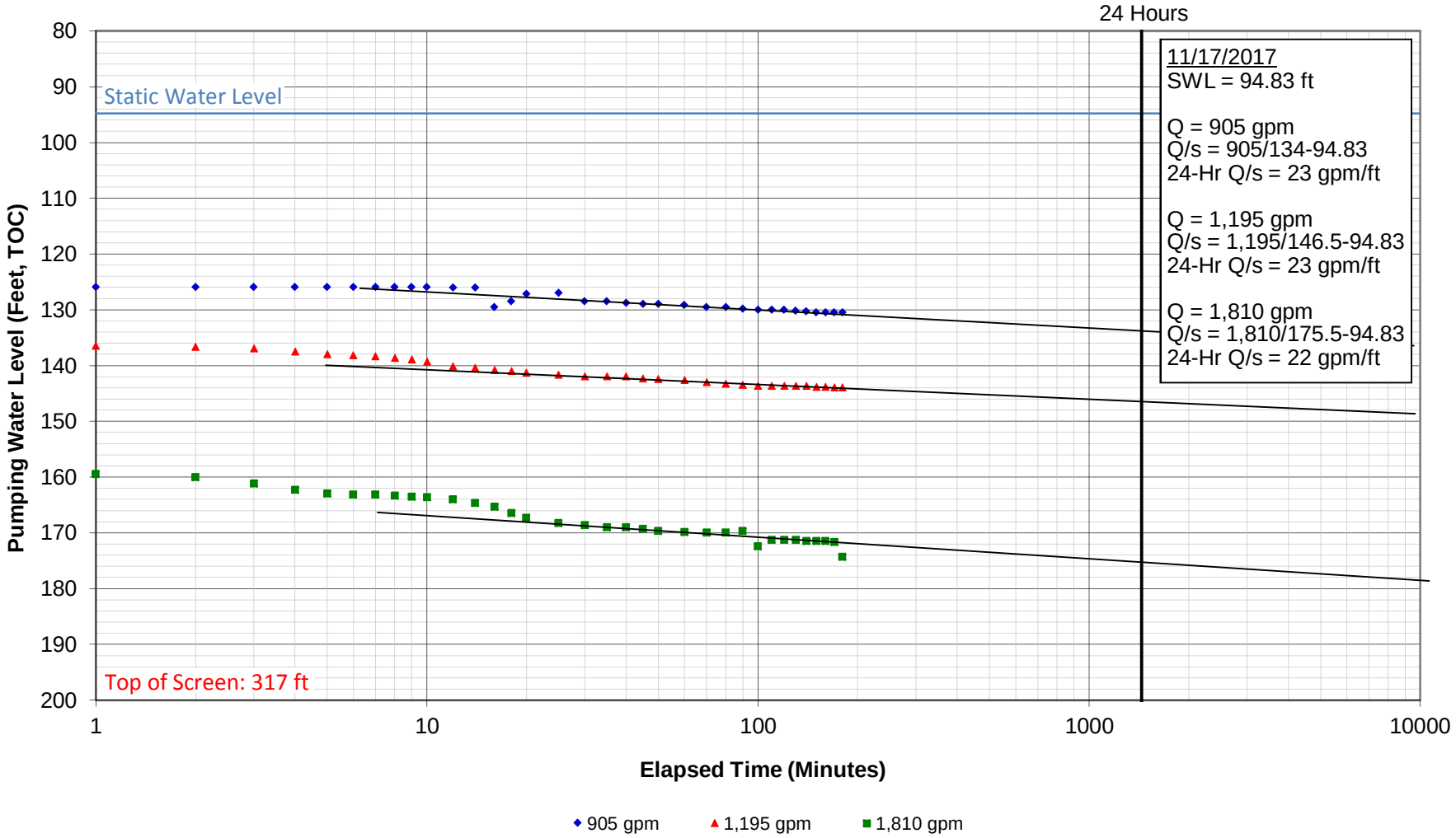
PROJECT NO. 8499006	AS-BUILT WELL PROFILE FOR **RIO LINDA/ELVERTA CWD WELL 16** RIO LINDA, CALIFORNIA	WOOD RODGERS BUILDING RELATIONSHIPS ONE PROJECT AT A TIME 3301 C Street, Bldg 100-B Sacramento, CA 95816 Tel: 916.341.7760 Fax: 916.341.7767	DATE: 6/11/18 10:09 SCALE: V: 1" = 60' DRAWN BY: J.REISCHE DESIGNED BY: L.ERNST CHECKED BY: S.SPAETH

FIGURE 2

J:\Jobs\8499006_RLECWD\Strater\20171108_Well_16_AsBuilt

NO.	DESCRIPTION	ENGR. INIT	BY APPROVED	DATE
1	PRELIMINARY PW DESIGN	JAR		6/26/2017
2	FINAL PW DESIGN	JAR		10/23/2017
3	AS-BUILT WELL PROFILE	JAR		11/8/2017

RLECWD
Well 16
Three-Hour Constant Rate Tests



WOOD RODGERS

FIGURE 3

RLECWD
Well 16
Long-Term Constant Rate Test

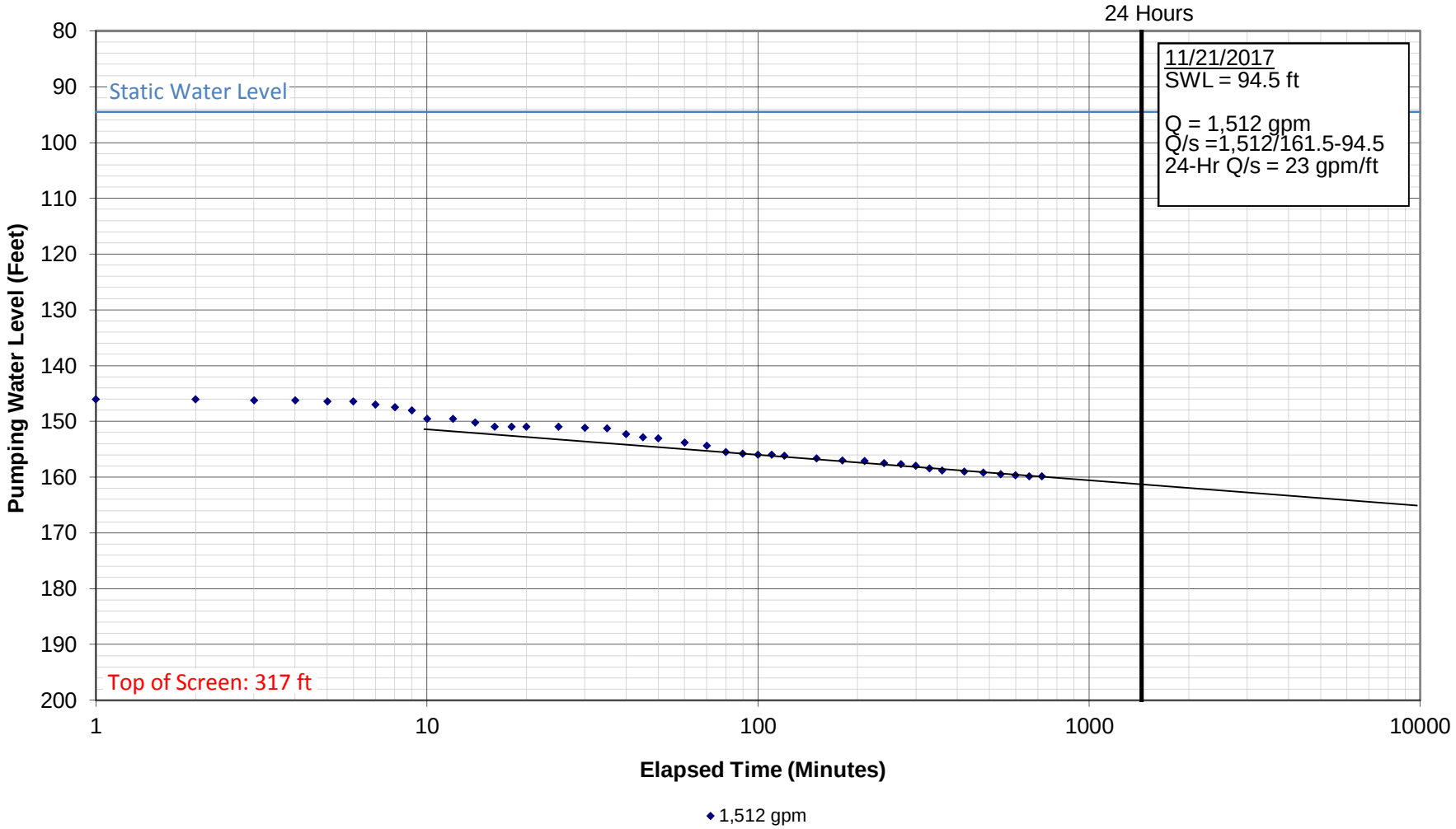


FIGURE 4

TABLE 1
SUMMARY OF WATER QUALITY RESULTS

Rio Linda/Elverta Community Water District Well 16 Sample Date: 11/21/2017	Notification Level	Primary MCL	Regulatory Action Level	Secondary MCL	Units	Result	Exceeds MCL
GENERAL MINERAL							
Bicarbonate Alkalinity (as CaCO3)					mg/l	72	☐
Calcium					mg/l	21	☐
Carbonate Alkalinity (as CaCO3)					mg/l	<3	☐
Chloride				250/500/600	mg/l	65	☐
Fluoride		2.0			mg/l	0.16	☐
Foaming Agents (MBAs)				0.5	mg/l	<0.05	☐
Hardness (as CaCO3)					mg/l	100	☐
Hydroxide Alkalinity (as CaCO3)					mg/l	<3	☐
Magnesium					mg/l	12	☐
Nitrate (as N)		10			mg/l	1.3	☐
Nitrite (as N)		1			mg/l	<0.05	☐
Potassium					mg/l	2.6	☐
Sodium					mg/l	35	☐
Sulfate				250/500/600	mg/l	11	☐
Total Alkalinity (as CaCO3)					mg/l	72	☐
GENERAL PHYSICAL							
Color				15	color units	<5	☐
pH					pH units	7.8	☐
Specific Conductance				900/1600/2200	umhos/cm	390	☐
Total Dissolved Solids				500/1000/1500	mg/l	290	☐
Turbidity				5	NTU	0.22	☐
INORGANICS							
Aluminum		1000		200	ug/l	<50	☐
Antimony		6			ug/l	<2	☐
Arsenic		10			ug/l	3.5	☐
Barium		1000			ug/l	94	☐
Beryllium		4			ug/l	<1	☐
Cadmium		5			ug/l	<1	☐
Chromium		50			ug/l	<10	☐
Chromium-6		50			ug/l	6.3	☐
Copper			1300	1000	ug/l	<5	☐
Cyanide		150			ug/l	<0.5	☐
Iron				300	ug/l	<30	☐
Lead			15		ug/l	<1	☐

Note: " MCL" is the Maximum Contaminant Level established by the California State Water Resources Control Board, Division of Drinking Water. Multiple values for MCL represent trigger levels or recommended/upper ranges.

TABLE 1
SUMMARY OF WATER QUALITY RESULTS (Continued)

Rio Linda/Elverta Community Water District Well 16 Sample Date: 11/21/2017	Notification Level	Primary MCL	Regulatory Action Level	Secondary MCL	Units	Result	Exceeds MCL
INORGANICS							
Manganese	500			50	ug/l	<10	☐
Mercury		2			ug/l	<0.2	☐
Nickel		100			ug/l	<10	☐
Selenium		50			ug/l	<2	☐
Silver				100	ug/l	<10	☐
Thallium		2			ug/l	<1	☐
Zinc				5000	ug/l	<50	☐
RADIONUCLIDES							
Uranium		20			ug/l	<1	☐

Note: " MCL" is the Maximum Contaminant Level established by the California State Water Resources Control Board, Division of Drinking Water. Multiple values for MCL represent trigger levels or recommended/upper ranges.

APPENDIX C

Encroachment Permit

ENCROACHMENT PERMIT

SACRAMENTO COUNTY MUNICIPAL SERVICES AGENCY
827 - 7TH STREET, ROOM 105, SACRAMENTO, CA 95814
PHONE (916) 874-6544

Encroachment Inspection Area: 01

U.S.A. TICKET NO. _____
Phone (800) 227-2600

ENUC2019-00579

1. Permit Type: Utility

2. Application is made for permissions to excavate, construct and/or otherwise encroach on County right-of-way by performing the work described below on:

   U Street and 14th Street in Rio Linda, CA

   Project Location

3. Scope of Work:

RIO LINDA ELVERTA COMMUNITY WATER DISTRICT

INSTALL 8-INCH AND 12-INCH DUCTILE IRON PIPE ALONG ASPHALT ROADWAYS AT A TRENCH WIDTll OF TYPICAL 5 FEET ANDA DEPTH
OF TYPICAL 4.5 FEET. THE LENGTH OF THE PLPE TO BE INSTALLED IS APPROXIMATELY 1,900 FEET. IN ADDITION, FOUR (4) FIRE HYDRANTS WILL BE INSTALLED. THE STREETS INCLUDED IN THIS PROJECT ARE BOUND BY THE FOLLOWING: U STREET BETWEEN DRY CREEK RD AND 14™ STREET, AND 14™ STREET APPROXIMATELY 800 FEET SOUTH OF U STREET.

4. **Except for Annual Permits: Permittee shall schedule a pre-construction meeting to activate this permit by calling CMID at (916) 875-2707.**
5. Before starting work, the Permittee shall notify Sacramento County Construction Management at (916) 875-2707,24 hours in advance of the date work is to begin.
   a) For emergency work, notification shall be provided within 1 hour of dispatch as defined in Section 7-8.03 of the County Standard Construction Specifications
   b) No notification required for work that does not involve excavation and does not obstruct or modify pedestrian, bicycle or vehicular traffic patterns.
6. **Permittee shall contact the County Survey Section at (916) 874-6546 for potential location of survey monuments.**
7. Applicant must check with all Utility Companies serving the area covered by this permit, for location of existing underground pipes, conduits or cables. Underground Service Alert (U.S.A.) does not locate non-pressurized sewer and drainage facilities.
8. Attention is directed to teh General Provisions attached hereto and to any specific conditions made a part of hereof.

In consideration of the granting of this application, it is agreed by the applicant that the County of Sacramento and any officer or employee thereof shall be saved harmless by the applicant from any liability or responsibility for any accident, loss or damage to persons or property, happening or occuring as the proximate result of any of the work undertaken under the terms of this application and the permit or permits which may be granted in response to thereto, and that all of said liabilities are hereby assumed by the applicant. It is further agreed that if any part of this installation interferes with future use of the highway, it must be removed or relocated, as designated by the Director of County Engineering, at the expense ofthe applicant or their successor in interest.

FOR USE BY UTILITY COMPANIES			
District:		Division:	
Engineer:		Job No:	

Contact Person: SARA ROGERS
Phone (916) 991-1000
Applicant Signature: _____

Applicant: RIO LfNDNELVERTA COMMUNITY WATER DISTRICT SARA ROGERS Phone: (916) 991-1000

Address: 730 L STREET RIO LINDA CA 95673 - 5673

Invoice #	Fee Item	Fee Due	Fee Paid	Date Paid
1179017	IT Recovery Fee Billable	$15.75	$0.00	
1179017	Permit Fee - Utility Company	$350.00	$0.00	

Fees Due: $365.75 **Fees Paid:** $0.00 **Current Balance** **$365.75**

DEPARTMENTAL REVIEW	APPROVED	DATE	DEPARTMENTAL REVIEW	APPROVED	DATE
WATER SUPPLY	N/A		**WATER QUALITY**	YES	10/16/2019
TRANSPORTATION	YES	10/23/2019	**TECHNICAL RESOURCES**	YES	10/23/2019
WATER RESOURCES	YES	10/4/2019	Sub. Order Number:	90010214	
			Customer Number:	1000025341	

Approved application is subject to payment of fees, pre-construction meeting with CMID, Attachment A, and is revocable at any time. This permit is nontransferable and EXPIRES ONE YEAR from date issued.

***ANNUAL Permits expire December 31 of the year permit is issued.**

On Behalf of the Director of County Engineering

By: _____
CMID INSPECTOR Date

Plan Submittal Date: 10/2/2019	"ASBUILT" Inspector Approval	_____ Name Date

Department of Transportation Specific Comments

DESCRIPTION:

Permit No. ENUC2019-00579
Description of Work: Rio Linda/Elverta Community Water District will install 8 in and 12 in ductile iron pipe along asphalt roadways at a trench width of typical 5 ft and depth of typical 4.5 ft. Length of pipe to be installed is approx. 1900 ft long. In addition, (4) fire hydrants will be installed. Streets include U St between Dry Creek Rd and 14th St, and 14th St approx. 800 ft south of U St.

SPECIFIC REQUIREMENTS FOR ALL ENCROACHMENT PERMITS

- A mandatory preconstruction meeting is required prior to beginning any work on site. This permit is not activated and therefore not approved until a preconstruction meeting held.
- Site specific notification must be given to Sacramento County Construction Management and Inspection Division at (916) 875-2707 a minimum of 24-hours prior to any work.
- The deposit may be released 180 days after the acceptance of the work provided all inspection costs have been paid in full where applicable.
- Applicant is aware that permit fees DO NOT include inspection charges. Inspection charges will be billed separately at a later date.
- All work covered under this encroachment permit shall comply with the provisions of the revised January 2016 edition of the County of Sacramento Standard Construction Specifications (SCS) and the Standard Requirements for Encroachment Permits (attachment "A"). Prior to the start of any work, it is the responsibility of the applicant to be sure that all requirements including those indicated on "Attachment A" and the SCS are fully understood. Any failure to comply with any of the requirements indicated on attachment A, the SCS or any requirements indicated below may result in work stoppage, fines and/or penalties, or both. This permit is issued in accordance with Division 2, Chapter 5.5 of the Streets and Highways Code of the State of California and Chapter 12.08 of the Sacramento County Code as amended on January 6, 1998.
- Specific attention is directed to the "BACKFILL AND PAVEMENT RESTORATION REQUIREMENTS**"** section of attachment "A". All work covered under this permit shall conform to these requirements. Deviations from these requirements shall be reviewed and approved (if appropriate) in writing separately from this encroachment review process.

POSSIBLE CONFLICTING PROJECTS

- No projects are proposed at this location which will conflict with the work covered under this permit.

TRAFFIC CONTROL REQUIREMENTS

- Construction traffic controls shall be provided in conformance with the Sacramento County Department of Transportation Traffic Control Templates. These templates can be obtained through the Department website at http://www.sacdot.com/Pages/TrafficControlPlansandDetourPlans.aspx

TRENCH CUT FEES:

- No trench cut fees are required for this project.

PAVEMENT MORATORIUM RESTRICTIONS:

- No roadways included under this permit are subject to the pavement moratorium

HOLIDAY MORATORIUM:

- No Holiday Moratorium Streets are included in this work

Reviewed by BL on 10/23/19 – Sac County ROW Management Section

-ATTACHMENT A-

STANDARD REQUIREMENTS
FOR
SACRAMENTO COUNTY ENCROACHMENT PROJECTS

REQUIREMENTS AND STANDARDS

Provisions of the most recent editions of the County of Sacramento Standard Construction Specifications (SCS) and the County of Sacramento Improvement Standards shall apply to all work covered under this encroachment permit. This permit is issued in accordance with Division 2, Chapter 5.5 of the Streets and Highways Code of the State of California and Chapter 12.08 of the Sacramento County Code as amended on January 6, 1998. The following requirements shall also apply to this work.

ACCEPTANCE OF PROVISIONS

It is understood and agreed by the Permittee that performing any work under this permit shall constitute an acceptance of the general and specific conditions hereof.

WORK AND MATERIALS

Work and materials shall be in accordance with the current edition of the County of Sacramento "Standard Construction Specifications." All work shall be in compliance with the Americans with Disabilities Act.

VALID PERMIT KEPT ON SITE

This permit is valid only for work done in the unincorporated Sacramento County area. Any use of private property for storage of materials, trenching and/or placement of signage (other than traffic control devices) shall be approved by the property owner of the land parcel or acting agent thereof. This permit shall be kept on the worksite and must be shown to any authorized representative of the Agency or any law enforcement officer upon demand. Fines for failing to provide a valid permit may be accessed in accordance with Chapter 12.08 of the Sacramento County Code.

GENERAL DEPOSIT

Applicant shall post a $2,500.00 deposit as specified in Chapter 12.08 of the Sacramento County Code. The deposit may be released 180 days after acceptance of the work provided all inspection costs have been paid in full where applicable.

GUARANTEE

Should any failure of the work occur within a period of one year after completion and acceptance by the Agency, (i.e., sign off of permit), including the refilled excavation settling or if the resurfacing or restoration of the roadway disintegrates or develops ruts or holes or if found that materials used were not in compliance with County Standard Specifications, the permittee shall repair and/or resurface the work to the satisfaction of the Agency. If the permittee fails or refuses to do such corrective work, the County may elect to complete the corrective work and collect the cost of the work from the permittee, or to pursue such other remedies as may be available to complete the corrective work at the permittee's expense.

PROSECUTION OF WORK

Any work authorized by this permit shall be performed in a workmanlike, diligent and expeditious manner to the satisfaction of the Agency. The Permittee shall submit a schedule prior to beginning work for any project lasting more than 5 working days.

U.S.A. NOTIFICATION REQUIRED

The Permittee shall notify Underground Service Alert two working days in advance of performing excavation work by calling the toll-free number (800) 227-2600. U.S.A. notification to be renewed at not more than 14 calendar day intervals.

Disregard for or destruction of underground utilities may be cause for revocation of this permit and/or denial of future permits at the discretion of the Agency. Any utility so damaged shall be immediately reported to the owner and the Agency.

ADDITIONAL NOTIFICATION REQUIREMENTS

This permit is for work within the County Right of Way only. Applicant is responsible for coordinating and obtaining all other permits, permission, rights, etc. necessary for work both within the County Right of Way and beyond the limits covered under this permit.

Work performed within the former McClellan Air Force Base must be coordinated with Paul Bernheisel (916) 997-1798 or Mike Swart at (916) 643-0830, ext. 230. A McClellan Facility Encroachment permit is required through these contacts prior to obtaining a County Permit.

Work performed within the former Mather Air Force Base must be coordinated with Clark Whitten at (916) 874-2555. Address: 700 H Street, Ste. 7650, Sacramento, CA 95814

STORAGE OF EQUIPMENT OR MATERIALS WITHIN THE RIGHT-OF-WAY

No equipment of materials shall be parked or stored within any traffic lane or within the public right-of-way at any time of day or night, including holidays and weekends without written consent from the Department of Transportation.

TREES

Unless specifically approved on the face of this permit, the removal or trimming of a tree(s) requires a separate tree permit per County Ordinance, call (916) 874-6291.

TRAFFIC CONTROL REQUIREMENTS AND HOURS OF WORK

A traffic control plan (or plans) shall be submitted for review and approval for any work requiring modifications to existing traffic patterns. The traffic control plan (or plans) shall include provisions for vehicular, pedestrian and bicycle access. Additionally, the traffic control plans (or plans) shall address traffic signal operations for any work performed within 200 feet of a signalized intersection.

Contractor shall contact schools affected by construction to determine if school is in session. If school is in session, no construction activities shall take place 30 minutes before and 30 minutes after the arrival (am) or departure (pm) bell. Contractor shall also be responsible for providing notification to any fire station that could potentially be affected by construction activities.

Transportation routes involving a river crossing over the American River have been identified as being critical for traffic circulation between areas north and south of the river. In order to maintain traffic flow

across these critical corridors, no lane or road closures are permitted from 7:00 am to 9:00 pm at the following locations:

Watt Avenue	Between Folsom Boulevard and Fair Oaks Boulevard
Sunrise Boulevard	Between Folsom Boulevard and Fair Oaks Boulevard
Hazel Avenue	Between Folsom Boulevard and Winding Way

Lane or road closures at these locations during the times indicated will only be allowed in emergency situations or with the written approval of the Director of the Department of Transportation or his designee.

ROAD CLOSURE

No highway or street may be closed without first obtaining approval in writing from the Agency. If permission is granted, it shall be the Permittee's responsibility to notify the Highway Patrol and Fire Department prior to closing the street.

LANE/ROAD CLOSURE DURING NOVEMBER/DECEMBER HOLIDAY SEASON

Unless specifically approved by the Agency, construction will be suspended and no activities that interfere with public traffic shall be conducted on designated streets during the holiday season (defined as the four-day Thanksgiving weekend and December 8 through January 1). All existing pits, excavations, trenches, and openings in the road surface shall be backfilled and paved to produce a level and smooth surface. All barricades and barriers shall be removed from all traffic lanes, unless authorized by the Agency as long-term traffic controls. SCC 7-8.06

MAINTAINING AND PROTECTING TRAFFIC CONTROL FACILITIES

Metal objects (such as manhole frames and lids, valve boxes, bore casings, etc.) shall not be installed within 72 inches of a traffic detector loop. Any traffic signal or detector operation disruption shall be repaired and the system made operational within eight hours of the damage. Should the County elect to provide repair or replacement services, the Permittee shall be required to reimburse the County for all costs involved.

EXISTING SPEED TABLES:

If work requires excavating into existing speed tables, one half of the speed table shall be removed and reconstructed in accordance with current County speed table requirements. If the remaining half of the speed table does not meet current standards, the entire speed table shall be removed and reconstructed in accordance with current standards. If excavation is cored and no greater than 1 sq. ft. in area, in lieu of removing the speed table, pavement restoration may be as specified in Attachment A for "backfilling of potholes and borings within pavement areas".

DIRECTIONAL BORE REQUIREMENTS

Prior to beginning work, the contractor must submit to the Agency (County of Sacramento Inspector) a general work plan. Verify all underground utilities in accordance with Government Code 4216 (SCS sec. 6-16). Before drilling, prepare a directional bore profile showing all verified utility depths with utility required clearances and the projected bore path (elevation). Contractor shall provide directional bore profile to the Agency (County of Sacramento Inspector) prior to drilling. Directional bore depths to be a minimum of 42 inches below pavement grade. Directional bore profile, log of boring operation and a guidance system log shall be kept onsite with the permit. Surface incisions on project streets shall not exceed industry bore pit standards. In the event surface incision dimensions (i.e., length and width) exceed industry bore pit standards (as determined by the Agency), additional pavement restoration will be required. Additional pavement restoration shall include a slurry seal placed over the entire width of the roadway (or to the roadway centerline if disturbances are isolated to one half of the roadway) to encompass the area of restored

pavement. Surface incisions located within 50 feet shall be included in the same slurry seal area. Slurry seal shall extend 4 feet beyond the outermost surface incisions.

TUNNELING

No tunneling will be permitted except on major work as may be specifically approved and set forth on the permit thereof. Tunneling under sidewalks are also not allowed.

PROTECTION OF EXISTING SURFACES

The permittee's contractor shall use appropriate equipment, construction methods and effort/care to prevent damage to existing pavement. The permittee shall also document the pre-existing pavement conditions in a manner that will allow construction damage to be identified. The permittee shall make a post construction evaluation of the pavement surface upon completion of the work and will be responsible for repairing all damage to the pavement surface resulting from construction activities. The permittee will also be responsible for repairing any damaged pavement that cannot be identified as pre-existing.

Excavations within sidewalk areas, when not active, must be covered with a material suitable for pedestrian use and secured to avoid shifting. The excavation shall be covered for no more than 7 days (i.e., the excavation must be backfilled and the surface restored within 7 days of initial excavation). Sidewalk repairs shall conform to Sacramento County Details 4-25 and 4-43.

MAINTENANCE

The permittee agrees to exercise reasonable care to properly maintain any encroachment placed by it in the County right-of-way. The permittee further agrees to repair any damage to portions of the right-of-way which occurs as a result of the maintenance of the encroachment.

TRENCHING

Not more than one-half of the width of a traveled way shall be disturbed at one time and the remaining width shall be kept open to traffic by bridging or backfilling. Pedestrian and bicycle facilities shall be maintained through the work site at all times unless provisions have been shown on an approved traffic control plan.

TEMPORARY BRIDGING OF EXCAVATIONS AND TRENCHES

The use of steel plates shall be approved by the Agency prior to installation. Steel plates used in the roadway, shall have the name and 24 hour emergency telephone number of the contractor responsible for maintaining the plates stenciled on the roadway pavement adjacent to the plates. Painted text shall be in white lettering. The text shall be neatly stenciled lettering, a minimum five inches (5") in height and shall be maintained in a neat and legible condition for the duration of plate placement. Steel plates shall conform to the following width and thickness requirements:

Steel Plate Width	Min. Thickness
18" or less	¾"
18" to 72"	1"
Width greater than 72"	per analysis by engineer

When steel plates are used to cover excavations on roadways with two or more lanes in each direction or posted 45 mph or greater posted speed or where the related work is to take place for longer than two (2) weeks, the steel plates shall be inlayed or recessed into the existing pavement. Existing pavement surface shall be milled out to ensure that the top of plate elevation matches the existing elevations of the adjacent

pavement surface. Steel plates must be large enough to allow a minimum of one foot (1') of bearing on all sides of the trench.

When steel plates are used to cover excavations on all other roadways, they maybe placed on top of the asphalt with transitional ramps of MC250 asphalt mix (cutback) against all vertical edges of the plates. All ramping must be accomplished to provide a minimum angle of approach of twelve to one (12:1), providing a smooth, gradual transition between the pavement and the plate. Steel plates shall be anchored to the roadway surface with pins or spikes on the four (4) outermost corners. Additional pins shall be placed as necessary to assure the steel plates are secured. Pins shall be installed such that they do not protrude above the plate surface anymore than is necessary to anchor the plate and shall not create a hazard for the motoring or pedestrian public. Steel plates should be welded together to prevent shifting/bouncing where necessary. Where the Street surface is uneven, plates shall be bedded on MC250 asphalt mix (cutback). The steel plates shall extend beyond the edge of the trench a minimum of 18", but no more than 30" on all sides. No corner of any steel plate shall protrude into the traveled way as to create a hazard to the motoring public.

Steel plates shall have a nonskid surface static coefficient of friction of 0.35 per California Test 342 for all steel plates within traveled roadway, and 0.50 per ASTM C 1028 for those steel plates in pedestrian crosswalks or accessible areas. When required by the Agency, the Contractor shall certify in writing to the Agency that steel plates to be used in the Work meet the required static coefficient of friction.

The length of a series of plates running parallel to traffic wheel paths shall not exceed 30' unless approved by the agency or noted in the TCP or contract drawings. Steel plates shall not remain on the roadway for longer than seven (7) calendar days, unless otherwise approved by the Agency

Trench walls and adjacent soils shall be sufficiently stabilized prior to the use of steel plates for bridging. For conditions that require a support structure (wide excavation with multiple plates), the system must be designed by a registered professional engineer and submitted to the Agency for approval before use.

Steel plates shall be installed to operate with minimum noise levels as indicated in Sacramento County Code, Section 6.68, "Noise Control". All steel plates within the right-of-way, whether used in or out of the traveled way, shall be without deformation (e.g., chains, attachments, weldments, or irregularities that can constitute a hazard). BUMP (W8-1) warning signs shall be properly posted and maintained in advance of all roadway plates placed on the surface of the pavement. The Contractor is responsible to maintain the steel plates in a proper condition until the roadway is properly back-filled and patched to allow for the safe passage of vehicles. The Contractor shall be responsible for any damages or injuries which may occur as a result of the plates being placed in the roadway. The Contractor must reimburse to the Agency any cost for emergency repairs.

In sidewalk areas, one and one-eighths inch (1-1/8") plywood with a nonskid surface static coefficient of friction of 0.50 per ASTM C 1028 may be substituted for steel plating where the excavation is less than two (2) feet deep and when authorized by the Agency. Transitional ramps of MC250 asphalt mix (cutback) shall be installed against vertical edges in the direction of pedestrian traffic (both up and down-stream). All ramping must be accomplished to provide a minimum angle of approach of twelve to one (12:1), providing a smooth, gradual transition between the sidewalk and the plate. Plywood shall extend beyond the edge of the trench and any overlap shall be a minimum of 18". Plywood shall not be placed such that it protrudes past the sidewalk edge.

REMOVAL OF USA MARKINGS

Before the project is accepted as complete, all USA and other construction related markings shall be removed to the satisfaction of the Agency**.** Removal shall occur within 30 days of the date the markings are no longer needed, or upon completion of the work, whichever is sooner. The Agency will accept natural weathering of markings if the markings disappear within the 30 day period. If the markings are in brick paver or concrete areas and if by natural weathering or other approved removal methods the markings still remain, the

contractor must replace the concrete or the brick pavers in-kind, unless the utility operator has failed to use chalk-based paint or other non-permanent marking materials. Excavators and utility operators are encouraged to avoid marking in these areas by using offset markings. Removal methods shall be non-destructive and residual shadowing shall not remain.

Removal of markings shall comply with the federal, state and local requirements of the National Pollutant Discharge Elimination System (NPDES) and the Regional Water Quality Control Board.

U.S.A. markings not removed by the required time lines may be removed and the sidewalk or street repaired/replaced by the Agency at its discretion. The Agency will charge the excavator a service fee equal to the actual costs of removal plus an administrative fee of 20% for removing the markings and making any repairs and/or replacements. This fee will include the cost to comply with NPDES.

DAMAGE TO EXISTING IRRIGATION SYSTEMS

Irrigation systems owned or operated by the County of Sacramento are located within the right-of-way and on dedicated property outside the right-of-way. In the event the irrigation systems are damaged due the permittee's activities, it shall be repaired under the supervision of the Department of Transportation, Contract Landscape Section staff (916-875-5123). The system shall be repaired in accordance with the current County Standards. Care shall be taken to eliminate any debris from entering the system. Any damage resulting from repairs or contamination into the irrigation system will be the responsibility of the permittee. A contractor working in the Landscape construction or maintenance field shall be required for all necessary repairs to the landscape system.

Any permittee working in the right-of-way shall verify the location of the utilities with regards to easements. It shall be the permittee's onus to verify they are not encroaching on dedicated properties such as Assessment District parcels along the right-of-way. In the event a utility has been installed on dedicated property outside of the right-of-way or utility easements, or is planned to be placed on dedicated property, a utility easement must be acquired.

DRIVEWAYS

Portland cement concrete is not allowed for private driveway approaches within County right-of-way unless specifically approved by the Director of the Department of Transportation.

CLEANUP

All roadside drainage ditches shall be restored to a true grade and intake and outlet ends of all culverts shall be left free from all excess material and debris.

RECORD DRAWING

Upon completion of underground or surface work of consequence, the Permittee shall furnish record drawings to CMID showing location and details of work performed.

FUTURE MOVING OF INSTALLATION

The installation authorized herein shall, upon demand of the Agency, be relocated in a timely manner by, and at the sole expense of the Permittee whenever construction, reconstruction, maintenance, or traffic conditions on the highway may require such relocation. The permittee must commence such relocation within the time specified in said demand and thereafter diligently prosecute the same to completion.

BACKFILLING OF POTHOLES AND BORINGS WITHIN PAVEMENT AREAS

Backfilling of potholes or similar types of minor excavations shall be with native or aggregate base materials compacted to 95%. In lieu of using compacted materials, controlled density fill (CDF) conforming to section 50-15 of the SCS may be used.

Backfilling of borings for soil or ground water sampling shall be in accordance with Sacramento County Environmental Health Requirements and County Standards. Backfilling of borings within pavement areas shall utilize cementitious grout materials regardless of the depth of encountered ground water. Backfilling of the upper one foot of borings/monitoring wells located in pavement areas shall consist of either high strength non-shrink grout or fast-setting concrete (minimum compressive strength of 4000 psi). The grout/concrete shall be uniformly color stained black to match surrounding asphalt surfaces (surface staining of placed concrete is prohibited). Placement of material shall utilize hand-rodding methods to facilitate consolidation. Once placed and rodded the surface shall be finished smooth using hand-trowel or other methods.

In the event that consolidation of backfill materials occurs within the first 24-hours of placement resulting in settlements within the boring/monitoring well hole greater than ¼-inch, the hole shall be subsequently refilled with high strength non-shrink grout as required to reestablish a smooth surface. Additionally, if separation/shrinkage of the placed concrete is greater than 1/8-inch occurs along the outer perimeter of the filled hole, a flexible sealant shall be placed such that it uniformly fills associated gaps/voids. If the above criteria are not satisfactorily met, the County Inspector may require cutting/grinding within affected areas and subsequently repave in accordance with County Drawing 4-64.

TEMPORARY PAVEMENT REQUIREMENTS

Vehicular travel over backfilled but unpaved excavations will not be allowed. The Contractor shall provide a temporary surface suitable for driving consisting of at least one and one half inches (1-1/2") of plant mix type "A" asphalt concrete on all roadways with two or more marked traffic lanes in each direction or 45 mph or greater posted speed. Plant mix type "A" or asphalt plant mix cutback maybe used on all other roadways.

All temporary paving shall be identified by painting the words "TEMPORARY PAVEMENT" along with the name of the contractor responsible for maintaining the temporary paving material and the date in which the material was placed. Painted text shall be in white lettering at the beginning, ending and along the length of the temporary paving at a spacing not to exceed 500 ft. The TEMPORARY PAVING and the contractor or utility's name shall be neatly stenciled 5 inches minimum in height and shall be maintained in a neat and legible condition. The date in which the material was place may be painted free hand without the use of a stencil, but must be legible.

Temporary pavement and/or portions of temporary pavement totaling 1000 ft or greater in length shall also be identified with a construction sign placed along the edge of the roadway and constructed in accordance with section 34 of the SCS. Temporary pavement signs shall be 30" X 30" in a diamond configuration and shall be orange with 5 inch black lettering. Signs shall be installed at the beginning, ending and at a spacing not to exceed 1000 ft. and shall be installed within the road right of way whenever possible. Signs shall not be installed in a location that would obstruct visibility or create an obstacle for pedestrians. Property owner's permission must be obtained if sign is placed on private property.

In no case shall temporary pavement be allowed to remain for a period greater than 30 calendar days unless specifically approved by the Department of Transportation Right-of-Way Management Section.

RESTORATION OF SURFACES

(Note: Requirements for Trench Restoration are currently in the process of being revised. New requirements may be enforced on this project if final paving has not been completed prior to implementation of new requirements.)

Replace section 14-3 STREET AND PARKING LOTS and Section 14-4 CONCRETE of the County Standard Construction Specifications with the following:

14-3 STREETS AND PARKING LOTS

14-3.01 Trench Restoration

Edges of trench restoration shall be cut/grind so that edges are parallel or perpendicular to the centerline of the roadway. All required sand/slurry seal must be placed so that edges are parallel or perpendicular to the centerline of the roadway. Edges of existing pavement that are broken or damaged shall be removed and neatly trimmed back to stable and undisturbed base and surface materials. For locations where the existing pavement is severely fractured, remove loose asphalt to the nearest crack beyond the specified restoration limits.
Repaving of trenched areas shall be in accordance with Standard Drawing 4-64 (including Shallow Trench, Deep Trench and Earth Saw Trench Details) with the following exceptions:

Roadways less than 3 years old

Cuts in pavement that have been constructed or overlaid within the last three (3) years are not generally allowed. County Code section 12.09.120 prohibits excavations in newly constructed or overlaid roadways for a period of three (3) years. In circumstances such as emergency repair work where no other feasible options exist, the Sacramento County Dept. of Transportation may grant a waiver to this restriction. In the event that a waiver is granted, the applicant should be prepared to meet more stringent restoration requirements than those specified in these specifications.

Roadways with pavement 3 to 5 year old

Cuts in pavement that have been constructed or overlaid within three (3) to five (5) years shall receive a minimum 1-1/2 inch deep grind from lane line to lane line or edge of pavement and overlaid with asphalt concrete in conformance with these specifications. At roadway intersections and cul-de-sac bulbs, minimum grind and overlay shall extend to include the entire ¼ quadrant of the roadway affected by the work. 1-1/2 inch grind depth shall be considered a minimum and shall be adjusted as necessary to produce a stable surface for new pavement material. A seal coat will not be required.
For Earth Saw Trench Section, delete "is within 20" of lip of gutter, otherwise 6" minimum" and replace with "edge of pavement or lane line". A seal coat will not be required

Roadways with pavement greater than 5 years old

Minor Roadways:

Alternate 1 – Comply with requirements of Drawing 4-64 except eliminate tee portion of asphalt restoration by limiting the extent of paving to the projected area above the trench. Follow the trench paving with a minimum 1-1/2 inch grind and overlay from center of roadway to edge of pavement.

Alternate 2 – Comply with requirements of Drawing 4-64. Slurry seal or sand seal from edge of pavement to centerline of roadway and a minimum of two (2) feet beyond the trench paving limits. At roadway intersections and cul-de-sac bulbs, minimum slurry seal or sand seal shall be placed on the entire ¼ quadrant of the roadway affected by the work. Sand seal applications shall be limited to 250 sq. ft. or less or as directed by the County **(Black sand shall be used for this application)**.

Roadways with 2 or more lanes in each direction or 45 mph or greater posted speed:

Add: Arterial and thoroughfares shall receive a minimum 1-1/2 inch deep grind from lane line to lane line or edge of pavement and overlay with asphalt concrete in conformance with these specifications. 1-1/2 inch grind depth shall be considered a minimum and shall be adjusted as necessary to produce a stable surface for new pavement material. A seal coat will not be required

Limits for "Seal Coats" specified in section 49-2.02 which is referenced in the "Earth Saw Trench Section" detail shall be revised to comply with the limits indicated above.

14-3.01 Repair to areas damaged by Contractor's Operations

Areas of existing asphalt surfaces damaged during construction shall be removed and the top four inches (4") of base material shall be re-compacted to a minimum relative compaction of ninety-five percent (95%). Base or underlying material that is wet, loose, or otherwise unsuitable for supporting new paving shall be removed to a maximum depth of twelve inches (12") below the bottom surface of the new asphalt pavement section and replaced with aggregate base material per the requirements of Section 22, "Base Material", of the County Standard Construction Specifications. Aggregate base material shall be compacted in layers not exceeding six inches (6") in depth to a minimum relative compaction of ninety-five percent (95%). If unsuitable materials exist below this depth, an approved geotextile fabric shall be installed prior to placing the aggregate base materials.

14-3.02 Asphalt Concrete

The asphalt concrete shall conform to requirements specified in Section 23, "Asphalt Concrete", of the Sacramento County Standard Construction Specifications. If the existing pavement surfacing is rubberized asphalt, top layer of new asphalt surfacing shall match the existing. Special attention should be noted that section 23-3.02 "Binders" specifies that "Conventional dense graded asphalt used on on-ramps, off-ramps, arterial streets and thoroughfare streets shall use PG70-10 binder."

Contractor is responsible for developing and providing appropriate placing and compacting techniques for producing asphalt concrete in conformance with these specifications including the determination of minimum acceptable paving temperatures for the specific mix to be used.
In no case however shall any layer of asphalt concrete be placed when the atmospheric temperature is below 50°F, during raining weather or when the roadway is moist or damp. For the purpose of this provision, "raining" shall mean any weather condition that causes the roadway to become moist or damp. In the case of sudden precipitation, all paving work must stop immediately, all asphalt concrete on site not yet placed and all asphalt concrete in transit from the plant shall be rejected. Asphalt concrete shall be delivered to the site in a thoroughly blended condition and spread by a self-propelled asphalt paving machine in such a manner as to avoid segregation during the placing operations and placed in such a manner as to achieve a density of not less than 92%, nor greater than 97% (CTM 309). Prior to placing asphalt concrete pavement, the vertical edges of any existing pavement, curbs, and gutters adjoining the area to be paved shall be clean and given a tack coat of asphaltic emulsion. Horizontal surfaces of asphalt (new and/or existing) shall also receive a tack coat prior to placing new asphalt. Asphaltic emulsion shall be of the high viscosity type subject to the approval of the Agency, and shall conform to Sections 39 and 94 of the State Specifications. Asphalt paving machine shall be used for placing the finish lift of asphalt concrete paving on all trench restorations. Limited areas inaccessible to mechanical spreading and compaction equipment or where irregularities or unavoidable obstacles exists may be spread, raked and luted by hand tools or other methods approved by the Agency. Asphalt paving machines shall be mechanical spreading and finishing equipment provided with a screed or strike-off assembly capable of distributing the material to not less than the full width of the trench. Screed action shall include any cutting, crowding or other practical action which is effective on the mixture without tearing, shoving or gouging and which produces a surface texture of uniform appearance. The screed shall be adjustable to the required section and thickness. The paver shall operate independently of the vehicle being unloaded.

Final pavement surface for trenches greater than 3 feet in width and which are mostly parallel to the centerline of the street shall not vary from the edge of a 10 foot straight edge (placed parallel and perpendicular to the trench) by more than 3/8-inch, except at intersections or changes in grade.

Final pavement surface for trenches 3 feet or less in width, bore holes having an area less than 50 square feet, and trenches of any width not mostly parallel to the centerline of the street shall match the smoothness of the existing pavement, except final pavement surface grade shall not exceed 3/8-inch above a line between the existing pavement surface at each edge of the excavation. Final pavement below this line is not acceptable.

Pavement not meeting the above requirements shall be removed and replaced. Such pavement shall be removed to a minimum depth of 1-1/2 inches for the full width of the trench. The minimum length of removal along the trench shall extend for 4 feet beyond the ends of the non-conforming areas, but in no case exceed the limits of the original pavement repair.

14-3.02A Density requirements

The County may require testing of the asphalt concrete used in pavement restoration to verify that the materials being place conforms to these specifications. Density of asphalt concrete for quality control purposes may be determined by nuclear gage testing or other approved nondestructive testing method. At the County's request, the Contractor shall provide quality assurance testing based on sampling of the asphalt on a lot basis defined as each five hundred (500) linear feet of trench. Compaction results shall be from comparing the average of density of cores taken from the compacted pavement to the Maximum Theoretical Density (Rice) as determined by California Test 309 (CT 309) taken from randomly sampled material on a lot basis. A minimum of two (2) cores per lot shall be sampled with half of the cores taken at the joint between the newly placed and the existing asphalt concrete (not more than 1 ft away from existing asphalt concrete). Contractor shall meet with the inspector and mutually agree on the sampling location. The density of each core shall be determined per CTM 308. The core samples shall be four inches (4") in diameter. Samples shall be neatly cut with a saw, core drill, or other approved equipment. If the density does not fall within the specified density range, the Contractor may test at two additional locations within the same 500 linear feet of trench area and average the results of all three tests. This averaged result shall fall within the above-specified range. The Contractor shall notify the County inspector prior to paving and provide contact information for Contractor's testing personnel. The Agency reserves the right to conduct parallel quality assurance testing at its discretion in accordance with Caltrans test methods, 308, 309, and 375. Asphalt not meeting the above specified compaction requirements will be rejected on a lot basis.

14-3.03 Seal Coats

Specified seal coat treatment shall conform to the following requirements and shall not be placed until at least seventy-two (72) hours after the placement of the final paving lift.

Slurry Seal (type 2)

Slurry seal shall be furnished and placed as specified in Section 37-2 for Slurry Seal, of the State Specifications, with the exception that the fifth paragraph of Section 37-2.06, "Placing", shall be modified to provide that the thickness of application of slurry seal shall be adjusted to provide one (1) layer not less than one eighth inch (1/8") thick nor greater than one-quarter inch (1/4") thick. The requirement for wetting surface prior to placement of slurry seal is waived.

Sand Seal

Sand seal shall be furnished and placed as specified in Section 37-1, "Seal Coats", of the State Specifications with the exception of the requirements for the asphaltic binder and aggregate. Asphaltic binder and aggregate shall be as

follows:

- The asphaltic materials for sand seal shall conform to the requirements in Section 50-17, "Asphalt, Liquid Asphalt, and Asphaltic Emulsion", of these Specifications. The asphaltic materials shall be CRS 1.
- The rate of application of CRS 1 shall vary between 0.08 and 0.15 gallons per square yard as directed by the Agency, depending upon the surface condition and weather.
- Aggregate for sand seal shall conform to Section 37-2.02C, "Aggregate", of the State Specifications and shall be spread at the rate of six (6) to ten (10) pounds per square yard, or as directed by the Agency. Preparation of seal coat, applying bituminous binder, spreading, and finishing shall be in accordance with Section 37, "Bituminous Seals", of the State Specifications, with the exception that steel wheeled rollers for sand seal may be eliminated and the pneumatic roller used for all seal operations. Asphaltic emulsion shall be applied by a distributor truck.
- Black sand shall be used for this application.

14-3.04 Shoulders

Surface restoration of trenches located in a shoulder within six feet (6') of the traveled way shall consist of a structural section equal to the original, or as shown on the Plans, but having a minimum of five inches (5") of aggregate base compacted to a relative compaction of ninety-five percent (95%).

14-4 CONCRETE

Repairs to concrete curbs, gutters, sidewalks, driveways and other concrete surfaces shall be made by removing and replacing the entire portions between joints or scores, except as follows:

- Curb and gutter shall be replaced between saw cuts so that the remaining or new curb and gutter will not be less than four feet (4') in length, measured from the saw cut to the nearest score mark, expansion joint, construction joint or weaken plane joint.
- The entire width of sidewalk shall be replaced between saw cuts for a length of not less than four feet (4') in length, measured from the saw cut to the nearest score mark, expansion joint, construction joint or weaken plane joint.
- Driveways shall be replaced as directed by the Agency, either completely or partially by saw cutting in the middle of the driveway.
- Existing driveways not in conformance with current ADA requirements shall be completely removed and replaced to conform to current requirements.
- In accordance with section 4-18 of the County of Sacramento Improvement Standards and the American with Disabilities Act (ADA), California Code of Regulations, Title 24 and the California Manual on Uniform Traffic Control Devices, any modification of any portion of an intersection shall require access improvements to all corners of that intersection. Re-construction of existing sidewalk ramps as a result of damage to the sidewalk ramp shall be considered a modification to a portion of the intersection. All existing corners of an intersection where sidewalk ramps are not in conformance with current ADA requirements shall be completely removed and replaced to conform to current requirements.
- Curb dowels and reinforcing shall be provided and shall be installed in accordance with Section 27-6 of the County Standard Construction Specifications.

Replacement shall be in accordance with the applicable requirements, including the placement of Aggregate Base Class 2 under the new concrete as specified in Section 27, "Curb, Gutter, Sidewalk, and Drainage Structures" of the County Standard Construction Specifications. Pedestrian access shall be maintained in accordance with Section 12-12.02, "Pedestrian and Bicycle Access' of the County Standard Construction Specifications.

14-5 PAVEMENT MARKINGS

Replace entire section with the following:

Except where specified otherwise in these Specifications or the Special Provisions, the Contractor shall replace all crosswalks, legends and other permanent pavement markings and raised markers that have been disturbed, destroyed or covered by the Work. Damaged pavement legends shall be completely removed and crosswalks shall be removed from edge of road to centerline in accordance with section 13-2.09 "Removal of Traffic Stripes and Pavement Markings" and a sand seal or slurry seal conforming to section 14-3.04 "Seal Coat" shall be applied. Seal coat shall cover the entire pavement surface and extend a minimum of 6 inches past the areas where the legend has been removed. All edges of seal coat shall be perpendicular or parallel to the centerline of the roadway. Pavement markings shall then be replaced in accordance with section 48-2 "Thermoplastic Traffic Stripes and Pavement Markings".

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DWR STANDARD REQUIREMENTS FOR ENCROCHMENT PERMITS

Show all County storm drain facilities within the vicinity of the project site and denote with SD.

If project disturbs one acre or more, project owner must determine if coverage under the Construction General Permit (CGP) or a waiver of coverage must be obtained. Include Waste Discharge Identification (WDID) number on construction drawings.

NOTES TO BE INCLUDED ON CONSTRUCTION DRAWINGS:

1. For locations where tunneling/trenching occurs under existing storm drain pipe, control density backfill shall be used consistent with Section 50-15 of the Sacramento County Standard Construction Specifications (September 2001 Revised March 2004, Revised January 2008 and Revised January 1, 2016).
2. Sacramento County Department of Water Resources requires a minimum horizontal separation of 36 inches and a minimum vertical separation of 18 inches from nearest side of storm drain facility. All drainage facilities shall be field verified prior to any construction activity.
3. All drain inlets within the project limits and any downstream inlets that may be affected shall be protected using Sacramento County Standard Construction Specifications (September 2001 Revised March 2004, Revised January 2008 and Revised January 1, 2016).
4. If during construction, the drainage system is damaged or found to be damaged, immediately contact the Drainage Maintenance Engineering Office by calling 311 and the inspector. Repairs shall adhere to the current Sacramento County Standard Construction Specifications.

POTHOLE NOTE:

Prior to beginning construction, the contractor shall pothole all drainage locations on these plans and allow utility company appointed surveys to locate the Utilities within l/10 (0.10') of a foot. After surveys have located the utilities, the contractor shall backfill the potholed areas in accordance with Sacramento County Standard Construction Specifications. Utility companies shall review the information provided by surveys and revise the alignment of the utility lines as necessary.

DWR ENCROACHMENT PERMIT STORM WATER CONDITION OF APPROVAL

1. Contractor shall inspect on a daily basis all immediate access roads and gutters. At a minimum daily (or when deemed necessary by the inspector) and prior to any rain event, the discharger shall remove sediment or other construction activity related materials that are deposited on the roads and gutters (by vacuuming or sweeping).
2. A haul route plan and soil export destination locations shall be part of this permit. Grading permit/s may be required for soil disposal locations.

STANDARD CONSTRUCTION SPECIFICATIONS 10-4.03 STORMWATER QUALITY

Contractors performing construction in the County of Sacramento are required to develop and implement a Water Pollution Control Program (WPCP).

Unless specifically authorized in writing by the Agency, activities that could create water pollution (like potholing, clearing, grubbing, directional drilling, boring, or similar ground-disturbing activities) must not be performed without a written program to control water pollution.

WATER POLLUTION CONTROL PROGRAM (WPCP)

The Permit holder must prepare a Water Pollution Control Program (WPCP) detailing the following:

1. A map showing:
    a. Locations of storm drain system.
    b. Locations of water lines with owner contact information.
    c. Locations of soil stockpiles and solid waste containers.
    d. Locations of Vehicle and equipment fueling, servicing, cleaning and storage areas.
    e. Locations of Material storage areas.
    f. Locations of erosion and sediment control Best Management Practices (BMPs).
    g. Site drainage (flow arrows) during execution of the Work.
    h. Locations of stabilized vehicle accesses.
    i. Locations of concrete clean out areas.
2. List of chemicals, potential pollutants, and hazardous materials to be used. For example: drilling fluids, marking paint removal solutions, etc.
3. Methods for (include copies of BMP: drawings, details, and/or descriptions):
    a. Storm Water and Non-Storm Water dewatering.
    b. Street cleaning.
    c. Managing run-on and run off.
    d. Frack-out prevention and control.
    e. Spill prevention and control.
    f. Handling and disposal of solid waste.
    g. Methods for safekeeping and secondary containment of chemicals, potential pollutants, and hazardous materials.
    h. Storage and dispensing of fuel and lubricants.
    i. Clean out and disposal of concrete.
    j. Construction BMP maintenance, inspection, and repair.
    k. Sanitation provisions.
4. Methods of site stabilization after completion of the work.
5. Construction BMP implementation and removal schedule.

The program must be available on-site and is subject to review by County personnel.

Failure to implement the program may subject the permit holder to formal enforcement actions including but not limited to stop work notification.

SACRAMENTO AREA
SEWER DISTRICT
SERVING YOU 24/7

Review drawing attached to this permit. For lower lateral location contact U.S.A. 1-800-227-2600. In the event of damage and or broken SASD (sewer) facilities, contact SASD Radio room at (916) 875-6730 and provide location of damage line, a SASD representative will document and evaluate the damage.

We are enforcing County Standard .Please plot public utilities with offset dimensions relative to other facilities, utilities; center line & right of way, and write adjacent Assessor's Parcel Number (see Encroachment Review application form). Please request Plan & Profile of the sewer facilities in your project area in writing and or visit us from 1:00 PM to 4:30 PM at:

10060 Goethe Rd.

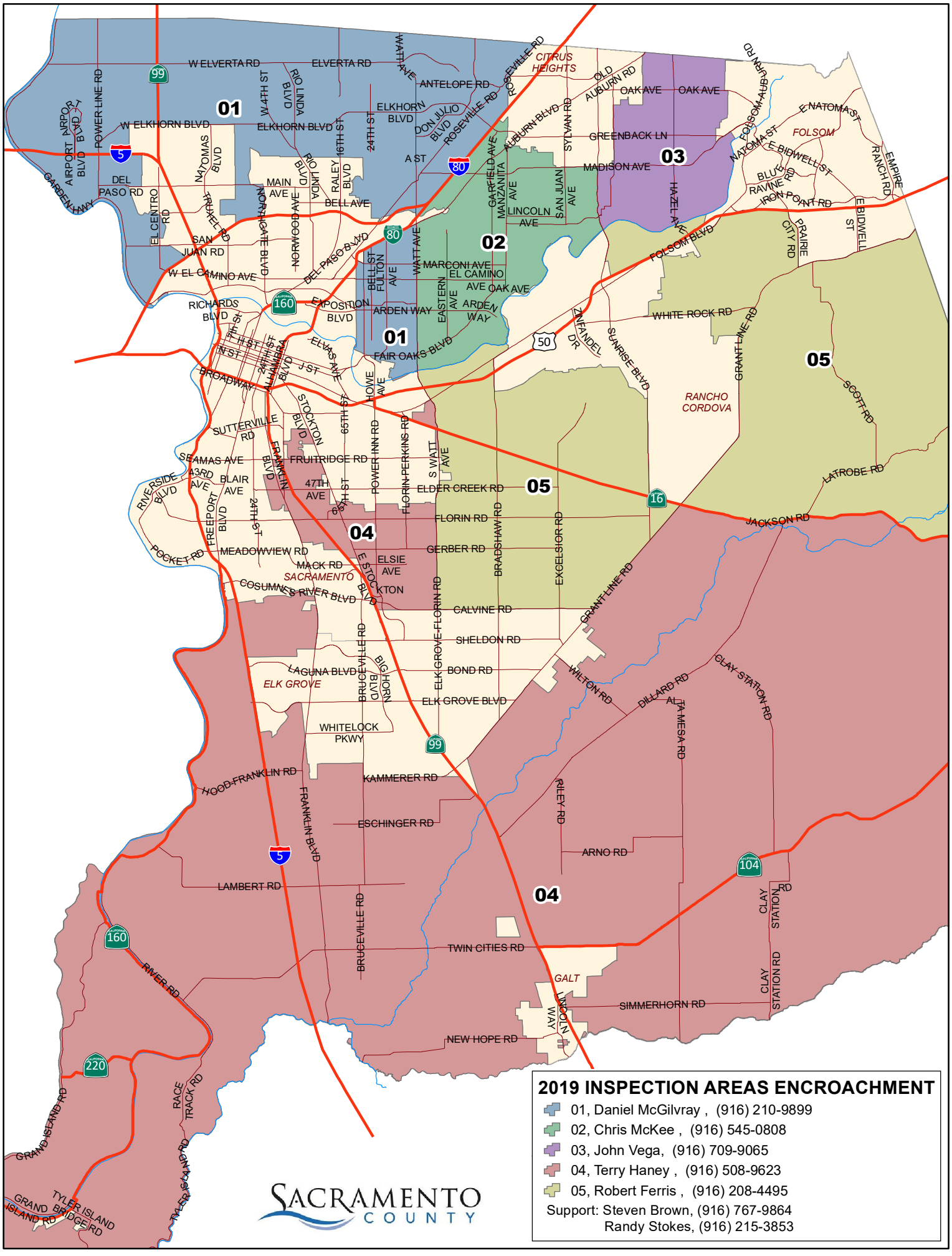
Sacramento Ca. 95827

Maintain 5' Min. Horizontal clearance to Sewer facilities. Except Water Main per State Health & Safety code requires 10' min Horizontal clearance.

Maintain 1' Min. Vertical clearance to Sewer facilities on all crossings.

To access any SASD sewer:

An approved Access Permit is required. Access Permit is available on SASD website www.sacsewer.com , please allow 10 days for approval.


01
02
03
04
05
CITRUS HEIGHTS
FOLSOM
RANCHO CORDOVA
SACRAMENTO
ELK GROVE
GALT
W ELVERTA RD
ELVERTA RD
ANTELOPE RD
ELKHORN BLVD
W ELKHORN BLVD
A ST
OAK AVE
GREENBACK LN
MADISON AVE
LINCOLN AVE
MARCONI AVE
EL CAMINO AVE
ARDEN WAY
FAIR OAKS BLVD
FOLSOM BLVD
WHITE ROCK RD
BROADWAY
FRUITRIDGE RD
ELDER CREEK RD
FLORIN RD
GERBER RD
MEADOWVIEW RD
MACK RD
CALVINE RD
SHELDON RD
BOND RD
ELK GROVE BLVD
WHITELOCK PKWY
KAMMERER RD
ESCHINGER RD
LAMBERT RD
TWIN CITIES RD
SIMMERHORN RD
NEW HOPE RD
ARNO RD
JACKSON RD
GRANT LINE RD
LATROBE RD
SCOTT RD
WILTON RD
DILLARD RD
CLAY STATION RD
HOOD-FRANKLIN RD
RIVER RD
GRAND ISLAND RD
TYLER ISLAND RD
BRIDGE RD
RACE TRACK RD
POWER LINE RD
DEL PASO RD
MAIN AVE
SAN JUAN RD
W EL CAMINO AVE
RICHARDS BLVD
EL CENTRO RD
NATOMAS BLVD
TRUXEL RD
NORTHGATE BLVD
NORWOOD AVE
RIO LINDA BLVD
W 4TH ST
W 16TH ST
24TH ST
RALEY BLVD
BELL AVE
DEL PASO BLVD
BELL ST
FULTON AVE
WATT AVE
GARFIELD AVE
MANZANITA AVE
SAN JUAN AVE
AUBURN BLVD
SYLVAN RD
OLD AUBURN RD
ROSEVILLE RD
DON JULIO BLVD
ELKHORN BLVD
WATT AVE
AIRPORT BLVD
GARDEN HWY
EXPOSITION BLVD
ELVAS AVE
J ST
N ST
H ST
11TH ST
12TH ST
ALHAMBRA BLVD
STOCKTON BLVD
65TH ST
HOWE AVE
POWER INN RD
FLORIN-PERKINS RD
S WATT AVE
SUTTERVILLE RD
SEAMAS AVE
43RD AVE
BLAIR AVE
RIVERSIDE BLVD
FRANKLIN BLVD
47TH AVE
59TH ST
24TH ST
FREEPORT BLVD
POCKET RD
ELSIE AVE
E STOCKTON BLVD
COSUMNES RIVER BLVD
BRUCEVILLE RD
BIG HORN BLVD
ELK GROVE-FLORIN RD
BRADSHAW RD
EXCELSIOR RD
ZINFANDEL DR
SUNRISE BLVD
GRANT LINE RD
FOLSOM AUBURN RD
E NATOMA ST
NATOMA ST
E BIDWELL ST
BLUE RAVINE RD
IRON POINT RD
EMPIRE RANCH RD
PRAIRIE CITY RD
HAZEL AVE
RILEY RD
LINCOLN WAY
CLAY STATION RD
TA MESA RD
AL
5
80
99
160
50
16
104
220
2019 INSPECTION AREAS ENCROACHMENT
01, Daniel McGilvray , (916) 210-9899
02, Chris McKee , (916) 545-0808
03, John Vega, (916) 709-9065
04, Terry Haney , (916) 508-9623
05, Robert Ferris , (916) 208-4495
Support: Steven Brown, (916) 767-9864
Randy Stokes, (916) 215-3853
SACRAMENTO COUNTY

U.S.A. TICKET NO. _____
Phone (800) 227-2600

SACRAMENTO COUNTY MUNICIPAL SERVICES
827 – 7TH STREET, ROOM 102, SACRAMENTO, CA. 95814
PHONE (916) 874-6544

PERMIT NO. ENUC2019-00579
MAP NUMBER
COORDINATES

APPLICATION FOR ENCROACHMENT PERMIT

1. Permit Type:

2. Application is made for permission to excavate, construct and/or otherwise encroach on County right-of-way by performing the work described below on:

U Street and 14th Street in Rio Linda, CA
Project Location

3. Scope of Work:

INSTALL 8-INCH AND 12-INCH DUCTILE IRON PIPE ALONG ASPHALT ROADWAYS AT A TRENCH WIDTH OF TYPICAL 5 FEET AND A DEPTH OF TYPICAL 4.5 FEET. THE LENGTH OF THE PIPE TO BE INSTALLED IS APPROXIMATELY 1,900 FEET. IN ADDITION, FOUR (4) FIRE HYDRANTS WILL BE INSTALLED. THE STREETS INCLUDED IN THIS PROJECT ARE BOUND BY THE FOLLOWING: U STREET BETWEEN DRY CREEK RD AND 14TH STREET, AND 14TH STREET APPROXIMATELY 800 FEET SOUTH OF U STREET.

4. **Permittee shall schedule a pre-construction meeting to activate this permit by calling CMID at (916) 875-2707.**
5. **Permittee shall notify Construction Management and Inspection Division (CMID) at (916) 875-2707, at least 24 hours in advance prior to commencing work.**
6. **Permittee shall contact the County Survey Section at (916) 876-5829 for potential location of survey monuments.**
7. Applicant must check with all Utility Companies serving the area covered by this permit, for location of existing underground pipes, conduits or cables. Underground Service Alert (U.S.A.) does not locate non-pressurized sewer and drainage facilities.
8. Attention is directed to the General Provisions attached hereto and to any specific conditions made a part of hereof.

In consideration of the granting of this application, it is agreed by the applicant that the County of Sacramento and any officer or employee thereof shall be saved harmless by the applicant from any liability or responsibility for any accident, loss or damage to persons or property, happening or occurring as the proximate result of any of the work undertaken under the terms of this application and the permit or permits which may be granted in response to thereto, and that all of said liabilities are hereby assumed by the applicant. It is further agreed that if any part of this installation interferes with the future use of the highway, it must be removed or relocated, as designated by the Chief Deputy County Executive of Municipal Services, at the expense of the applicant or their successor in interest.

FOR USE BY UTILITY COMPANIES			
District		Division:	
Engineer		Job No:	

Contact Person SARA ROGERS (916) 803-0012

Applicant Signature: 9-24-2019

Applicant: RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT Phone: (916) 991-1000

Address: 730 L STREET City RIO LINDA State CA ZIP 95673

DEPARTMENTAL REVIEW	APPROVED	DATE			VALIDATION:
WATER SUPPLY			Bond / Deposit: Code: 077C-0772982-5500000		
TRANSPORTATION			PERMIT FEE: Code: 005A-2900000-92925800		
WATER RESOURCES					
WATER QUALITY			Sub. Order Number:		
TECHNICAL RESOURCES			Customer Number:		

Approved applications subject to payment of fees, pre-construction meeting with CMID, Attachment A, and is revocable at any time. This permit is nontransferable and EXPIRES **ONE YEAR** from date issued. ***ANNUAL Permits expire December 31 of the year permit is issued.**

***MICHAEL PENROSE*, Road Commissioner**

By: _____ Date: _____
CMID INSPECTOR

Plan Submittal Date:	"ASBUILT" Inspector Approval: _____ (Name) _____ (Date)

Traffic control plans templates:
http://www.sacdot.com/Pages/TrafficControlPlansandDetourPlans.aspx

Sacramento County General Map Viewer e-Map-It
http://generalmap.gis.saccounty.net/Default.aspx

STATEMENT OF APPLICANTS RESPONSIBILITY

Encroachment Permit

Dear Applicant:

Please read the following statement outlining your responsibilities regarding the checking and approval of your Encroachment Permit.

California Government Code Section 66451.2 authorizes cities & counties to charge a fee for the actual cost of review. Sacramento County has implemented this fee in Section 22.20.016 of Sacramento County Code. In submitting your plan for review and signing this form, you are agreeing to take responsibility for the costs generated by the County related to plan review, material testing, and construction inspections. An application fee of $365.75 ($350.00 + $15.75 I.T. Recovery Fee) is to accompany this encroachment permit submittal. Upon receipt, a unique account will be established in your name. You will receive a statement on a monthly basis, and all charges must be paid in full prior to final inspection approvals of your permit. If you are the owner of the affected land please sign on the line below. If you are an authorized agent of the owner please sign below and present a copy of your power of attorney for this project. Failure to keep your account current may result in delays of permit approval and final inspection approvals.

I hereby confirm that I understand my financial responsibility for this plan. If I sell or option this property, I will disclose the terms of this statement, and if I fail to do so, I will be jointly responsible.

Property Address/Project Name:	Well 16 Pump Station Project		
Assessor's Parcel No.:	See Plan Sheets		
FOR UTILITY ENCROACHMENT PERMITS ONLY IDENTIFY UTILITY PURVEYOR WHO OWNS FACILITIES:	Rio Linda/Elverta Community Water District		
Applicant's Name:	Tim Shaw		
Title:	General Manager		
Company Name:	Rio Linda/ Elverta Community Water District		
Contractor's License No.:	N/A	Business License:	N/A
Address:	730 L Street, Rio Linda, CA 95673		
Telephone No.:	(916) 991-1000	E-mail Address:	gm@rlecwd.com
SECURITY DEPOSIT			
☐ Bond	Bond Number: N/A	Bond Amount:	N/A
Bond Exp. Date: N/A	Bonding Company:	N/A	
☐ Cash			
Refund Cash Deposit To:			
Name:	N/A		
Address:	N/A		
Signature:	Timothy R Shaw	Date:	9-24-2019

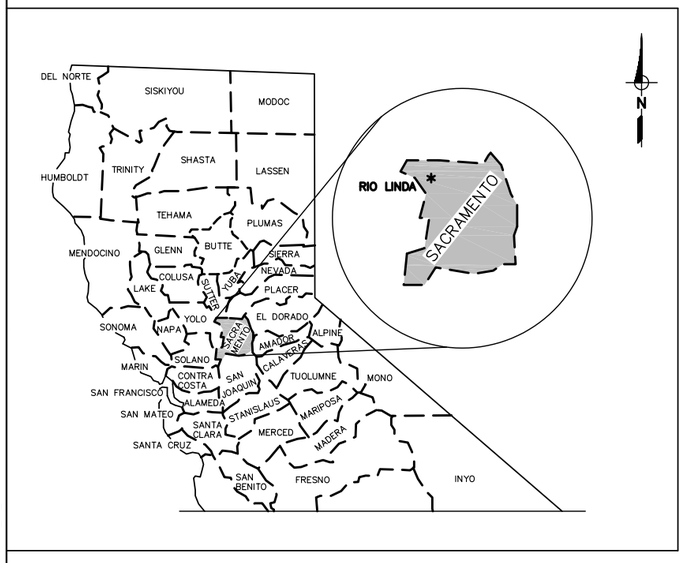
RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT

RIO LINDA, CALIFORNIA

WELL 16 PUMP STATION PROJECT

ENCROACHMENT PERMIT SET

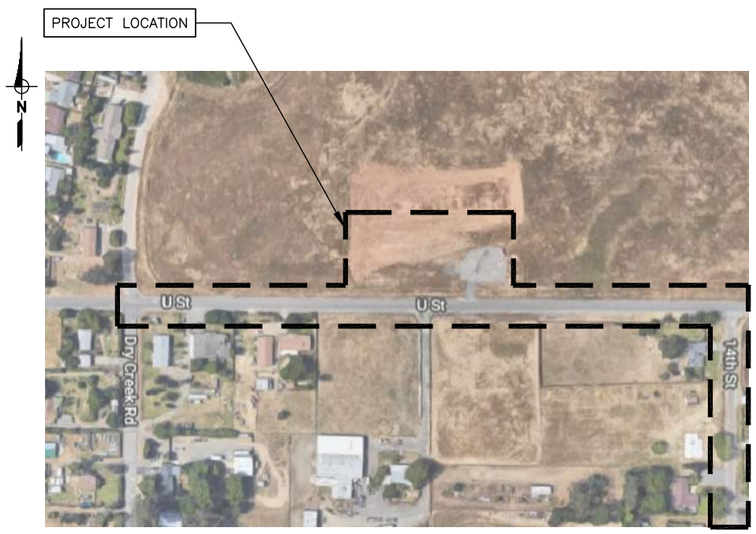
OCTOBER 2019



VICINITY MAP

NOT TO SCALE

INDEX OF DRAWINGS



LOCATION MAP

NOT TO SCALE

APPROVED - RLECWD GENERAL MANAGER DATE

DOMENICHELLI & ASSOCIATES DATE

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

0 1"

AT FULL SCALE

(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER

DRAWN: J. CADE

CHECKED: S. ROGERS

DATE: OCTOBER 2019

DOMENICHELLI & ASSOCIATES

Domenichelli & Associates
1101 Investment Blvd. Suite 115
El Dorado Hills, CA 95762
Ph: (916) 933-1997
Fax: (916) 933-4778

REGISTERED PROFESSIONAL ENGINEER JAMA MILLER CROSS NO. 73226 Exp. 6/30/21 CIVIL STATE OF CALIFORNIA

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

COVER SHEET

DRAWING NUMBER 1

SHEET NUMBER G1

FILENAME

RLWD FILE NO.

Z:\RLECWD\WELL 16 EQUIPPING PROJECT\02 DESIGN\CAD -\WORKING 7_22_19\WELL 16 - G1-ENCROACHMENT.DWG

PROJECT NOTES

1. WORK INCLUDED (BUT NOT LIMITED TO):

   A. ALL WORK SHALL CONFORM TO THE APPLICABLE LOCAL, STATE, AND FEDERAL CODES AND SPECIFICATIONS INCLUDING OSHA.

   B. EXCAVATIONS SHALL BE CARRIED OUT IN THE DRY AND PROVISIONS SHALL BE MADE TO PREVENT THE BOTTOM OF EXCAVATION FROM FLOODING AT ALL TIMES.

   C. IT IS THE CONTRACTORS RESPONSIBILITY TO ASSURE JOB SAFETY. LOCAL, STATE AND FEDERAL, INCLUDING OSHA, LAWS AND RULES SHALL BE ENFORCED BY THE CONTRACTOR AT ALL TIMES.

   D. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT (USA), (800) 642–2444, 48 HOURS PRIOR TO ANY EXCAVATION. THE CONTRACTOR SHALL ALSO NOTIFY ALL OTHER UTILITIES, NOT IN USA, 48 HOURS PRIOR TO ANY EXCAVATION.

   E. ALL STRUCTURES AND FACILITIES DAMAGED BY CONTRACTOR SHALL BE REPAIRED OR REPLACED AT CONTRACTOR'S EXPENSE.

2. EXISTING TOPOGRAPHIC SURVEY WAS PREPARED BY ALAN DIVERS SURVEYING, PLACERVILLE CA. USING MONUMENTS AND CALCULATIONS OFF RECORD MAP. ALL ELEVATIONS ARE NGVD–29 VERTICAL DATUM AS TRANSFERRED BY GPS OBSERVATION.

3. PUBLIC SAFETY AND TRAFFIC CONTROL PLAN SHALL BE PROVIDED IN ACCORDANCE WITH THE GENERAL SPECIFICATIONS. SAFE VEHICULAR AND OPERATION STAFF ACCESS SHALL BE PROVIDED AT ALL TIMES DURING CONSTRUCTION.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS AND OTHER SURVEY MARKERS DURING CONSTRUCTION. ALL SUCH MONUMENTS OR MARKERS DESTROYED DURING CONSTRUCTION SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.

5. EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.

6. THE TYPES LOCATIONS, SIZES, AND/OR DEPTHS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE IMPROVEMENT PLANS WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE TYPES, EXTENT, SIZES, LOCATIONS, AND DEPTHS OF SUCH UNDERGROUND UTILITIES. A REASONABLE EFFORT HAS BEEN MADE TO LOCATE AND DELINEATE ALL KNOWN UNDERGROUND UTILITIES. HOWEVER, THE DISTRICT CAN ASSUME NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF THE DELINEATION OF SUCH UNDERGROUND UTILITIES NOR FOR THE EXISTENCE OF OTHER BURIED OBJECTS OR UTILITIES WHICH MAY BE ENCOUNTERED BUT WHICH ARE NOT SHOWN ON THESE DRAWINGS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ACTUAL LOCATIONS.

7. ALL CONSTRUCTION SHALL CONFORM TO THESE PLANS AND THE LATEST EDITION OF RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT'S STANDARD CONSTRUCTION SPECIFICATIONS.

8. THE CONTRACTOR SHALL NOTIFY THE DISTRICT CONSTRUCTION INSPECTION SUPERVISOR AT (916) 991–1000 AT LEAST FORTY–EIGHT (48) HOURS PRIOR TO INTENDED START OF WORK TO ARRANGE A PRE–CONSTRUCTION FIELD MEETING AND SHALL VERIFY AT THIS TIME THAT THE INSPECTOR HAS RECEIVED COPIES OF THE APPROVED PLANS. NO CONSTRUCTION MAY BE DONE PRIOR TO THIS MEETING.

9. COMPLIANCE WITH NOISE RESTRICTIONS IS REQUIRED. HOURS OF CONSTRUCTION OPERATION SHALL BE LIMITED FROM 7:00 A.M. TO 6:00 P.M. WEEKDAYS. NO SATURDAY WORK SHALL BE ALLOWED UNLESS APPROVED BY THE DISTRICT. NO SUNDAY WORK IS APPROVED. CONSTRUCTION EQUIPMENT SHALL BE MUFFLED AND SHROUDED TO MINIMIZE NOISE LEVELS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

10. NO REFUELING, LUBRICATION, OR MAINTENANCE OF CONSTRUCTION VEHICLES SHALL BE DONE ANYWHERE ON THE SITE EXCEPT WITHIN APPROVED CONSTRUCTION STAGING AREAS.

11. PRIOR TO COMMENCEMENT OF ANY WORK SHOWN ON THESE PLANS LOCATED WITHIN EXISTING RIGHT–OF–WAY OR EASEMENTS, THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM SACRAMENTO COUNTY PLANNING, INSPECTION, AND PERMITTING DEPARTMENT. THE CONTRACTOR WILL BE REQUIRED TO POST A PERFORMANCE BOND AND PROVIDE PROOF OF INSURANCE NAMING THE DISTRICT AS ADDITIONALLY INSURED.

ARCHAEOLOGY NOTE

SHOULD ANY CULTURAL RESOURCES, SUCH AS STRUCTURAL FEATURES, UNUSUAL AMOUNTS OF BONE OR SHELL, ARTIFACTS, HUMAN REMAINS, OR ARCHITECTURAL REMAINS BE ENCOUNTERED DURING ANY DEVELOPMENT ACTIVITIES, WORK SHALL BE SUSPENDED AND THE OWNER SHALL BE NOTIFIED IMMEDIATELY. CONTRACTOR SHALL COMPLY WITH ALL CONTRACT REQUIREMENTS FOR PROTECTION OF CULTURAL AND ARCHITECTURAL RESOURCES.

CONSTRUCTION WATER

ALL CONSTRUCTION WATER TO BE OBTAINED FROM A HYDRANT LOCATION APPROVED BY RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT. CONTRACTOR MUST OBTAIN A HYDRANT PERMIT AND INCORPORATE AN APPROVED BACKFLOW PREVENTION DEVICE IN ORDER TO USE A HYDRANT FOR CONSTRUCTION WATER.

RLECWD GENERAL NOTES

1. RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT IS A MEMBER OF U.S.A. ONE CALL PROGRAM. THE CONTRACTOR SHALL NOTIFY U.S.A. A MINIMUM OF 48 HOURS PRIOR TO START OF ANY EXCAVATION.
2. ALL MATERIALS USED AND WORK PERFORMED IN WATER SYSTEM CONSTRUCTION AND INSTALLATION SHALL COMPLY WITH APPROVED PLANS, SPECIAL CONDITIONS, AND THE DISTRICT STANDARDS AND SPECS. ANY AND ALL DEVIATIONS FROM THESE DOCUMENTS SHALL REQUIRE PRIOR WRITTEN APPROVAL BY THE GENERAL MANAGER OF THE DISTRICT.
3. TEN (10) DAYS PRIOR TO PRE–CONSTRUCTION MEETING, THE CONTRACTOR SHALL FURNISH TO THE DISTRICT, A LIST OF MATERIALS PROPOSED TO BE USED IN CONSTRUCTING THE WATER SYSTEM, INCLUDING MANUFACTURER, ACTUAL LOCATION OF MANUFACTURER AND MODEL NUMBER.
4. AN ON–SITE MEETING WITH THE DISTRICT INSPECTOR, REGISTERED PROFESSIONAL ENGINEER, COUNTY INSPECTOR, AND CONTRACTOR MUST BE HELD AT LEAST TWO (2) DAYS IN ADVANCE OF CONSTRUCTION TO INSPECT MATERIALS, SCHEDULE INSPECTIONS, REVIEW THE APPROVED WATER SYSTEM PLANS AND SCHEDULE ANY TIE–IN CONNECTIONS. PRE–CONSTRUCTION MEETINGS WILL NOT BE SCHEDULED UNTIL ALL DISTRICT COSTS AND FEES HAVE BEEN PAID IN FULL AND SUBMITTALS OF ALL MATERIALS LISTS, GUARANTEE LETTERS AND ENCROACHMENT/MAINTENANCE BONDS HAVE BEEN RECEIVED.
5. ALL WATER SYSTEM SHUTDOWNS SHALL BE MADE ONLY BY THE DISTRICT PERSONNEL. UNDER NO CIRCUMSTANCES SHALL ANYONE OTHER THAN THE DISTRICT OPEN OR CLOSE ANY VALVE IN THE DISTRICT SYSTEM. SHUTDOWNS FOR THE PURPOSE OF MAKING CONNECTIONS TO EXISTING MAINS MUST BE SCHEDULED AT LEAST THREE (3) DAYS IN ADVANCE, AND ARE ONLY PERMITTED MONDAY THRU THURSDAY, BETWEEN THE HOURS OF 9:00AM AND 3:00PM OR AS APPROVED BY THE DISTRICT. ALL CONNECTIONS WILL BE SUPERVISED AND CONTROLLED BY THE DISTRICT.
6. THE FINISH GRADE SHALL BE ESTABLISHED, STAKED, AND MARKED AT EACH WATER SERVICE CONNECTION AND HYDRANT LOCATION. PERMANENT PROPERTY CORNER MARKERS SHALL BE PLACED BY A LICENSED SURVEYOR.
7. THE COMPLETED WATER SYSTEM MUST BE DISINFECTED, HDYRO–TESTED, AND FLUSHED. THE CONTRACTOR OR DISTRICT SHALL PROVIDE ALL TESTING AND PAY FOR ALL DISTRICT INSPECTION COSTS.
8. NO WATER SERVICE WILL BE PROVIDED AND NO CONNECTION TO WATER SERVICE WILL BE PERMITTED UNTIL THE REQUIREMENTS FOR TEMPORARY WATER APPROVAL HAVE BEEN COMPLETED.
9. AT THE TIME OF FINAL ACCEPTANCE BY THE DISTRICT, THE COMPLETED WATER SYSTEM AND MAIN EXTENSIONS WITH ALL APPURTENANCES, APPARATUS, FITTINGS AND EQUIPMENT SHALL BECOME AND FOREVER REMAIN THE PROPERTY OF THE DISTRICT.
10. ALL BACKFLOW PREVENTION DEVICES SHALL BE TESTED BY CERTIFIED APPROVED COUNTY TESTER PRIOR TO FINAL ACCEPTANCE. COPIES OF SATISFACTORY TEST RESULTS SHALL BE FURNISHED TO THE DISTRICT PRIOR TO FINAL ACCEPTANCE OF SYSTEM AT NO COST TO THE DISTRICT.
11. A SEPARATE SAMPLING STATION AND/OR STATIONS SHALL BE INSTALLED AS NECESSARY TO MEET STATE DEPARTMENT OF HEALTH SERVICES REQUIREMENTS FOR COLIFORM TESTING.
12. PIPELINES SHALL BE INSTALLED ON UNIFORM GRADES TO MINIMIZE HIGH SPOTS AND LOW SPOTS IN THE LINE.
13. THE CONTRACTOR IS RESPONSIBLE FOR ALL TRAFFIC CONTROL. TRAFFIC CONTROL AND PAVEMENT CUTTING AND RESTORATION ARE UNDER THE JURISDICTION OF SACRAMENTO COUNTY. A TRAFFIC PLAN SHALL BE SUBMITTED TO THE DISTRICT PRIOR TO SUBMITTING TO SACRAMENTO COUNTY.

DWR NOTES FOR ENCROACHMENT

1. FOR LOCATIONS WHERE TUNNELING/TRENCHING OCCURS UNDER EXISTING STORM DRAIN PIPE, CONTROL DENSITY BACKFILL SHALL BE USED CONSISTENT WITH SECTION 50–15 OF THE SACRAMENTO COUNTY STANDARD CONSTRUCTION SPECIFICATIONS (SEPTEMBER 2001 REVISED MARCH 2004, REVISED JANUARY 2008 AND REVISED JANUARY 1, 2016).
2. SACRAMENTO COUNTY DEPARTMENT OF WATER RESOURCES REQUIRES A MINIMUM HORIZONTAL SEPARATION OF 36 INCHES AND A MINIMUM VERTICAL SEPARATION OF 18 INCHES FROM NEAREST SIDE OF STORM DRAIN FACILITY. ALL DRAINAGE FACILITIES SHALL BE FIELD VERIFIED PRIOR TO ANY CONSTRUCTION ACTIVITY.
3. ALL DRAIN INLETS WITHIN THE PROJECT LIMITS AND ANY DOWNSTREAM INLETS THAT MAY BE AFFECTED SHALL BE PROTECTED USING SACRAMENTO COUNTY STANDARD CONSTRUCTION SPECIFICATIONS (SEPTEMBER 2001 REVISED MARCH 2004, REVISED JANUARY 2008 AND REVISED JANUARY 1, 2016).
4. IF DURING CONSTRUCTION, THE DRAINAGE SYSTEM IS DAMAGED OR FOUND TO BE DAMAGED, IMMEDIATELY CONTACT THE DRAINAGE MAINTENANCE ENGINEERING OFFICE BY CALLING 311 AND THE INSPECTOR. REPAIRS SHALL ADHERE TO THE CURRENT SACRAMENTO COUNTY STANDARD CONSTRUCTION SPECIFICATIONS.

POTHOLE NOTE:

5. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL POTHOLE ALL DRAINAGE LOCATIONS ON THESE PLANS AND ALLOW UTILITY COMPANY APPOINTED SURVEYS TO LOCATE THE UTILITIES WITHIN L/10 (0.10') OF A FOOT. AFTER SURVEYS HAVE LOCATED THE UTILITIES, THE CONTRACTOR SHALL BACKFILL THE POTHOLED AREAS IN ACCORDANCE WITH SACRAMENTO COUNTY STANDARD CONSTRUCTION SPECIFICATIONS. UTILITY COMPANIES SHALL REVIEW THE INFORMATION PROVIDED BY SURVEYS AND REVISE THE ALIGNMENT OF THE UTILITY LINES AS NECESSARY.

SACRAMENTO COUNTY GENERAL NOTES

(FOR WORK WITHIN COUNTY RIGHT-OF-WAY)

1. ALL CONSTRUCTION WORK AND INSTALLATION SHALL CONFORM TO THE COUNTY OF SACRAMENTO STANDARD CONSTRUCTION SPECIFICATIONS AND ALL OF ITS DRAWINGS, DATED FEBRUARY 2017. ALL WORK IS SUBJECT TO THE APPROVAL OF THE ENGINEER.
2. CALL UNDERGROUND SERVICES ALERT AT 1–800–227–2600 A MINIMUM OF 48 HOURS IN ADVANCE OF BEGINNING ALL EXCAVATION WORK.
3. UTILITY INFORMATION WAS COMPILED FROM DATA PROVIDED BY THE UTILITY OWNERS AND LOCATIONS ARE APPROXIMATE. CONTRACTOR SHALL EXPOSE AND VERIFY THE ACTUAL LOCATION AND ELEVATION OF ALL EXISTING UTILITIES IN THE CONSTRUCTION AREA. THE ELEVATION AND LOCATION DATA SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR SHALL ANTICIPATE, AND ALLOW TIME FOR, NECESSARY RELOCATIONS. ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES SHALL BE PROTECTED FROM CONSTRUCTION EQUIPMENT AND OPERATIONS.
4. UTILITY RELOCATION REQUIRED FOR THE CONSTRUCTION OF THESE FACILITIES WILL BE PERFORMED BY THE UTILITY COMPANY, UNLESS OTHERWISE NOTED.
5. TEMPORARY OR PERMANENT RELOCATION OR ALTERATION OF UTILITIES REQUESTED BY THE CONTRACTOR FOR ITS CONVENIENCE SHALL BE ITS RESPONSIBILITY AND IT SHALL MAKE ALL ARRANGEMENTS AND BEAR ALL COSTS.
6. FOR ALL TRENCH EXCAVATIONS FIVE FEET OR MORE IN DEPTH, THE CONTRACTOR SHALL OBTAIN A PERMIT FROM CAL OSHA (2424 ARDEN WAY, STE 165, (916) 263–2800) PRIOR TO BEGINNING ANY EXCAVATION. A COPY OF THIS PERMIT SHALL BE AVAILABLE AT THE CONSTRUCTION SITE AT ALL TIMES.
7. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR FURNISHING, INSTALLING AND MAINTAINING ALL WARNING SIGNS AND DEVICES NECESSARY TO SAFEGUARD THE GENERAL PUBLIC AND THE WORK AND TO PROVIDE FOR THE PROPER AND SAFE ROUTING OF VEHICULAR AND PEDESTRIAN TRAFFIC DURING THE PERFORMANCE OF THE WORK.
8. ALL ROAD STRIPING AND PAVEMENT MARKING DAMAGED DURING CONSTRUCTION SHALL BE REPLACED, TO THE SATISFACTION OF SACRAMENTO COUNTY, AT NO EXTRA COST.
9. CONTRACTOR SHALL PROTECT ADJACENT IMPROVEMENTS, INCLUDING BUT NOT LIMITED TO PAVEMENT, FROM INJURY OR DAMAGE. THE CONTRACTOR SHALL UTILIZE SUITABLE SAFEGUARDS TO PROTECT ADJACENT IMPROVEMENTS FROM INJURY OR DAMAGE. IF SUCH IMPROVEMENTS ARE INJURED OR DAMAGED BY REASON OF CONTRACTOR'S OPERATIONS, THEY SHALL BE REPLACED OR RESTORED TO A CONDITION AS GOOD AS WHEN THE CONTRACTOR ENTERED UPON THE WORK, AND ALL EXPENSES OF WHATEVER NATURE ARISING FROM SUCH DAMAGE SHALL BE BORNE BY THE CONTRACTOR.
10. THREE (3) SET OF "AS–BUILTS" PLANS SHALL BE SUBMITTED TO SACRAMENTO COUNTY CONSTRUCTION INSPECTION SUPERVISING INSPECTOR. ALL SHEETS SHALL BE STAMPED "RECORD DRAWINGS OR "AS–BUILTS".
11. CONTRACTOR SHALL PRESERVE ALL SURVEY MONUMENTS AND MONUMENT WELLS. CONTRACTOR SHALL PROTECT IN PLACE; OR REPLACE ANY SURVEY MONUMENT THAT IS DESTROYED OR DISTURBED DURING CONSTRUCTION WITH A CALTRANS TYPE "D" MONUMENT (OR OTHER APPROPRIATE MONUMENT WHICH HAS BEEN APPROVED BY THE COUNTY SURVEY OFFICE). CONTRACTOR MUST SUBMIT A SURVEY REQUEST FOR SETTING REFERENCE POINTS FOR EXISTING SURVEY MONUMENTS, A MINIMUM OF ONE WEEK PRIOR TO BEGINNING ANY WORK.
12. ANY AND ALL UTILITIES DAMAGED DURING CONSTRUCTION MUST BE SATISFACTORILY REPLACED AND/OR REPAIRED, AND INSPECTED BY THE COUNTY.
13. CONTRACTOR SHALL REPLACE ANY EXISTING PROPERTY AND/OR FENCING DAMAGED OR ALTERED DURING CONSTRUCTION (TYP.).
14. CONTRACTOR SHALL RECONSTRUCT ANY EXISTING DRAINAGE FEATURES (I.E. SWALES, DITCHES, BERMS & CULVERTS) IF DISTURBED OR ALTERED DURING CONSTRUCTION TO PRE–EXISTING CONDITIONS OR AS CALLED OUT IN THESE PLANS.
15. EXISTING DRIVEWAYS ALONG THE CONSTRUCTION ALIGNMENT ARE NOT INTENDED FOR CONSTRUCTION USE. CONTRACTOR SHALL NOTIFY AND COORDINATE WITH RESIDENTS, PROPERTY OWNERS, AND BUSINESS OWNERS PER SECTION 6–12.03 OF THE GENERAL PROVISIONS. ACCESS TO DRIVEWAYS, HOUSES, AND BUILDINGS SHALL BE MAINTAINED AT ALL TIMES PER SECTION 6–12.04 OF THE GENERAL PROVISIONS. WHEN EXCEPTIONS ARE REQUIRED ACCOMMODATIONS SHALL BE MADE TO LIMIT ACCESS RESTRICTIONS TO 4 HOURS AND SHALL BE COORDINATED WITH THE RESIDENT ENGINEER. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING DRIVEWAYS DURING CONSTRUCTION. RESTORE ANY DAMAGE TO RESIDENTIAL DRIVEWAYS TO ORIGINAL CONDITION OR BETTER (TYP.)
16. CONTACT AND COORDINATE W/RESIDENTS PRIOR TO RESTRICTED ON–STREET PARKING. PROVIDE 48 HRS NOTICE.
17. ANY WORK TO BE DONE ON PRIVATE PROPERTY REQUIRES A TEMPORARY PERMIT OF ENTRY. NO WORK SHALL BE DONE ON PRIVATE PROPERTY UNTIL A SIGNED PTE IS PROVIDED IN ADVANCE.
18. SEE "ATTACHMENT A" (PROVIDED IN PROJECT SPECIFICATIONS) FOR ADDITIONAL SACRAMENTO COUNTY REQUIREMENTS AND GUIDELINES.

Z:\RLECWD\WELL 16 EQUIPPING PROJECT\02 DESIGN\CAD -WORKING 7_22_19\WELL 16 - G1-ENCROACHMENT.DWG

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

0 1"

AT FULL SCALE

(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

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REGISTERED PROFESSIONAL ENGINEER — SHAWN MILLER DOMENICHELLI — No. C 74226 Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

NOTES

DRAWING NUMBER	2
SHEET NUMBER	G2
FILENAME	
RLWD FILE NO.	

SYMBOL LEGEND

SYMB	DESC KEY	DESCRIPTION	SYMB	DESC KEY	DESCRIPTION
AC	AC	AIR CONDITIONER			CREPE MYRTLE
E	ECBX	ELECTRIC BOX			DEER GRASS
	ECEL	ELECTROLIER			BOULDER
EM	ECMT	ELECTRIC METER		DI	DRAINAGE INLET
	ECMH	ELECTRIC MANHOLE	DD	DD	DOWN DRAIN
T	TF	ELECTRIC TRANSFORMER	SD	SDMH	STORM DRAIN MANHOLE
PP	PP	POWER / ELEC. POLE	FH	FH	EX FIRE HYDRANT
PH	PH	PUBLIC PHONE		BO	BLOWOFF
	GUY	GUY WIRE	WT	WTVA	WATER VALVE
	LITE	STREET LIGHT	W	WELL	WELL
G	GSMH	GAS MANHOLE	MW	MW	MONTORING WELL
GS	GSMT	GAS METER		BO	BOLLARD
GV	GSVA	GAS VALVE		SIGN	SIGN
IR	IRBX	IRRIGATION BOX		FCOR	FENCE CORNER
IR	IRMH	IRRIGATION MANHOLE	SB	SB	SOIL BORING
IR	IRVA	IRRIGATION VALVE	SS	SSMH	SANITARY MANHOLE
CO	SSCO	SANITARY CLEAN OUT	MB	MB	MAIL BOX

	CUT AND CAP	
	NEW FIRE HYDRANT	(PLAN & PROFILE SHEETS)
	NEW COMBINATION AIR VACUUM VALVE	(PLAN & PROFILE SHEETS)
	NEW GATE VALVE	(PLAN & PROFILE SHEETS)
W	EXISTING WATER LINES	(PLAN & PROFILE SHEETS)
	NEW WATER LINES	(PLAN & PROFILE SHEETS)
	PROPOSED PIPING ABOVE GRADE	
	PROPOSED PIPING BELOW GRADE	
GAS	EXISTING GAS LINES	(PLAN & PROFILE SHEETS)
SS	EXISTING SANITARY SEWER	(PLAN & PROFILE SHEETS)
SD	EXISTING STORM DRAIN	(PLAN & PROFILE SHEETS)
OH	OVERHEAD ELECTRIC (ATT, COMCAST, & SMUD)	(PLAN & PROFILE SHEETS)
ROW	PROPERTY LINES/ROW LINES	(PLAN & PROFILE SHEETS)
	EXISTING DITCH FLOWLINE	
	ROADWAY CENTERLINE	
EOP	EDGE OF PAVEMENT	(PLAN & PROFILE SHEETS)
	BARBED WIRE FENCE	
	CHAIN LINK FENCE	
	WOOD POST FENCE	
	SLOPE	

LINETYPES

- UNDERGROUND, NEW FACILITIES
- ABOVE GROUND, NEW FACILITIES
- UNDERGROUND, EXISTING FACILITIES
- ABOVE GROUND, EXISTING FACILITIES
- EXISTING FACILITIES TO BE REMOVED
- EXISTING FACILITIES TO BE ABANDONED
- EASEMENTS
- EXISTING CITY RIGHT OF WAY
- PL — PROPERTY LINE
- SS — EXISTING SEWER
- W — EXISTING WATER LINE
- W — PROPOSED WATER LINE
- SD — EXISTING STORM DRAIN
- EXISTING FENCE
- PROPOSED FENCE
- GAS — EXISTING GAS LINE
- T — EXISTING TELEPHONE CONDUIT
- E — EXISTING ELECTRICAL CONDUIT
- OHE — EXISTING OVERHEAD ELECTRICAL
- FO — PROPOSED FIBER OPTIC
- 1600 — CONTOUR ELEVATION
- LIMITS OF EXCAVATION
- DIRT ROAD

ABBREVIATIONS

@	AT	KIP	THOUSAND POUNDS
AC	ASPHALT CONCRETE	KW	KILOWATT
AB	AGGREGATE BASE		
ABAN	ABANDONED	L	ANGLE
AVRV	AIR / VACUUM RELEASE VALVE	LB	POUNDS
AFF	ABOVE FINISH FLOOR	LF	LINEAR FEET
BF	BLIND FLANGE	LT	LEFT
BFV	BUTTERFLY VALVE	LR	LONG RADIUS
BCR	BEGIN CURVE RETURN	MAX	MAXIMUM
BLDG	BUILDING	MECH	MECHANICAL
B.M.	BENCH MARK	MFR	MANUFACTURER
BOF	BOTTOM OF FLANGE	MH	MANHOLE
BOF*	BOTTOM OF FLANGE, NOT INCLUDING BOLTS	MIN	MINIMUM
		MISC	MISCELLANEOUS
BOP	BOTTOM OF PIPE	MJ	MECHANICAL JOINT
BOS	BOTTOM OF STAIRS	MO	MASONRY OPENING
BW	BACKWASH WATER		
		NO, #	NUMBER
CAV	COMBINATION AIR VACUUM VALVE	NPT	NATIONAL PIPE THREAD
CD	CHEMICAL DRAIN	NTS	NOT TO SCALE
CIP	CAST IN PLACE		
CLG	CEILING	O.C.	ON CENTER
CLR	CLEAR	OF	OVERFLOW
CLS	CHLORINE SOLUTION	OH	OVERHEAD ELECTRIC
℄	CENTERLINE	OZ	OUNCE
CMP	CORRUGATED METAL PIPE		
CO	CLEANOUT	PE	PLAIN END
CONC	CONCRETE	PCV	PRESSURE CONTROL VALVE
CONT	CONTINUOUS	PL	PLATE (STEEL)
CPLG	COUPLING	PLYWD	PLYWOOD
C TO C	CENTER TO CENTER	PP	POWER POLE
CV	CHECK VALVE	PRESS	PRESSURE
		PRV	PRESSURE RELIEF VALVE
d	PENNY (NAIL SIZE)	PSI	POUND PER SQUARE INCH
DET	DETAIL	PTW	PUMP TO WASTE
DIA	DIAMETER	PUE	PUBLIC UTILITY EASEMENT
DIP	DUCTILE IRON PIPE	PVC	POLYVINYL CHLORIDE
DN	DRAIN PIPE	PW	POTABLE WATER
DWG	DRAWING		
		R, RAD	RADIUS
EA	EACH	RD	ROAD
ECC	ECCENTRIC	RDCR	REDUCER
ECR	END CURVE RETURN	RDW	REDWOOD
EG	EXISTING GRADE	RED	REDUCER
EL	ELEVATION	RM	ROOM
ELB	ELBOW	RO	ROUGH OPENING
ELEC	ELECTRIC, ELECTRICAL	RPPA	REVERSE PRESSURE PRINCIPLE ASSEMBLY
EOP, EP	EDGE OF PAVEMENT	RTN	RETURN
ESEW	EMERGENCY SHOWER & EYEWASH	RV	ROOF FENT
EW	EACH WAY	ROW	RIGHT-OF-WAY
EXH	EXHAUST		
EX, EXIST	EXISTING	SAM	SAMPLING
		SCHED	SCHEDULE
FC	FLANGED COUPLING ADAPTER	SD	STORM DRAIN
FCA	FLEXIBLE COUPLING	SEC	SECTION
FCTRY	FACTORY	SH	SHEET
FD	FLOOR DRAIN	SHT'G	SHEATHING
FDN	FOUNDATION	SPEC	SPECIFICATIONS
FF	FINISH FLOOR	SQ	SQUARE
FG	FINISH GRADE	SST	STAINLESS STEEL
FIG	FIGURE	STA	STATION
FL	FLOOR	STD	STANDARD
FLG	FLANGE	STL	STEEL
FFL, FL	FLOW LINE	STRL	STRUCTURAL
FS	FINISH SURFACE	STRUCT	STRUCTURE
FT	FOOT, FEET		
FTG	FOOTING	TAN	TANGENT
		TARV	TOP OF AIR RELEASE VALVE
GA	GAGE	TBG	TUBING
GAL	GALLON	TECH	TECHNICAL
GALV	GALVANIZED	TEMP	TEMPERATURE
GSP	GALVANIZED STEEL PIPE	THD	THREAD
GV	GATE VALVE	TOC	TOP OF CURB
		TOG	TOP OF GRATE
HDW	HARDWARE	TOP	TOP OF PIPE
HORIZ	HORIZONTAL	TOR	TOP OF ROCK
HP	HIGH POINT	TOW	TOP OF WALL
HP	HORSEPOWER	TYP	TYPICAL
HR	HOSE RACK	TW	TREATED WATER
IE	INVERT ELEVATION	UBC	UNIFORM BUILDING CODE
IN	INCH	UNO	UNLESS NOTED OTHERWISE
INSUL	INSULATION	V	
			VENT, FOLT
JT	JOINT	VAC	VACUUM
		VTR	VENT THRU ROOF
		WM	WATER METER
		WW	WASTE WATER

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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

0 1"

AT FULL SCALE

(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

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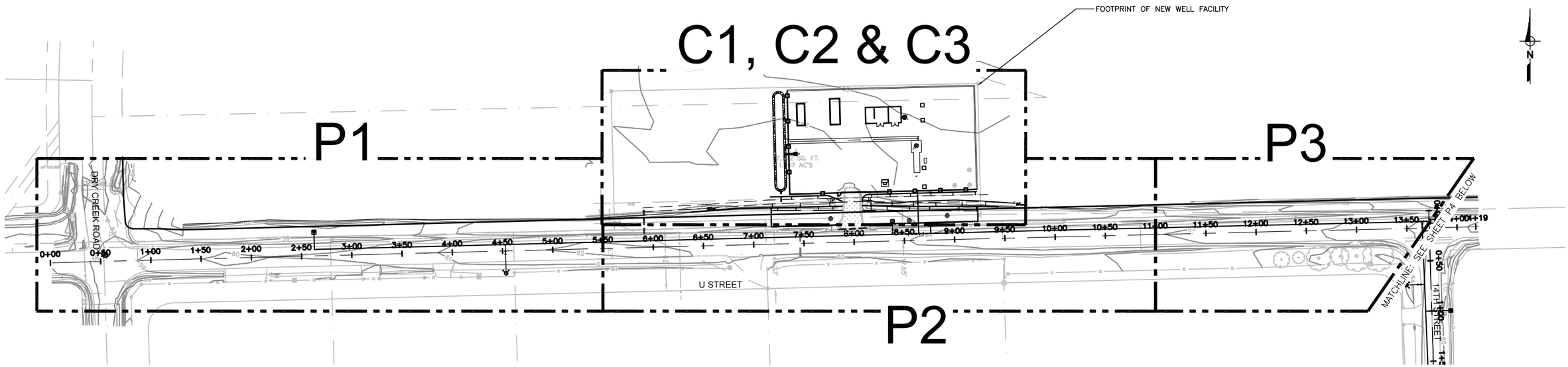
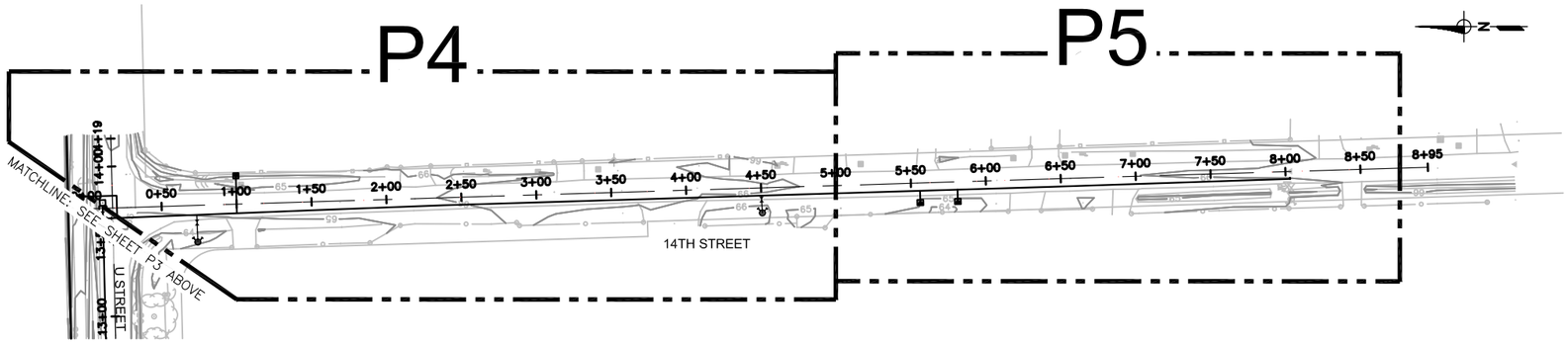
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

ABBREVIATIONS AND SYMBOLS

DRAWING NUMBER: 3
SHEET NUMBER: G3
FILENAME:
RLWD FILE NO.:





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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

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DESIGNED: D. HEIGHER

DRAWN: J. CADE

CHECKED: S. ROGERS

DATE: OCTOBER 2019

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REGISTERED PROFESSIONAL ENGINEER — SARA MILLER DOMENICHELLI — No. C 71226 Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

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PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

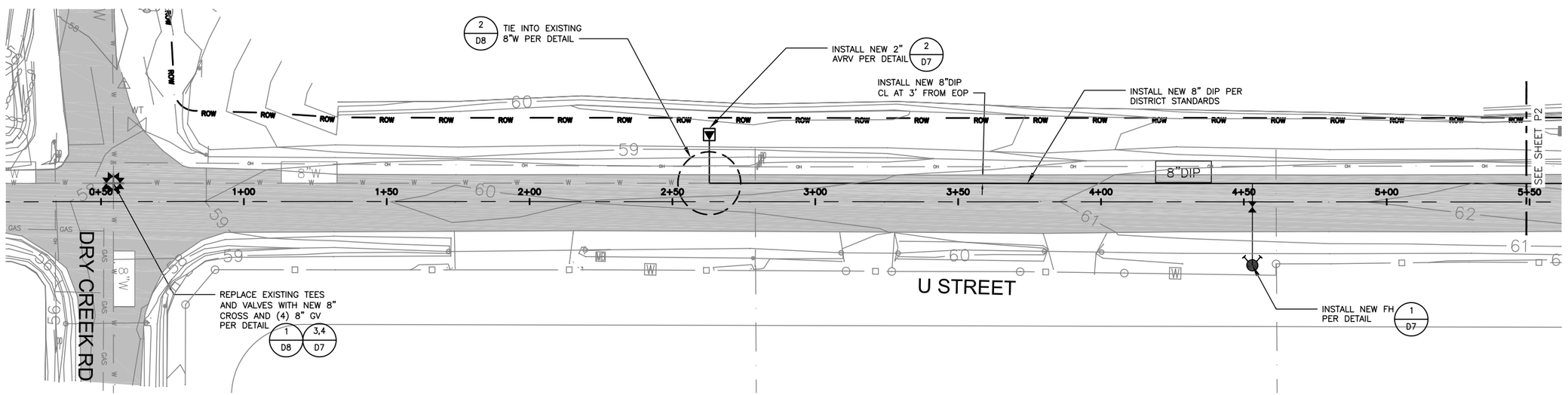
OVERALL PLAN & SHEET KEY

DRAWING NUMBER 4

SHEET NUMBER G4

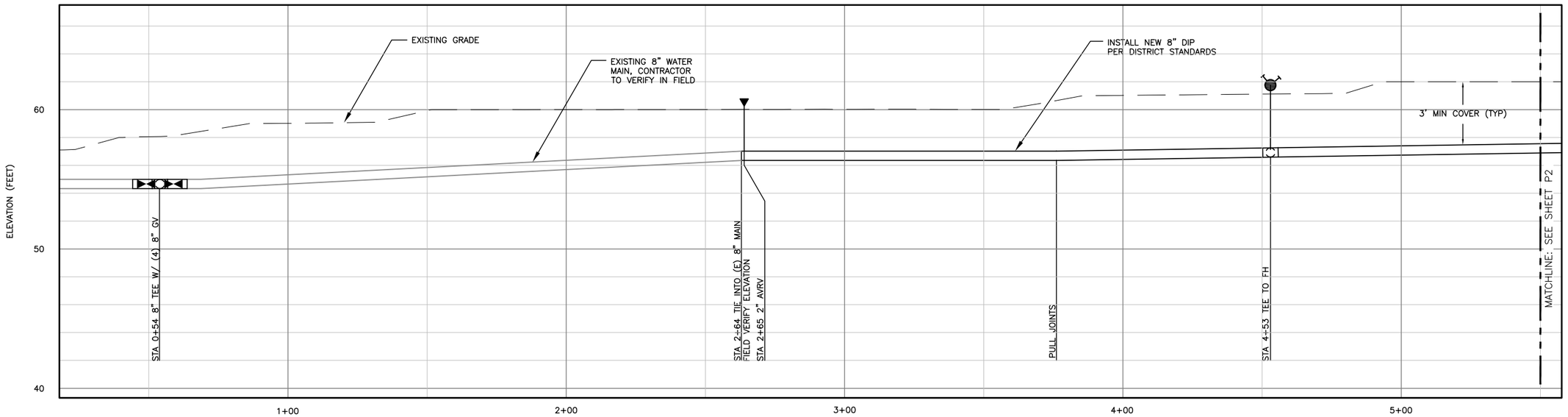
FILENAME

RLWD FILE NO.



DRY CREEK & U STREET PLAN

SCALE: 1" = 20'



PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" – 4'

NOTES

1. ALL NEW WATER MAINS SHALL BE DUCTILE IRON PIPE WRAPPED WITH 8 MIL POLYETHYLENE ENCASEMENT PER AWWA C105.
2. ALL FITTINGS SHALL BE RESTRAINED BY DEVICES AND/OR THRUST BLOCKS.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING MANUFACTURER STANDARDS FOR ALL JOINT DEFLECTIONS.
4. CONTRACTOR SHALL TEST, FLUSH, AND DISINFECT NEW MAINS PRIOR TO CONNECTING TO EXISTING FACILITIES.
5. CONTRACTOR TO MAINTAIN 36" MINIMUM COVER OVER TOP OF PIPE, 18" VERTICAL CLEARANCE BETWEEN WATERLINE AND STORM DRAINS, AND 12" VERTICAL CLEARANCE FROM ALL OTHER UTILITIES.
6. NEW WATER MAIN CROSSING BELOW STORM DRAIN SHALL BE CONSTRUCTED WITH 18–FT, JOINT FREE, FULL LENGTH, CLASS 350 DUCTILE IRON PIPE

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING
0 1"
AT FULL SCALE
(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

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REGISTERED PROFESSIONAL ENGINEER
SIGMA WILLIAM ROGERS
No. 24226
Exp. 6/30/21
CIVIL
STATE OF CALIFORNIA

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730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

U STREET PIPELINE PLAN AND PROFILE

DRAWING NUMBER: 14
SHEET NUMBER: P1
FILENAME:
RLWD FILE NO.:

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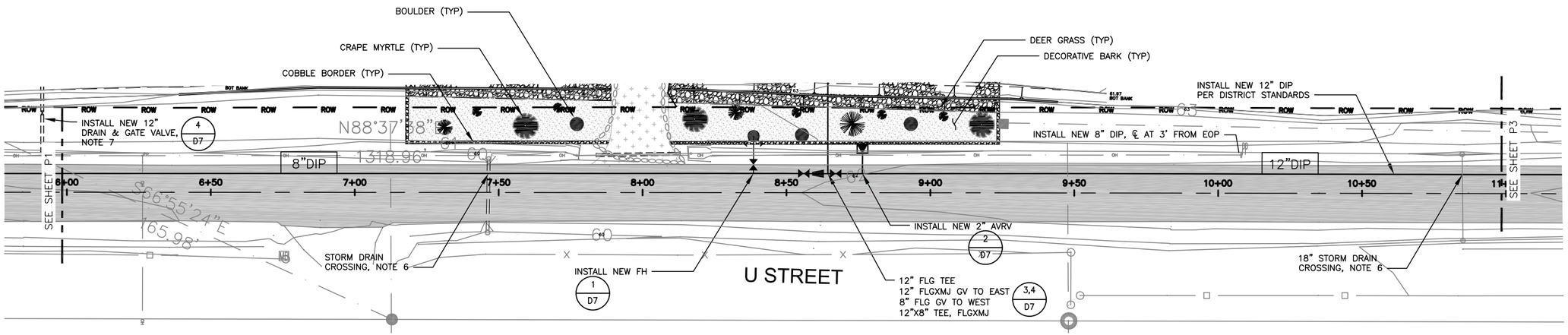
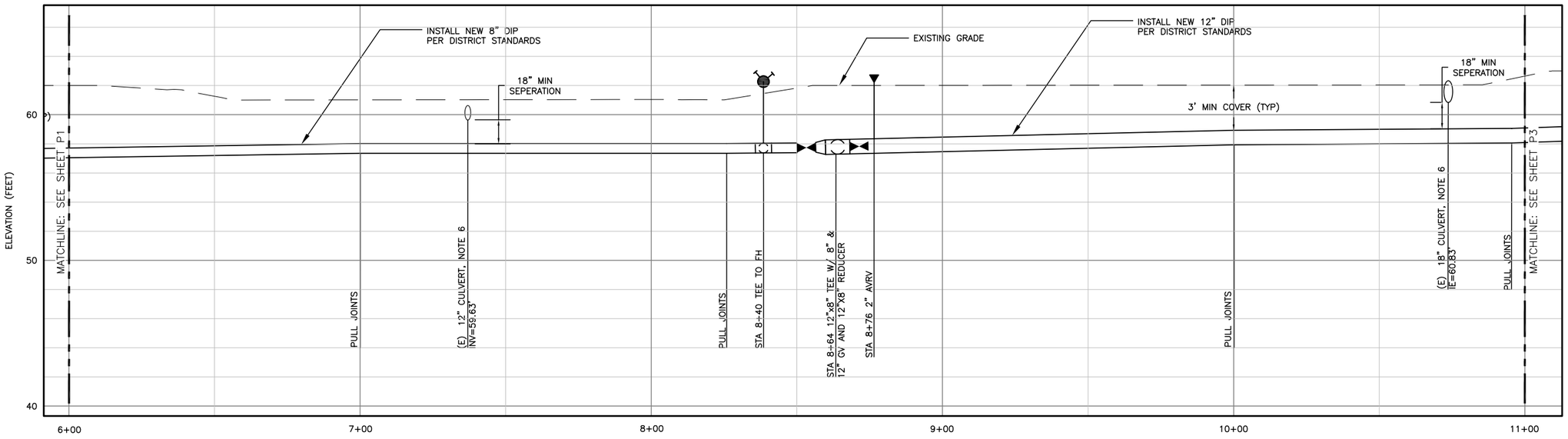


U STREET PIPING PLAN

1"=20'



PROFILE

H:1"=20' V:1"=4'

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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

0 1"

AT FULL SCALE

(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

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REGISTERED PROFESSIONAL ENGINEER — JAMA MILLER ROGERS — No. 24226 Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

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RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

U STREET PIPELINE PLAN AND PROFILE AND FRONTAGE LANDSCAPING PLAN

DRAWING NUMBER 15
SHEET NUMBER P2
FILENAME
RLWD FILE NO.

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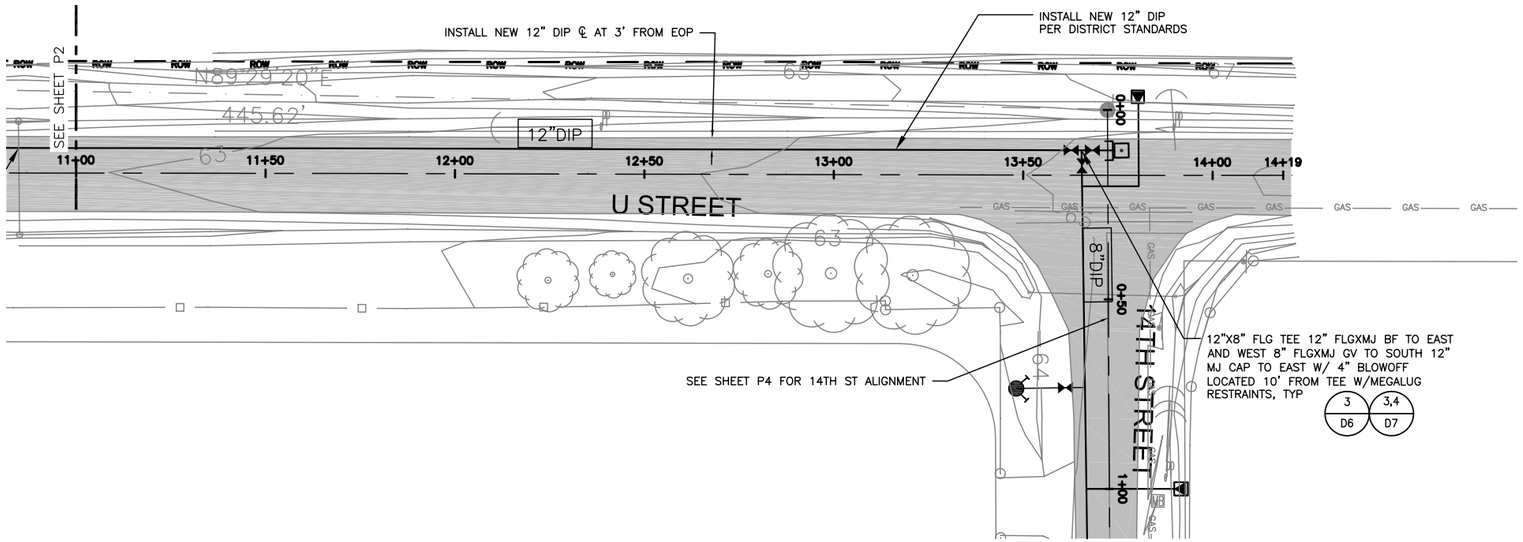
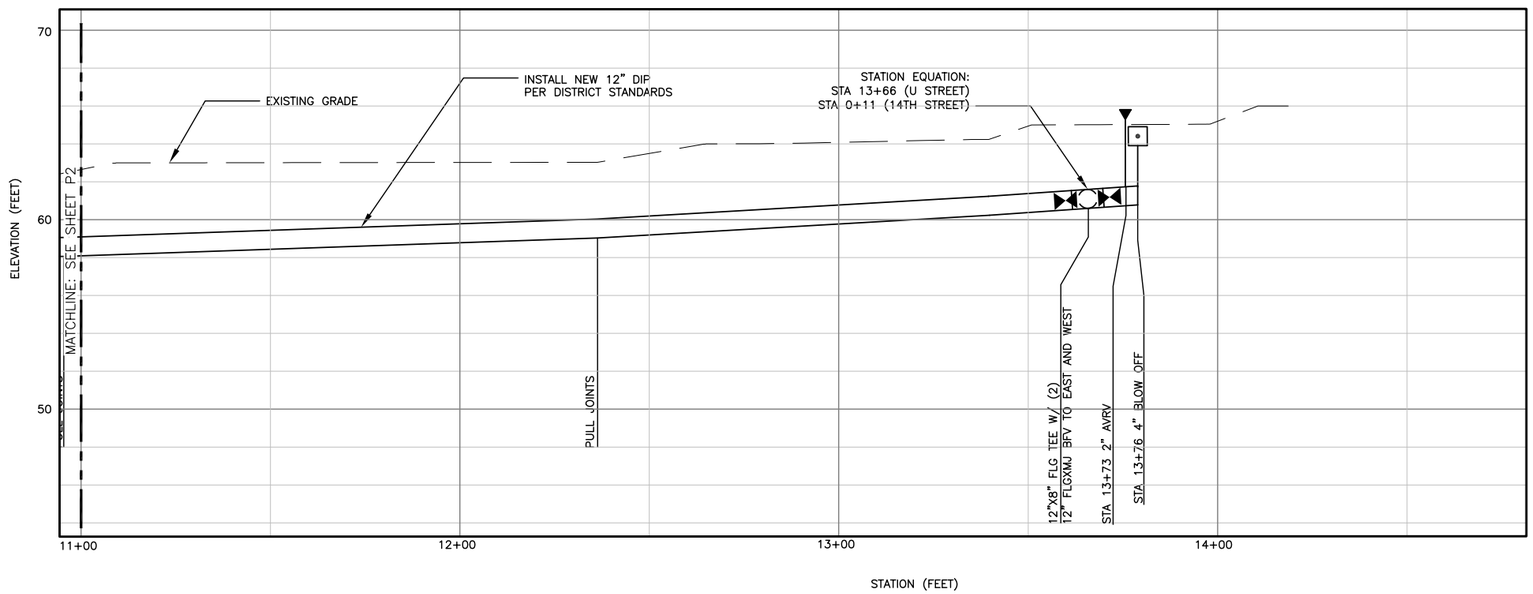


U STREET & 14TH STREET PLAN

SCALE: 1" = 20'



PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'

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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING
0 1"
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DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

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REGISTERED PROFESSIONAL ENGINEER
SARA MILLER ROGERS
No. C 69226
Exp. 6/30/20
CIVIL
STATE OF CALIFORNIA

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730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

U STREET PIPELINE PLAN AND PROFILE

DRAWING NUMBER: 16
SHEET NUMBER: P3
FILENAME:
RLWD FILE NO.:

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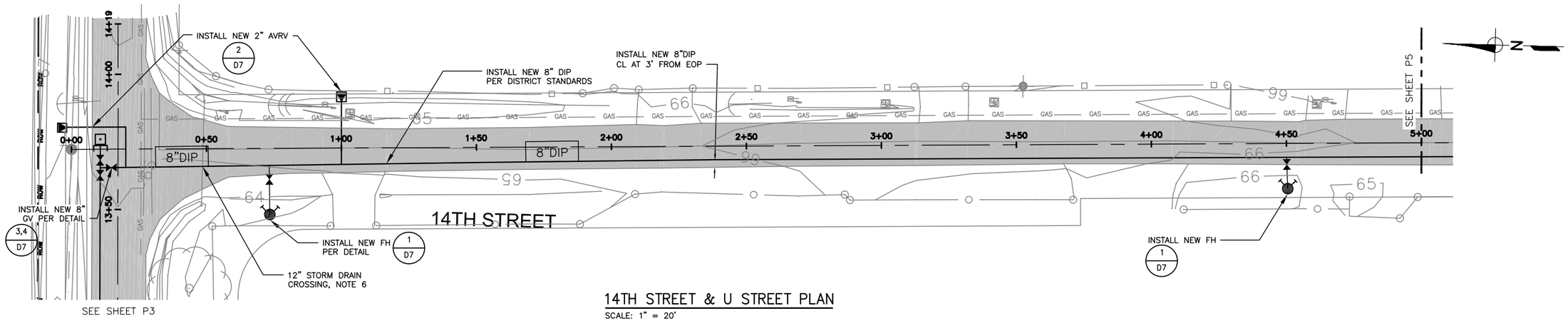
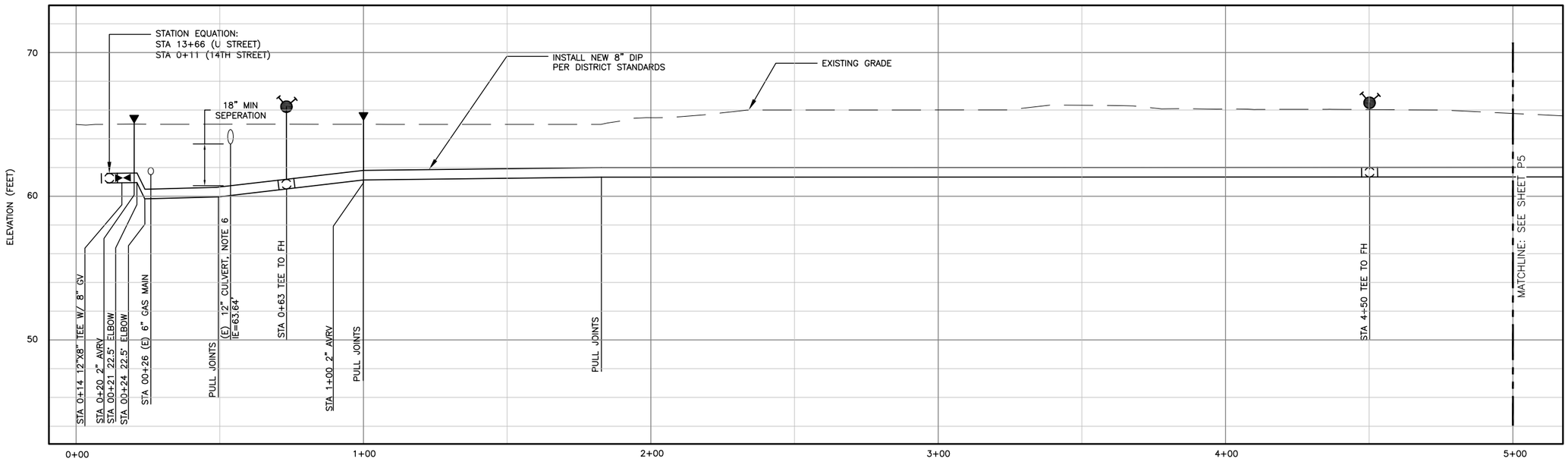


14TH STREET & U STREET PLAN

SCALE: 1" = 20'



PROFILE

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REV.	DESCRIPTION	DATE	BY	CHKD.

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DATE: OCTOBER 2019

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EMMA MILLER
No. 94226
Exp. 6/30/21
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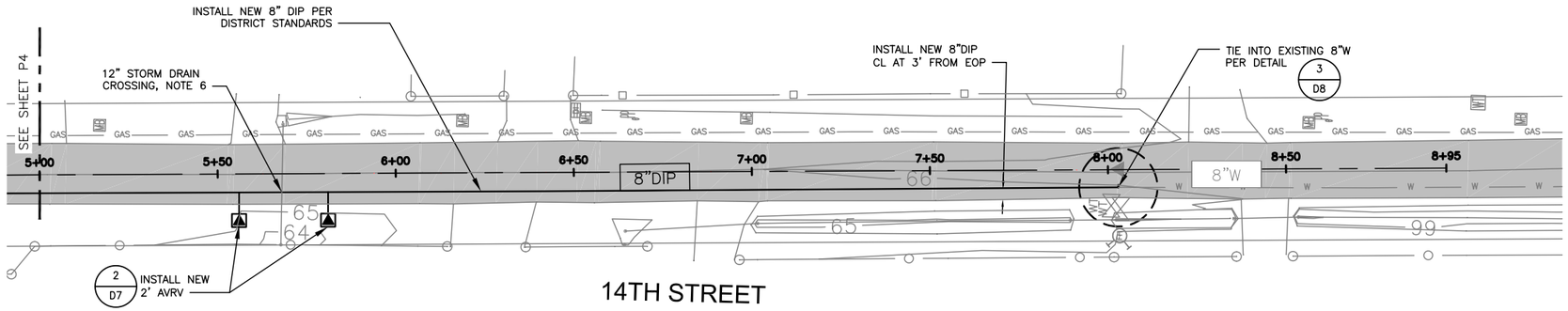
RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

14TH STREET PIPELINE PLAN AND PROFILE

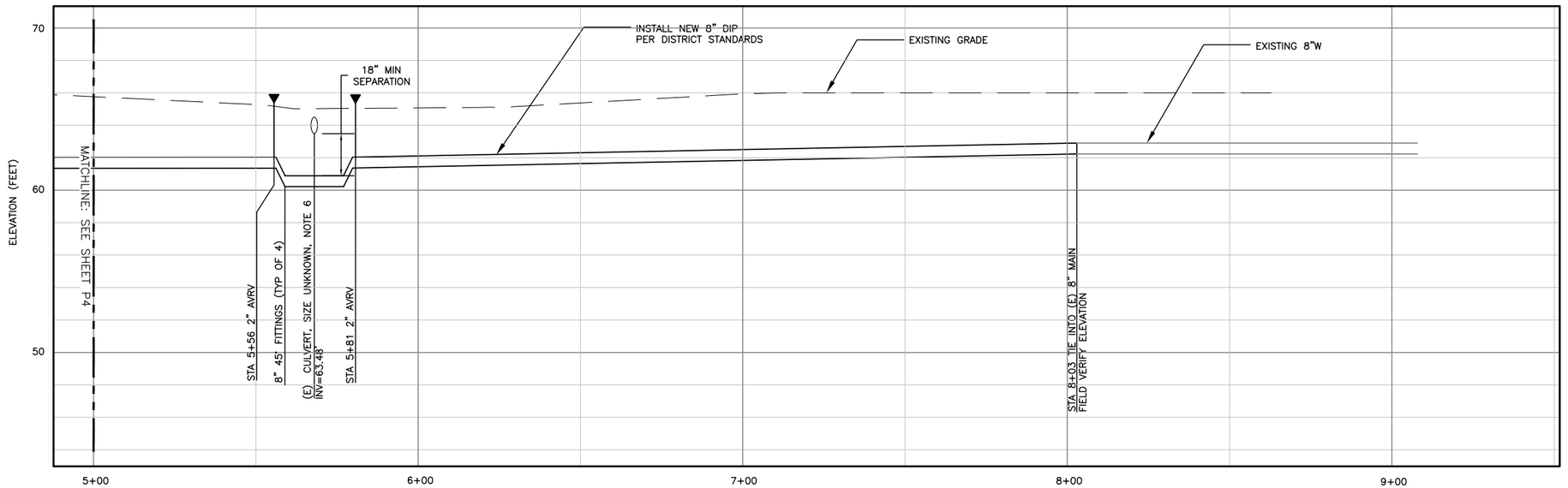
DRAWING NUMBER 17
SHEET NUMBER P4
FILENAME
RLWD FILE NO.

Z:\RLECWD\WELL 16 EQUIPPING PROJECT\02 DESIGN\CAD -WORKING 7_22_19\WELL 16 - P SHEETS.DWG



14TH STREET PLAN

SCALE: 1" = 20'



PROFILE

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" – 4'

NOTES

1. ALL NEW WATER MAINS SHALL BE DUCTILE IRON PIPE WRAPPED WITH 8 MIL POLYETHYLENE ENCASEMENT PER AWWA C105.
2. ALL FITTINGS SHALL BE RESTRAINED BY DEVICES AND/OR THRUST BLOCKS.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING MANUFACTURER STANDARDS FOR ALL JOINT DEFLECTIONS.
4. CONTRACTOR SHALL TEST, FLUSH, AND DISINFECT NEW MAINS PRIOR TO CONNECTING TO EXISTING FACILITIES.
5. CONTRACTOR TO MAINTAIN 36" MINIMUM COVER OVER TOP OF PIPE, 18" VERTICAL CLEARANCE BETWEEN WATERLINE AND STORM DRAINS, AND 12" VERTICAL CLEARANCE FROM ALL OTHER UTILITIES.
6. NEW WATER MAIN CROSSING BELOW STORM DRAIN SHALL BE CONSTRUCTED WITH 18–FT, JOINT FREE, FULL LENGTH, CLASS 350 DUCTILE IRON PIPE

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

0 1"

AT FULL SCALE

(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

DOMENICHELLI & ASSOCIATES

Domenichelli & Associates
1101 Investment Blvd. Suite 115
El Dorado Hills, CA 95762
Ph: (916) 933–1997
Fax: (916) 933–4778

REGISTERED PROFESSIONAL ENGINEER — JARRA WILLIAMS — No. 84226 — Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

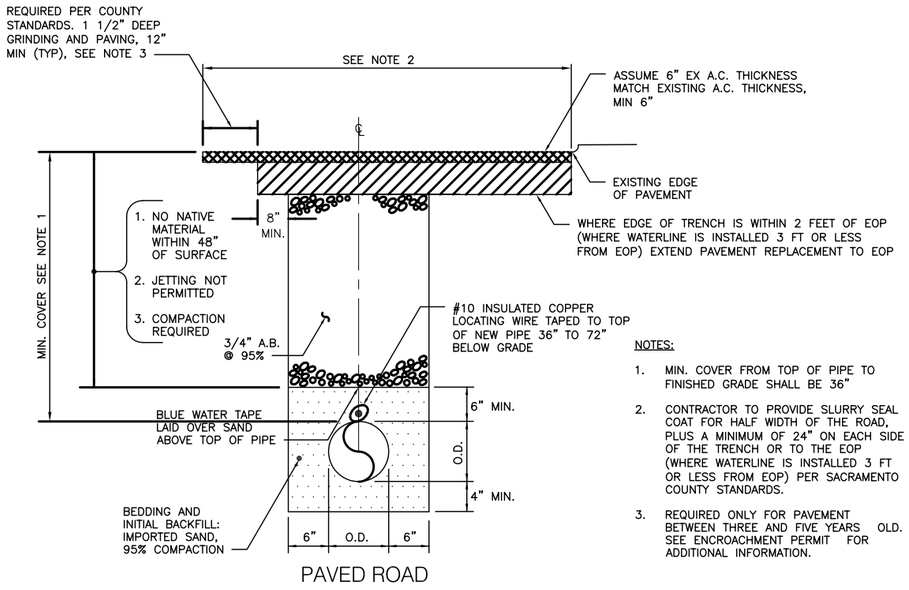
RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

14TH STREET PIPELINE PLAN AND PROFILE

DRAWING NUMBER: 18
SHEET NUMBER: P5
FILENAME:
RLWD FILE NO.:

Z:\RLEC\DWELL 16 EQUIPPING PROJECT\02 DESIGN\CAD -WORKING 7_22_19\WELL 16 - P SHEETS.DWG



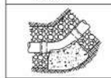
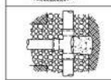
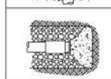
NOTES:

1. MIN. COVER FROM TOP OF PIPE TO FINISHED GRADE SHALL BE 36"
2. CONTRACTOR TO PROVIDE SLURRY SEAL COAT FOR HALF WIDTH OF THE ROAD, PLUS A MINIMUM OF 24" ON EACH SIDE OF THE TRENCH OR TO THE EOP (WHERE WATERLINE IS INSTALLED 3 FT OR LESS FROM EOP) PER SACRAMENTO COUNTY STANDARDS.
3. REQUIRED ONLY FOR PAVEMENT BETWEEN THREE AND FIVE YEARS OLD. SEE ENCROACHMENT PERMIT FOR ADDITIONAL INFORMATION.

TRENCH DETAIL – PAVED ROADWAYS — 1 TYP

NTS

REQUIRED BEARING AREAS IN SQ. FT.

INSTALLATION	TYPE FITTING	PIPE SIZES 4"	6"	8"	10"	12"
	90° ELL	2	4	7	12	16
	45° ELL	1	2	4	6	10
	22 1/2° ELL 11 1/4° ELL	1	1	2	3	5
	TEE	2	3	5	8	12
	DEAD END	2	3	5	8	12

NOTES:

1. THRUST BLOCKS ARE TO BE CONSTRUCTED OF CLASS "B" CONCRETE.
2. AREAS GIVEN ARE FOR CLASS 150 PIPE AT TEST PRESSURE OF 225 PSI IN SOIL WITH 2000 PSF BEARING CAPACITY. INSTALLATIONS USING DIFFERENT DATA SHALL ADJUST AREAS, SUBJECT TO DISTRICT APPROVAL.
3. BLOCKING IS TO BE PLACED AGAINST UNDISTURBED SOIL.
4. THRUST BLOCKS ARE TO BE FREE, SEPARATE AND INDEPENDENT OF ADJACENT OR NEARBY THRUST BLOCKS.
5. THRUST BLOCKS FOR PIPE SIZES LARGER THAN 12" SHALL BE CALCULATED AND SUBMITTED FOR DISTRICT DESIGN APPROVAL.
6. INSTALL 2" TEMPORARY BLOWOFF PER SD-7 AT DEAD ENDS.

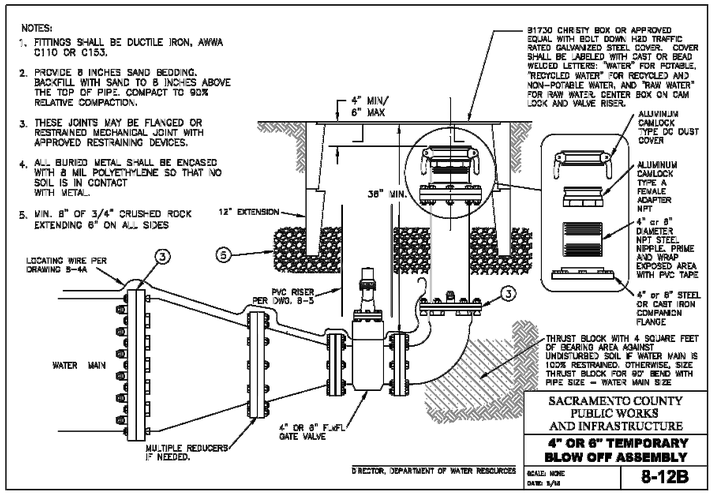
RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT 730 L STREET RIO LINDA, CA 95673 PHONE: 916-991-1000 FAX: 916-991-0613	STANDARD DETAIL NO. 2 THRUST BLOCK SCHEDULE		
	DATE JULY 2005	NOT TO SCALE	REV

THRUST BLOCK DETAIL — 2 TYP

NTS

NOTES:

1. FITTINGS SHALL BE DUCTILE IRON, AWWA C110 OR C153.
2. PROVIDE 8 INCHES SAND BEDDING. BACKFILL WITH SAND TO 8 INCHES ABOVE THE TOP OF PIPE. COMPACT TO 90% RELATIVE COMPACTION.
3. THESE JOINTS MAY BE FLANGED OR RESTRAINED MECHANICAL JOINT WITH APPROVED RESTRAINING DEVICES.
4. ALL BURIED METAL SHALL BE ENCASED WITH 8 MIL POLYETHYLENE SO THAT NO SOIL IS IN CONTACT WITH METAL.
5. MIN. 8" OF 3/4" CRUSHED ROCK EXTENDING 6" ON ALL SIDES



BLOW OFF ASSEMBLY DETAIL — 3 TYP

NTS

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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING

0 1"

AT FULL SCALE

(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER

DRAWN: J. CADE

CHECKED: S. ROGERS

DATE: OCTOBER 2019

DOMENICHELLI & ASSOCIATES

Domenichelli & Associates
1101 Investment Blvd. Suite 115
El Dorado Hills, CA 95762
Ph: (916) 933-1997
Fax: (916) 933-4778

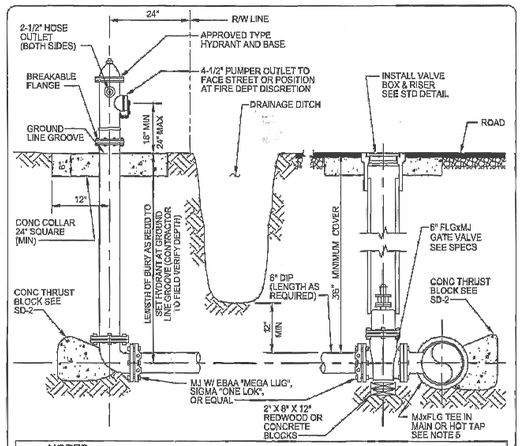
REGISTERED PROFESSIONAL ENGINEER — SARA MILLER DOMENICHELLI — No. C 64226 — Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

PIPELINE DETAILS 1

DRAWING NUMBER	25
SHEET NUMBER	D6
FILENAME	
RLWD FILE NO.	

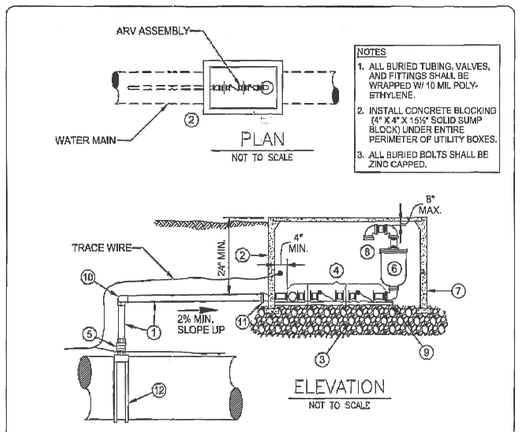


NOTES:

1. CONCRETE COLLAR TO BE PLACED AGAINST COMPACTED LOAD BEARING SOIL.
2. HYDRANTS TO BE PRIMED AND PAINTED SAFETY YELLOW WITH INDUSTRIAL ENAMEL.
3. FIRE HYDRANTS SHALL BE DRY BARREL WITH SOLID DRAIN RINGS AND SHALL HAVE PERMANENT, VISIBLE, FACTORY TAG MARKED "NO DRAIN" ON BONNET.
4. FIRE HYDRANTS SHALL MEET THE REQUIREMENTS OF SECTION 2.1.5.G. RATED WORKING PRESSURE SHALL BE 200 PSI.
5. THE DISTRICT WILL NOT ALLOW SHUTDOWNS FOR HYDRANT INSTALLATIONS. TAPPING SLEEVES FOR HOT TAPS MUST BE COMPLETE STAINLESS STEEL WITH A STAINLESS STEEL FLANGE. OBTAIN DISTRICT APPROVAL FOR TAPPING SLEEVE MAKE/MODEL.

Rio Linda / Elverta	RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT 730 L STREET, RIO LINDA, CA 95673, PHONE: 916-991-1000, FAX: 916-991-6616	STANDARD DETAIL NO. 8B	
		FIRE HYDRANT ASSEMBLY CASE 2 - UNIMPROVED RIGHT-OF-WAY	
		DATE JULY 2005	NOT TO SCALE / REV

FIRE HYDRANT DETAIL
NTS
1 TYP



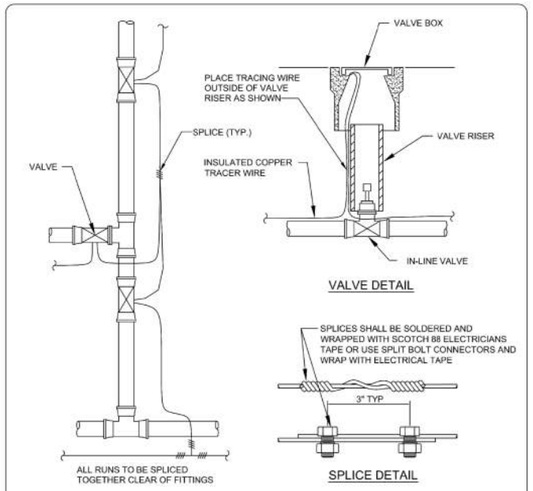
NOTES

1. ALL BURIED TUBING, VALVES, AND FITTINGS SHALL BE WRAPPED W/ 10 MIL POLY-ETHYLENE.
2. INSTALL CONCRETE BLOCKING (4" X 4" X 15½" SOLID SUMP BLOCK) UNDER ENTIRE PERIMETER OF UTILITY BOXES.
3. ALL BURIED BOLTS SHALL BE ZINC CAPPED.

1. 2" TYPE "K" POLYETHYLENE-COATED COPPER TUBING (2.1.5.H(a))
2. CHRISTY B-1730 (OR APPROVED EQUAL) W/ H20 LOADING UTILITY BOX W/ STEEL, CHECKER PLATE, BOLT DOWN TRAFFIC COVER MARKED "WATER" OR EQUAL
3. ¾" DRAIN ROCK (10" MIN DEPTH)
4. 2" BALL VALVE, NIPPLE, UNION, CHECK VALVE, UNION, CHECK VALVE, TO 90° STREET ELL
5. INSULATING CORPORATION VALVE (MUELLER B-25028 OR EQUAL)
6. COMBINATION AIR / VACUUM VALVE (APCO SERIES 1400 OR EQUAL)
7. CHRISTY EXTENSION SPOOL
8. CAP WITH STAINLESS STEEL SCREEN INSIDE BOX.
9. 2" X 6" REDWOOD, BAND BALL VALVE AND CHECK VALVE TO WOOD ALSO TO SIT ON ¾" DRAIN ROCK
10. SWING JOINT (2- 90° BRASS ELBOWS)
11. COMPRESSION JOINT (MUELLER H-15428 OR EQUAL)
12. BRONZE SADDLE WITH 2" FIP TAP

Rio Linda / Elverta	RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT 730 L STREET, RIO LINDA, CA 95673, PHONE: 916-991-1000, FAX: 916-991-6616	STANDARD DETAIL NO. 8C	
		1" & 2" AIR RELEASE VALVE ASSEMBLY (ALL BRASS)	
		DATE JULY 2005	NOT TO SCALE / REV

AIR RELEASE VALVE – PIPELINE
NTS
2 TYP

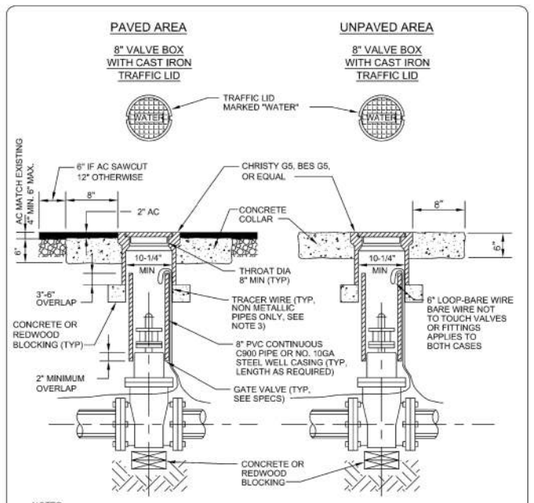


NOTES:

1. TRACING WIRE TO BE NO. 10 AWG, SINGLE STRAND, SOFT DRAWN COPPER WIRE WITH TYPE TW 3/64" INSULATION.
2. WIRE TO BE CONTINUOUS BETWEEN VALVE BOXES.
3. LOCATING WIRE TO BE PLACED ON TOP OF PIPE, TAPED WITH DUCT TAPE EVERY 3' AND AT ALL FITTINGS.
4. CONTRACTOR SHALL CONDUCT A CONTINUITY TEST ON ALL TRACING WIRE SPLICES.

Rio Linda / Elverta	RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT 730 L STREET, RIO LINDA, CA 95673, PHONE: 916-991-1000, FAX: 916-991-6616	STANDARD DETAIL NO. 4	
		TRACING WIRE FOR WATER MAINS	
		DATE JULY 2005	NOT TO SCALE / REV

TRACER WIRE DETAIL
NTS
3 TYP



NOTES:

1. INSTALL RISER AND BOX WITHIN 2 INCHES OF PLUMB.
2. VALVE BOX AND LID ASSEMBLY WITH HOLD DOWN SCREWS MAY BE REQUIRED BY DISTRICT BASED ON SITE-SPECIFIC CONDITIONS.
3. TRACER WIRE TO BE PER STANDARD DETAIL NO. 4. SECURE WIRE TO RISER PIPE WITH ZIP TIES.
4. PROVIDE VALVE EXTENSION IF DEPTH TO VALVE NUT EXCEEDS 2 FEET.
5. INSTALL CONCRETE BLOCKING (4"X4" SOLID SLUMP BLOCK) OR REDWOOD SUPPORTS UNDER ENTIRE PERIMETER OF BOX.

Rio Linda / Elverta	RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT 730 L STREET, RIO LINDA, CA 95673, PHONE: 916-991-1000, FAX: 916-991-6616	STANDARD DETAIL NO. 5	
		VALVE BOX AND RISER	
		DATE JULY 2005	NOT TO SCALE / REV

VALVE BOX & RISER DETAIL
NTS
4 TYP

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REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING
0 1"
AT FULL SCALE
(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

DOMENICHELLI & ASSOCIATES
Domenichelli & Associates
1101 Investment Blvd. Suite 115
El Dorado Hills, CA 95762
Ph: (916) 933-1997
Fax: (916) 933-4778

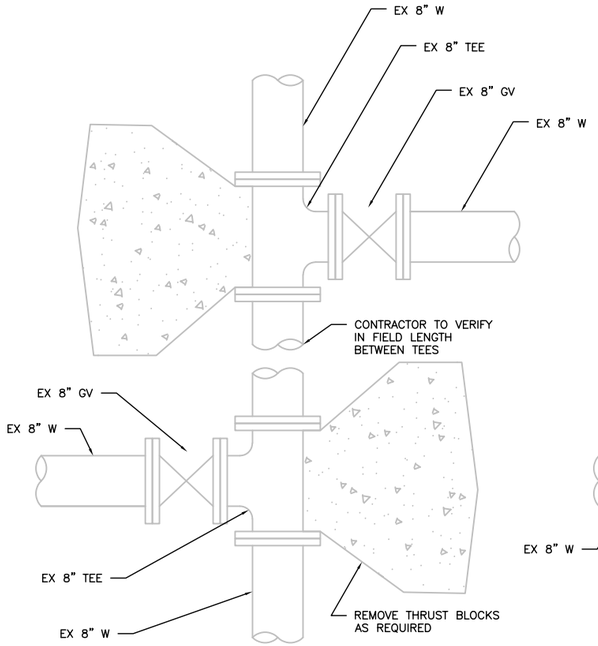
REGISTERED PROFESSIONAL ENGINEER JAMA MILLER No. C 77226 Exp. 6/30/21 CIVIL STATE OF CALIFORNIA

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

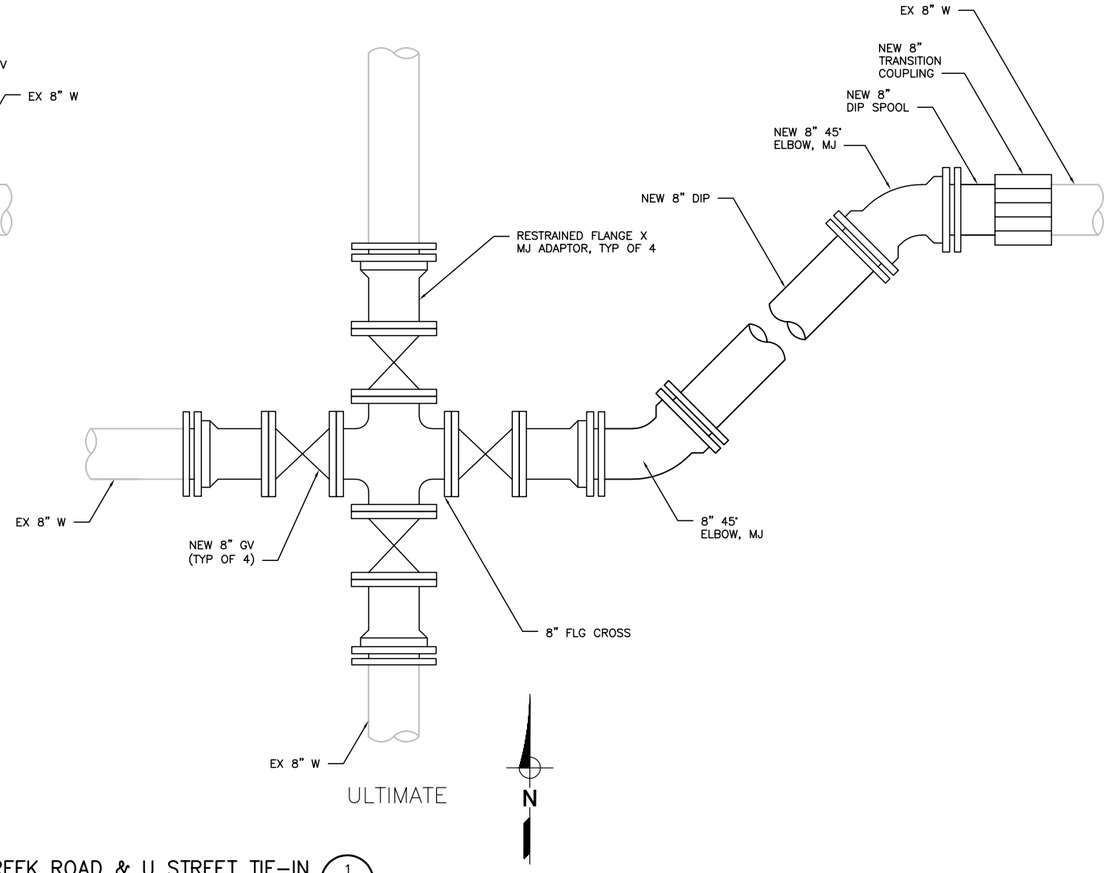
RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

PIPELINE DETAILS 2

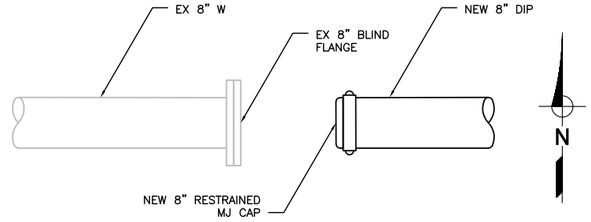
DRAWING NUMBER 26
SHEET NUMBER D7
FILENAME
RLWD FILE NO.



INTERIM



ULTIMATE



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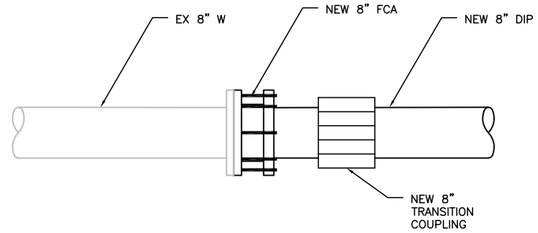
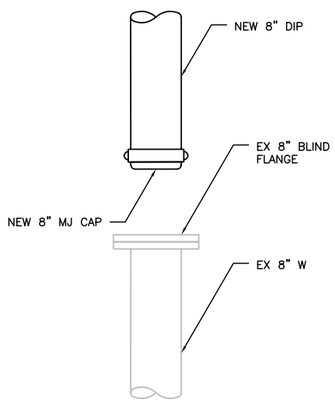


ULTIMATE

U STREET TIE–IN (2 TYP)
NTS

DRY CREEK ROAD & U STREET TIE–IN (1 P1)
NTS



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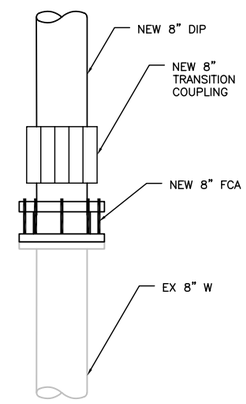

ULTIMATE

14TH STREET TIE–IN (3 TYP)
NTS

NOTES

1. CONTRACTOR SHALL POTHOLE EXISTING PIPELINE PRIOR TO CONSTRUCTION AND VERIFY TYPE AND SIZE. CONTRACTOR IS RESPONSIBLE FOR DETERMINING IF ANY ADDITIONAL FITTINGS ARE NECESSARY TO COMPLETE THE TIE–IN.
2. USE MEGALUG RESTRAINTS FOR ALL MJ FITTINGS
3. CONTRACTOR TO FIELD DETERMINE LENGTH AND CUT AS NECESSARY TO MAKE ULTIMATE CONNECTION
4. TEMPORARY MJ CAPS SHALL BE EQUIPPED TO ALLOW PIPE TO BE FLUSHED, PRESSURE TESTED, AND DISINFECTED.
5. ALL FITTINGS, RESTRAINTS, AND FERROUS METALS SHALL BE POLYETHYLENE WRAPPED.
6. THRUST BLOCKS NOT SHOWN. INSTALL THRUST BLOCKS PER DETAIL 28/D7.
7. EXISTING PIPE MAY HAVE THRUST BLOCKS THAT REQUIRE REMOVAL. CONTRACTOR RESPONSIBLE FOR REMOVAL AND DISPOSAL OF EXISTING THRUST BLOCKS

REVISIONS				
REV.	DESCRIPTION	DATE	BY	CHKD.

WARNING
0 1"
AT FULL SCALE
(IF BAR IS NOT 1" - SCALE ACCORDINGLY)

DESIGNED: D. HEIGHER
DRAWN: J. CADE
CHECKED: S. ROGERS
DATE: OCTOBER 2019

DOMENICHELLI & ASSOCIATES
Domenichelli & Associates
1101 Investment Blvd. Suite 115
El Dorado Hills, CA 95762
Ph: (916) 933–1997
Fax: (916) 933–4778

REGISTERED PROFESSIONAL ENGINEER JAMA MILLER FOSTER NO. 84226 Exp. 6/30/21 CIVIL STATE OF CALIFORNIA

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT
730 L STREET
RIO LINDA, CA 95673
PHONE: (916) 991-1000

RIO LINDA / ELVERTA COMMUNITY WATER DISTRICT WELL 16 PUMP STATION PROJECT

PIPELINE TIE IN DETAILS

DRAWING NUMBER 27
SHEET NUMBER D8
FILENAME
RLWD FILE NO.

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APPENDIX D

Division of Drinking Water (DDW) Waiver

October 31, 2019 PWS No. 3410018

Tim Shaw
General Manager
Rio Linda/Elverta Community Water District
730 L Street
Rio Linda, CA 95673

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT PUBLIC WATER SYSTEM (PWS NO. 3410018) – WELL 16 PUMP STATION CONSTRUCTION PROJECT

The California State Water Resources Control Board, Division of Drinking Water (Division) received an email on October 11, 2019, from the Rio Linda/Elverta Community Water District (RLECWD) regarding improvement plans specifically identified as: 'Well 16 Pump Station' construction project in the Sacramento county area and within the RLECWD public water system (PWS No. 3410018) service area. The aforementioned email provided information and requested a waiver from the water main separation requirements at four (4) locations where potable water mains cross other underground utility pipelines..

Section 64572, Article 4, Chapter 16, Division 4, Title 22 of the California Code of Regulations (CCR) details the water main separation requirements with other underground utility pipelines.

The RLECWD public water system proposal has been reviewed by Rachid Ait-Lasri, P. E. from this office. Rachid Ait-Lasri's review comments are enclosed for your review and action.

Water Mains Crossing Existing Utility Pipelines (other than sewer service lines)

With respect to the new water main crossing existing utility pipes, and in addition to Rachid Ait-Lasri's review comments, this waiver is subject to the following conditions:

1. At locations where utility pipelines cross over water pipelines, the minimum vertical separation between the outside wall of the water pipes and the outside wall of other utility pipes shall be at least twelve (12) inches.

2. At locations where other utility pipelines cross over water pipelines, an uncut section of water pipe shall be used and be placed such that the linear center of the water pipe is located at the crossing point to ensure that maximum separation between the water pipeline joint (as described in the attached memorandum) and the pipelines crossing location is achieved. The water pipeline joints shall be as described in the attached memorandum.
3. Unless specifically approved, at locations where other utility pipes, as defined under Section 64572 (b) of the CCR, are parallel to the water pipes, minimum horizontal separation between the outside wall of the water pipes and the outside wall of other utility pipes shall be at least 48 inches. Also, water pipeline shall be constructed at higher grade and the minimum vertical separation between the outside wall of the water pipes (bottom of pipe) and the outside wall of other utility pipes (top of pipe) shall be at least 12 inches. The water pipeline joints shall be as described in the attached memorandum.

Once the review comments along with the aforementioned conditions are incorporated into the design and construction of the project, no exception to the project would be noted.

This waiver is issued in accordance with Section 64551.100, Article 1.5, Chapter 16, Division 4, Title 22 of the CCR with respect to the items specifically mentioned in the waiver request letter and it is conditioned to completion and return of the enclosed "**VERIFICATION OF CONSTRUCTION IN ACCORDANCE WITH THE ISSUED WAIVER**" form by no later than 30 days after acceptance of the project by the RLECWD public water system. A copy of this verification form shall be kept along with this letter and the project as-built document.

RLECWD public water system may also submit a letter verifying construction of the project and completion of the as-built (record) drawings in accordance with this waiver. As a reference, a blank copy of the enclosed "**VERIFICATION OF CONSTRUCTION IN ACCORDANCE WITH THE ISSUED WAIVER**" shall be attached to such letter.

Water Mains Crossing Existing Sewer Service Lines

With respect to the new water main crossing existing sewer service lines, and once the following comments are incorporated into the design and construction of the project, no exception to the project would be noted. The comments are;

1. Field notes and photographs shall be maintained of each lateral crossing for both "over" and "under" crossings and the address of the property recorded,
2. Where (if) sewer laterals become broken, contact the agency with responsibility and establish with that agency how that repair is to be made and inspected. Repairs shall be recorded in field notes.

In addition to the abovementioned requirements, waivers would be subject to the following conditions:

1. At locations were sewer service lines cross over water pipelines, minimum vertical separation between the outside wall of the water pipes and the outside wall of other utility pipes shall be at least twelve (12) inches.
2. At locations were sewer service lines cross over water pipelines, an uncut section of water pipe shall be used and be placed such that the linear center of the water pipe is located at the crossing point to ensure that maximum separation between the water pipeline joint and the pipelines crossing location is achieved.

This waiver is issued in accordance with Section 64551.100, Article 1.5, Chapter 16, Division 4, Title 22 of the CCR with respect to the sewer service lines mentioned in the waiver request letter and it is conditioned to completion of the attached "**VERIFICATION OF SEWER SERVICE LINES CONSTRUCTION IN ACCORDANCE WITH THE ISSUED WAIVER**" form by no later than 30 days after acceptance of the project by the RLECWD public water system. A copy of this verification form shall be kept along with this letter and the project as-built document.

Once the aforementioned comments are incorporated into the design and construction of the project, no exception to the proposed construction would be noted with respect to the water main pipelines crossing the sewer service lines.

Pipeline construction at locations where the minimum separation requirements cannot be maintained, and/or are not specifically identified and mentioned in the waiver request letter are not part of this waiver.

Once the construction of the project begins, please notify this office so that site inspection(s) can be scheduled.

If you have any questions, or if we can be of any assistance, please do not hesitate to contact Rachid Ait-Lasri at (916) 445-6624, or by email at: Rachid.ait-lasri@waterboards.ca.gov.

Sincerely,

Ali R. Rezvani, P.E.
Sacramento District Engineer
Division of Drinking Water
STATE WATER RESOURCES CONTROL BOARD

cc. Rachid Ait-Lasri, P. E. – Water Resource Control Engineer, DDW, SWRCB

State Water Resources Control Board

Division of Drinking Water

TO: Ali R. Rezvani, P.E.
Sacramento District Engineer
DIVISION OF DRINKING WATER

FROM: Rachid Ait-Lasri, P.E.
Water Resource Control Engineer
SACRAMENTO DISTRICT OFFICE
DIVISION OF DRINKING WATER

DATE: October 31, 2019

SUBJECT: REPLY TO RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT PUBLIC WATER SYSTEM (PWS # 3410018) LETTER DATED OCTOBER 8, 2019 - WAIVER REQUEST CONCERNING THE WELL 16 PUMP STATION PROJECT

The State Water Resources Control Board Division of Drinking Water (Division) received a letter dated October 8, 2019, requesting a waiver from the water main separation requirements for the Rio Linda/Elverta Community Water District (RLEWD) public water system (PWS# 3410018), as specified in Section 64572, Article 4, Chapter 16, Division 4, Title 22 of the California Code of Regulations (CCR). The letter requested review of a proposal by the Water System to mitigate design issues for four (4) locations where it appeared infeasible to adhere strictly to this section of the regulations.

The project is within the RLEWD public water system in Rio Linda, CA. The Well 16 Pump Station Project is tieing the new Well 16 Pump Station to the existing water system. The Project includes approximately 1,900 feet of Class 350 ductile iron pipes (DIP) ranging in size from 8-inch to 12-inch diameter.

Specifically, Sections 64572 states:

(a) New water mains and new supply lines shall not be installed in the same trench as, and shall be at least 10 feet horizontally from and one foot vertically above, any parallel pipeline conveying:

(1) Untreated sewage,
(2) Primary or secondary treated sewage,
(3) Disinfected secondary-2.2 recycled water (defined in section 60301.220),
(4) Disinfected secondary-23 recycled water (defined in section 60301.225), and

(5) Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.

(b) New water mains and new supply lines shall be installed at least 4 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

(1) Disinfected tertiary recycled water (defined in section 60301.230), and
(2) Storm drainage.

(c) New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.

(d) If crossing a pipeline conveying a fluid listed in subsection (a) or (b), a new water main shall be constructed no less than 45-degrees to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of the fluid pipeline.

(e) The vertical separation specified in subsections (a), (b), and (c) is required only when the horizontal distance between a water main and pipeline is less than ten feet.

(f) New water mains shall not be installed within 100 horizontal feet of the nearest edge of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 horizontal feet of the nearest edge of any cesspool, septic tank, sewage leach field, seepage pit, underground hazardous material storage tank, or groundwater recharge project site.

(g) The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe barrel.

(h) With State Board approval, newly installed water mains may be exempt from the separation distances in this section, except subsection (f), if the newly installed main is:

(1) less than 1320 linear feet,
(2) replacing an existing main, installed in the same location, and has a diameter no greater than six inches more than the diameter of the main it is replacing, and
(3) installed in a manner that minimizes the potential for contamination, including, but not limited to:

(A) sleeving the newly installed main, or
(B) utilizing upgraded piping material.

Specifically, RLEWD and the Consultant have provided project construction drawings showing the areas where the waivers are being requested.

The waiver from the regulations is requested for the following locations:

1. An 8" Class 350 DIP restrained waterline crossing below the 12-inch drainage pipe on U Street at Station 7+37 at a minimum 18-inch separation (see Sheet P2).

2. A 12" Class 350 DIP restrained waterline crossing below the 18-inch drainage pipe on U Street at Station 10+73.5 at a minimum 18-inch separation (see Sheet P2).

3. An 8" Class 350 DIP restrained waterline crossing below the 12-inch drainage pipe on 14th Street at Station 0+54 at a minimum 18-inch separation (see Sheet P4).

4. An 8" Class 350 DIP restrained waterline crossing below the drainage pipe on 14th Street at Station 5+68 at a minimum 18-inch separation (see Sheet P5).

Attached are the construction drawings showing the areas where variances are being requested. The conflicts are high-lighted and numbered as noted above for ease of identification.

The RLEWD and Consultant believe the proposed construction methods will provide the same or a greater level of protection to public health. The restrained joints will help prevent the separation of adjoining pipe sections and reduce the risk that non-potable fluids will enter the water main.

The review concluded the following:

1. An 8" Class 350 DIP restrained waterline crossing below the 12-inch drainage pipe on U Street at Station 7+37 at a minimum 18-inch separation (see Sheet P2).

   The waiver request for this proposed crossing is acceptable.

2. A 12" Class 350 DIP restrained waterline crossing below the 18-inch drainage pipe on U Street at Station 10+73.5 at a minimum 18-inch separation (see Sheet P2).

   The waiver request for this proposed crossing is acceptable.

3. An 8" Class 350 DIP restrained waterline crossing below the 12-inch drainage pipe on 14th Street at Station 0+54 at a minimum 18-inch separation (see Sheet P4).

   The waiver request for this proposed crossing is acceptable.

4. An 8" Class 350 DIP restrained waterline crossing below the drainage pipe on 14th Street at Station 5+68 at a minimum 18-inch separation (see Sheet P5).

   The waiver request for this proposed crossing is acceptable.

The new water mains in the subject area should be constructed of Pressure Class 350 ductile iron pipe with restrained joints in all areas that do not comply with Section 64572 CCR. The entire length of these ductile iron pipe sections will be covered with 8-mil thick Polywrap protective coating.

As a result of the Division's review of the plans, the following conditions shall be implemented where separation requirements between water mains and storm drain pipelines cannot reasonably be met:

Waiver conditions:

1. The water main shall be constructed with Pressure Class 350 ductile iron pipe.
2. The water main shall be covered with 8-mil thick Polywrap protective coating as required by the Sacramento County Standard Construction Specifications.
3. Regarding pipelines that are proposed to be constructed parallel to other existing pipelines and cannot meet the minimum required separation, the water main and appurtenances shall be constructed with mechanically restrained joints using bolted connections or restrained push-on joints with grooved metal teeth (in accordance with ANSI/AWWA C111/A21.11 standards) for the entire length of the pipeline that do not comply with Section 64572 of the CCR.
4. Regarding pipelines that are proposed to be constructed and would cross other existing pipelines and cannot meet the minimum required separation, the water main and appurtenances shall be constructed with mechanically restrained joints using bolted connections for the entire length that do not comply with Section 64572 of the CCR.
5. Where the water main crosses below the storm drain pipeline, at least one foot of vertical separation shall be maintained at all crossings.
6. The water main shall be placed such that pipe joints will be as distant as possible from the centerline of the storm drain pipeline.

In accordance with Section 64572 of the CCR, the RLEWD waiver request for the specifically identified crossings and pipe placement for the Well 16 Pump Station Project, submitted on October 8, 2019, agrees with acceptable practices necessary to provide equal protection for the proposed main pipeline construction as required to obtain a written waiver from the Division regarding California Water Works Standards under Section 64551.100, Article 1.5, Chapter 16, Division 4, Title 22 of CCR.

Specifically, Sections 64551.100 states:

(a) A water system that proposes to use an alternative to a requirement in this chapter shall:

(1) Demonstrate to the State Board that the proposed alternative would provide at least the same level of protection to public health; and
(2) Obtain written approval from the State Board prior to implementation of the alternative.

The waiver is subject to the conditions listed above.

Attachments:
1. Letter with Memo from Rio Linda/Elverta Community Water District (10/8/2019)

VERIFICATION OF SEWER SERVICE LINES CONSTRUCTION IN ACCORDANCE WITH THE ISSUED WAIVER

Name of Public Water System: Rio Linda/Elverta Community Water District

Public System Number: CA3410018

As required by letter dated **October 31, 2019**, and with respect to waiver issued in accordance with Section 64551.100, Article 1.5, Chapter 16, Division 4, Title 22 of the California Code of Regulations, the undersigned verifies that construction of the **Well 16 Pump Station Project** at the following crossings was completed in accordance with requirements stated in the aforementioned waiver letter.

The crossings are:

Item	Water Main			Sewer Service Lines				
	Station	Size	Material	Size	Material	Fluid	Crossing (Under / Over)	Separation (inches)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Name _____ **California PE Number** _____

Signature _____ **Date** _____

THIS FORM MUST BE COMPLETED AND FILED AS PART OF PROJECT RECORD DRAWINGS

Disclosure: Be advised that Section 116725 and 116730 of the California Health and Safety Code states that any person who knowingly makes any false statement on any report or document submitted for the purpose of compliance with the attached order may be liable for a civil penalty not to exceed five thousand dollars ($5,000) for each separate violation for each day that violation continues. In addition, the violators may be prosecuted in criminal court and upon conviction, be punished by a fine of not more than $25,000 for each day of violation, or be imprisoned in county jail not to exceed one year, or by both the fine and imprisonment.

VERIFICATION OF CONSTRUCTION IN ACCORDANCE TO THE ISSUED WAIVER

Name of Water System: Rio Linda/Elverta Community Water District

Public System Number: CA3410018

Certification

As required by letter dated: **October 31, 2019**, and with respect to waiver issued in accordance with Section 64551.100, Article 1.5, Chapter 16, Division 4, Title 22 of the California Code of Regulations, the undersigned certifies that construction of the **Well 16 Pump Station Project** at the following crossings was completed in accordance with requirements stated in the aforementioned waiver letter and its attached memorandum. The crossings are:

1. An 8" waterline crossing below the 12-inch drainage pipe on U Street at Station 7+37 at a minimum 18-inch separation.

2. A 12" waterline crossing below the 18-inch drainage pipe on U Street at Station 10+73.5 at a minimum 18-inch separation.

3. An 8" waterline crossing below the 12-inch drainage pipe on 14th Street at Station 0+54 at a minimum 18-inch separation.

4. An 8" waterline crossing below the drainage pipe on 14th Street at Station 5+68 at a minimum 18-inch separation.

Name	**California PE Number**
Signature	**Date**

THIS FORM MUST BE COMPLETED AND RETURNED TO THE DIVISION OF DRINKING WATER – SACRAMENTO DISTRICT

A COPY OF THIS FORM SHOULD BE FILED AS PART OF THE PROJECT RECORD DRAWINGS

Disclosure: Be advised that Section 116725 and 116730 of the California Health and Safety Code states that any person who knowingly makes any false statement on any report or document submitted for the purpose of compliance with the attached order may be liable for a civil penalty not to exceed five thousand dollars ($5,000) for each separate violation for each day that violation continues. In addition, the violators may be prosecuted in criminal court and upon conviction, be punished by a fine of not more than $25,000 for each day of violation, or be imprisoned in county jail not to exceed one year, or by both the fine and imprisonment.

Rezvani, Ali@Waterboards

From: Ait-Lasri, Rachid@Waterboards
Sent: Thursday, October 31, 2019 11:22 AM
To: Rezvani, Ali@Waterboards
Subject: FW: PWS #CA3410018 (RLECWD) Well 16 - Waiver Request
Attachments: RLECWD Well 16 DDW Waiver Letter 2019_10-08.pdf; 2 - ATTACHMENT B - WELL 16 - DDW Plan Set.pdf; 1-ATTACHMENT A-DA_Water Separation Variance Request- RLECWD Well 16-signed.pdf; CA3410018-MEMO-Waiver_Request_Well_16_Pump_Station_10-31-2019.docx; Water Main Construction Verification 2019-10-31.doc; Construction Verification_2019-10-31.doc

Hi Ali,

Please see the attached waiver request from Rio Linda/Elverta Community Water District, as well as my memo and verification forms.

Please let me know if you have any questions.
Thanks,
Rachid

From: Sara Rogers <SaraR@daengineering.net>
Sent: Friday, October 11, 2019 10:31 AM
To: Ait-Lasri, Rachid@Waterboards <Rachid.Ait-Lasri@waterboards.ca.gov>
Cc: Mike Vasquez <mvasquez@ekiconsult.com>; Tim Shaw <GM@rlecwd.com>; Pat Goyet <pgoyet@rlecwd.com>
Subject: RE: PWS #CA3410018 (RLECWD) Well 16

Rachid – In addition to the permit amendment for Well 16 the District is requesting a waiver for a total of 4 locations where the new pipeline will cross existing drainage facilities. The attached is the documentation regarding that request. Please let me know if you would like any of these documents in hard copy format. We can quickly bring them to your office.

On another note – the plans that we had uploaded previously to the DropBox link did not include the final structural or electrical drawings. An updated set has been uploaded for your use. You can use the same link - https://www.dropbox.com/sh/rxu72p4iqlmmmox/AABiB_-fceCF5a8HnSZmYEvra?dl=0

Please let me know if you have any questions or comments. I am available any time at 916-803-0012.

Thanks – Sara

Sara M. Rogers, P.E., QSD
DOMENICHELLI & ASSOCIATES
1101 Investment Blvd., Suite 115
El Dorado Hills, CA 95762
Phone: (916) 933-1997
Fax: (916) 933-4778

From: Sara Rogers
Sent: Sunday, October 6, 2019 8:33 PM
To: Ait-Lasri, Rachid@Waterboards <Rachid.Ait-Lasri@waterboards.ca.gov>
Cc: Mike Vasquez <mvasquez@ekiconsult.com>; Tim Shaw <GM@rlecwd.com>; Pat Goyet <pgoyet@rlecwd.com>

Subject: RE: PWS #CA3410018 (RLECWD) Well 16
Importance: High

Rachid – I wanted to follow-up with you on the Permit Amendment for RLECWD Well 16. I had started coordination with Salvador on this project and I understand that you are taking over for him. Based on my discussions with Salvador the following information has been compiled for your review:

1. Permit Amendment Application
2. Well 16 – Drinking Water Source Assessment
3. Project CEQA document
4. Well Siting Checklist
5. Well Summary Report
6. Current Well 16 Plans

Use the following link to download the documents – https://www.dropbox.com/sh/rxu72p4iqlmmmox/AABiB_-fceCF5a8HnSZmYEvra?dl=0

Please take a look and let us know if you have any questions or need any additional information. The well site has been designed to be consistent with the District's existing Well 15. The project will require a DDW waiver for pipeline separation requirements. That request will be coming shortly. Feel free to give me a call at 916-803-0012 with any questions or if you have any problems downloading the documents.

Thanks – Sara

Sara M. Rogers, P.E., QSD
DOMENICHELLI & ASSOCIATES
1101 Investment Blvd., Suite 115
El Dorado Hills, CA 95762
Phone: (916) 933-1997
Fax: (916) 933-4778

From: Ait-Lasri, Rachid@Waterboards <Rachid.Ait-Lasri@waterboards.ca.gov>
Sent: Wednesday, September 25, 2019 8:54 AM
To: Pat Goyet <pgoyet@rlecwd.com>; Mike Vasquez <mvasquez@ekiconsult.com>
Cc: Sara Rogers <SaraR@daengineering.net>; Tim Shaw <GM@rlecwd.com>
Subject: RE: PWS #CA3410018 (RLECWD) Well 16

Thank you Pat and Mike,
Rachid

From: Pat Goyet <pgoyet@rlecwd.com>
Sent: Wednesday, September 25, 2019 8:06 AM
To: Ait-Lasri, Rachid@Waterboards <Rachid.Ait-Lasri@waterboards.ca.gov>
Cc: Sara Rogers <SaraR@daengineering.net>; Mike Vasquez <mvasquez@ekiconsult.com>; Tim Shaw <GM@rlecwd.com>
Subject: RE: PWS #CA3410018 (RLECWD) Well 16

Rachid,

We have not received the permit amendment for well 16 here at the District office. I have included District staff and engineering on my response as we are meeting today to discuss well 16 and receive an update from the design engineers Domenichelli & Associates (Sara Rodgers).

Patrick M. Goyet
Operations Superintendent
Rio Linda/Elverta Community Water District
Office: 916-991-8892, Cell: 916-796-5949

From: Ait-Lasri, Rachid@Waterboards <Rachid.Ait-Lasri@waterboards.ca.gov>
Sent: Tuesday, September 24, 2019 3:53 PM
To: Pat Goyet <pgoyet@rlecwd.com>
Subject: PWS #CA3410018 (RLECWD) Well 16

Hi Pat,

I am checking to see if an amended permit was issued for Well 16. The only thing I see on my side is some communication between Sara Rogers and our office back in June, and it seems that at that time, no permit was issued.

If no permit has been issued, we'll need to pick up where things stopped.

Thanks,
Rachid

Rachid Ait-Lasri, P.E.
Water Resource Control Engineer
Division of Drinking Water
State Water Resources Control Board
1001 "I" Street, 17th Floor, Sacramento, CA 95814
(916) 445-6624 | Rachid.Ait-Lasri@waterboards.ca.gov

RIO LINDA/ELVERTA COMMUNITY WATER DISTRICT

P. O. BOX 400 730 L STREET
RIO LINDA, CALIFORNIA 95673
Phone: 916-991-1000

8 October 2019

Ali R. Rezvani, P.E., District Engineer
State Water Resources Control Board, Division of Drinking Water
Sacramento District Office
1001 I Street, 17th Floor
Sacramento, CA 95814

Re: Request for Waiver from the California Waterworks Standards – Water Main Separation Requirements for Well 16 Pump Station Project

Dear Mr. Rezvani,

This letter is a request for a variance to the California Waterworks Standards (Title 22, Chapter 16, Section 64572) regarding separation requirements for water mains from existing storm drains. There are no sewer mains in the vicinity of the project.

The Rio Linda/Elverta Community Water District intends to install approximately 1,900 feet of 8-inch and 12-inch ductile iron pipe to tie their new Well 16 pump station into their existing water system. The project boundaries for the pipeline installation are U Street between Dry Creek Rd and 14th Street and on 14th Street to approximately 800 feet south of U Street in Rio Linda, CA.

There are a total of four (4) non-potable water (culverts) crossings identified on the plans. There are no new water mains within the required 10-foot horizontal separation from a sewer main or 4-foot horizontal separation of a storm-drain pipe. The proposed crossings reflect a minimum 18-inch clearance between the water main and storm drain culvert and will be constructed with full 18-foot lengths of Pressure Class 350 Ductile Iron Pipe, centered on the crossings where possible. All pipe joints within 8 feet of either side of the crossing centerline will be restrained. These requested variances are shown on the plans and annotated below.

- Item 1; Sheet P2, Station 7+37: 8" Class 350 DIP restrained water crossing 18" minimum below 12" culvert
- Item 2; Sheet P2, Station 10+73.5: 12" Class 350 DIP restrained water crossing 18" minimum below 18" culvert
- Item 3; Sheet P4, Station 0+54: 8" Class 350 DIP restrained water crossing 18" minimum below 12" culvert

- Item 4; Sheet P5, Station 5+68: 8" Class 350 DIP restrained water crossing 18" minimum below culvert.

In concurrence with the Design Engineer's professional opinion, the Rio Linda/Elverta Community Water District agrees that the proposed construction methods will provide a safe installation with virtually no chance of cross-contamination of potable water supply for the project.

If you have any questions, please feel free to contact me at (650) 292-9112, or by email at mvasquez@ekiconsult.com.

Sincerely,

G. Michael Vasquez, PE, PLS
Contract District Engineer
Rio Linda/Elverta Community Water District

Enclosed:

- Attachment A – Engineer's Variance Notification Letter to RLECWD for Well 16 Pump Station Project
- Attachment B – Well 16 Pump Station Project Plans

CC:

- Timothy Shaw, General Manager, Rio Linda/Elverta Community Water District
- Sara Rogers, PE, QSD, Design Engineer, Domenichelli & Associates

ATTACHMENT A

DOMENICHELLI AND ASSOCIATES, INC.
CIVIL ENGINEERING

Tim Shaw
General Manager
Rio Linda/Elverta Community Water District
730 L Street
Rio Linda, CA 95673

RE: Variance Request for Well 16 Pump Station Project

Dear Mr. Shaw:

This letter is a request for a variance to the California Waterworks Standards (Title 22, Chapter 16, Section 64572) regarding separation requirements for water mains from existing storm drains. This variance request involves the vertical and horizontal separation of potable water mains from storm drains. There are no existing sewer pipelines in the project area.

The project boundaries for the pipeline installation are U Street between Dry Creek Rd and 14th Street and on 14th Street approximately 800 feet south of U Street in Rio Linda, CA.

The following construction methods for vertical and horizontal separation includes:

1. The proposed crossings reflect a minimum of 18 inches of clearance between the water main and storm drain culvert and will be constructed 18-foot joint-free, full-length, Pressure Class 350 Ductile Iron Pipe centered on the crossings where possible. All joints within 8 feet on either side of the crossing will be restrained.

Our professional opinion is that the proposed construction methods will provide a safe installation with virtually no chance of cross-contamination of potable water supply for the project. If you have any questions, please feel free to contact me at (916) 933-1997, or by email at: sarar@daengineering.net

Regards,

Sara Rogers, PE C64226

REGISTERED PROFESSIONAL ENGINEER
SARA M. ROGERS
No. C64226
Exp. 6/30/21
CIVIL
STATE OF CALIFORNIA