City of Los Banos
At the Crossroads of California

Contract Documents
for
Construction of

ORCHARD TERRACE SEWER LIFT STATION REHABILITATION PROJECT

MAY 2025

Bid Proposals must be received no later than 2:00 p.m., June 10, 2025
City of Los Banos City Clerk
520 J Street
Los Banos, CA 93635

City of Los Banos
Public Works Department

Table of Contents

Advertisement for Bids

Information for Bidders

Bid

Bid Bond

Sample Forms

Agreement
Certificate of Contractor
Payment Bond
Performance Bond
Notice of Award
Notice to Proceed
Change Order

General Provisions

1. Terms and Definitions
2. Order of Precedence of Contract Documents
3. Venue
4. Giving Notice
5. Cumulative Remedies
6. Non-Discrimination
7. Non-Discrimination of the Disabled
8. Additional Instructions and Detail Drawings
9. Schedules, Reports and Records
10. Drawings and Specifications
11. Shop Drawings, Product Data and Samples
12. Materials, Services and Facilities
13. Inspection and Testing
14. Substitutions
15. Patents
16. Surveys, Permits and Regulations
17. Protection of Work, Property and Persons
18. Supervision by Contractor
19. Changes in the Work
20. Changes in Contract Price
21. Time for Completion and Liquidated Damages
22. Correction of Work
23. Suspension of Work, Termination and Delay
24. Progress Estimates
25. Progress Payments
26. Prompt Payment
27. Acceptance and Final Payment
28. Quantities and Unit Prices
29. Insurance
30. Contract Security
31. Assignments
32. Indemnification
33. Separate Contracts
34. Subcontracting
35. Employment of Apprentices
36. Payment of Prevailing Wages

37. Registration to Train Apprentices
38. Penalties
39. Engineer's Authority
40. Land and Rights-of-Way
41. Warranty and Guarantee
42. One (1) Year Warranty Period
43. Correction of Defective Work
44. Early Completion
45. Extended Warranties and Guarantees
46. Arbitration
47. Taxes
48. Contractor's Understanding
49. Accidents
50. Safety and Sanitation
51. Climatic Conditions
52. Officials Not to Benefit
53. Clean-Up
54. Notice to Owner
55. Payment of Withheld Funds
56. Storm Water Pollution Prevention Measures

Special Provisions

1. Requirements
2. Description of Work
3. Commencement, Prosecution and Completion of Work
4. Hours of Work
5. City Permits and Business Licenses
6. Testing
7. Responsibility Regarding Existing Utilities and Private Property
8. Obstructions
9. Materials Furnished By Owner
10. Materials Furnished By Contractor
11. Schedule of Values, Material List and Substitutions
12. Request for Extension of Time
13. Rights-of-Way
14. Coordination with Other Work
15. Closure of Streets
16. Construction Signs, Barricades, Lights and Flagmen
17. Traffic Control Plan
18. Disposal of Waste Materials
19. Noise Control
20. Water Supply
21. Notifications
22. Work Not Listed in Proposal
23. Submittals
24. Bid Item Descriptions

Technical Specifications

DIVISION 01 – GENERAL REQUIREMENTS

01 11 01 Owner-Furnished Contractor-Installed Items
01 22 00 Explanation of Bid Items
01 77 00 Contract Closeout

DIVISION 02 – EXISTING CONDITIONS

02 01 20 Protection of Underground Facilities and Survey Monuments
02 41 00 Demolition

DIVISION 03 – CONCRETE

03 30 01 Cast-in-Place Concrete (Site Work)
03 36 00 Concrete Lining for Corrosion Protection
03 41 00 Precast Concrete Structures

DIVISION 08 – OPENINGS

08 30 01 Sewer Lift Station Access Hatches

DIVISION 26 – ELECTRICAL

26 05 00 Common Work Results for Electrical
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 33 Raceways and Boxes for Electrical Systems
26 05 53 Identification for Electrical Systems
26 08 00 Commissioning of Electrical Systems
26 27 00 Low-Voltage Distribution Equipment
26 18 11 Overcurrent Protection Devices
26 29 13 Reduced-Voltage Motor Controllers
26 50 00 Lighting

DIVISION 31 – EARTHWORK

31 23 17 Trenching Backfilling and Compacting
31 23 19 Structure Excavation and Backfilling

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 11 23 Aggregate Base
32 12 16 Asphalt Concrete Paving
32 31 00 Fencing

DIVISION 33 – UTILITIES

33 01 31 Sewer Bypass
33 01 36 Sewer Reconstruction
33 05 26 Utility Line Marking

DIVISION 40 – PROCESS INTEGRATION

40 05 00 Pipe & Fittings
40 05 23 Valves & Appurtenances
40 61 00 Common Work Results for Process Control and Instrumentation Systems
40 61 14 Process Control and Instrumentation System Loop Descriptions
40 63 43 Programmable Logic Controllers
40 67 16 Free-Standing Panels
40 91 06 Level Measuring

DIVISION 43 – PROCESS GAS AND LIQUID HANDLING PURIFICATION AND STORAGE

43 21 63 Submersible Pumps

Advertisement for Bids

CITY OF LOS BANOS
520 J Street
Los Banos, California 93635

Notice is hereby given that separate sealed bids for the award of contract for the **Construction of Orchard Terrace Sewer Lift Station Rehabilitation** will be received by the City of Los Banos at the office of the City Clerk until 2:00 p.m. Pacific Daylight Savings Time, June 12, 2025 and then at said office publicly opened and read aloud.

The major work consists of furnishing and installing a pumping bypass and valve vault and standby generator with associated concrete pads, and replacing the wet well of an existing sanitary sewer lift station located at 100 Willmott Avenue; in the City of Los Banos. Improvements will include the removal of an existing wet well, sewer pipelines, electrical controls, conduit and appurtenances. The installation of a wet well, onsite piping, generator, installation of protective lining to wet well, temporary sewer bypass pumping as required, minor concrete and asphalt above proposed underground improvements.

The time for completion shall be one hundred and fifty (150) Calendar days.

The Contract Documents, in their entirety, can be viewed and/or obtained from the City of Los Banos website at www.losbanos.org or at the following locations:

Central California Builders Exchange (www.cencalbx.com)

Builders Exchange of Stockton (www.besonline.com)

Valley Builders Exchange, Inc. (www.valleybx.com)

Builders Exchange of Santa Clara County (www.bxscco.com)

Dodge Data & Analytics (www.construction.com/plans/)

A payment bond prepared and executed in accordance with California Civil Code Section 9550 and a bond for faithful performance of the contract will be required of the successful bidder who is awarded the contract.

The successful bidder must comply with the latest general prevailing rate of per diem wages as determined by the Director of Industrial Relations, State of California, Department of Industrial Relations and is to be paid to the various craftsmen and laborers required to construct said improvements and is made a part of the specifications and contract for said work to which reference is hereby made for further particulars.

No contractor or subcontractor may be listed on a bid proposal or 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.

This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. Contractor registration information can be found at:

http://www.dir.ca.gov/Public-Works/PublicWorks.html

Each bid shall be accompanied by cashier's or certified check or by a bidder's bond, made payable to the City of Los Banos and executed by a corporate surety licensed to issue surety bonds in the State of California, for an amount equal to at least ten percent (10%) of the amount of said bid and no bid shall be considered unless such cashier's or certified check or bidder's bond is enclosed therewith.

The successful bidder of this project shall have the following current and active California State Contractor's License at the time of the submission of the bid and throughout the duration of the contract: **Class A**.

Prospective bidders are encouraged to attend a non-mandatory pre-bid meeting on Thursday, May 29, 2025 at 10am. The meeting will be held at 411 Madison Avenue, Los Banos, CA 93635.

Bidders shall refer to the Contract Document's Information for Bidders for complete instructions.

Bidders are solely responsible for the cost of preparing their bids.

The City specifically reserves the right, in its sole discretion, to reject any or all bids, to re-bid, or to waive inconsequential defects, in bidding not involving time, or quality of the work. The City may reject any and all bids and waive any minor irregularities in the bids.

Information for Bidders

Sealed bids will be received by the City of Los Banos (herein called the "Owner"), at the office of the City Clerk until 2:00 p.m. Pacific Daylight Savings Time, June 12, 2025, then at said office, publicly opened and read aloud. Owner shall reject all bids received after the specified time and will return such bids to bidder, unopened. Bidders must submit bids in accordance with these instructions. No emailed or faxed bids will be accepted.

The major work consists of installing owner furnished pumps and furnishing and installing a pumping bypass and valve vault along with associated concrete and asphalt work located at 100 Willmott Avenue; in the City of Los Banos. Improvements will include sewer pipeline replacement, electrical controls, conduit and appurtenances, installation of owner furnished pumps, onsite piping, installation of protective lining to wet well, temporary sewer bypass pumping as required, concrete and asphalt work above proposed underground improvements. The time for completion is one hundred and fifty (150) calendar days.

Each bid must be submitted in a sealed envelope and addressed to the City of Los Banos at 520 J Street, Los Banos, CA 93635. Each sealed envelope containing a bid must be plainly marked on the outside as "**Orchard Terrace Sewer Lift Station Rehabilitation: Attention City Clerk**", and the envelope shall also bear on the outside, the name of the bidder, and their address. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed to the City of Los Banos at 520 J Street, Los Banos, CA, 93635, and also clearly state, "**Orchard Terrace Sewer Lift Station Rehabilitation: Attention City Clerk**".

A complete bid includes the Bid Form, List of Subcontractors, Equal Employment Opportunity, Non-Collusion Affidavit, Debarment and Suspension Certification, Bid Schedule, Experience, Bid Bond with surety, and a copy of a current California State Contractor's License. A signed Addendum, if issued, must also be submitted with the sealed bid. The Total Bid Amount must be filled in, in ink or typewritten, and the bid must be fully completed and executed when submitted. Only one set of original bid forms are required to be submitted. Mistakes must be corrected and the correction inserted; correction must be initialed in ink by person or persons signing the bid. No conditional bids will be accepted.

The bid shall be signed by a person or persons legally authorized to bind bidder to the contract. The individual or individuals signing each document shall warrant that they are authorized to bind the bidder.

The Owner may waive any informalities or minor defects or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 30 days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the bidder.

Each bid must be accompanied by a bid bond payable to the Owner for ten percent (10%) of the total amount of the bid. As soon as the bid amounts have been compared, the Owner will return the bid security of all except the three lowest responsive and responsible bidders. Once a bid has been awarded, and the payment bond and performance bond of the successful bidder has been received by the Owner, the bid security of the three remaining lowest responsive and responsible bidders will be returned.

All bonds must be acknowledged before a Notary Public by both the bidder and the surety. Attorneys-in-fact who sign bid bonds or payment bonds and performance bonds must file with each bond a certified and effective dated copy of their power of attorney.

Award and Execution of Contract

The party to whom the contract is awarded will be required to execute the Agreement, and obtain the performance bond and payment bond along with satisfactory evidence of insurance within ten (10) calendar days from the date when the Notice of Award is delivered to the successful bidder. The Notice

of Award shall be accompanied by the necessary agreement and bond forms. In case of failure of the bidder to execute the Agreement, the Owner may, at his option, consider the bidder in default, in which case the bid bond accompanying the bid shall become the property of the Owner.

A performance bond and a payment bond, each in the amount of 100 percent of the Contract Price, with a corporate surety named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570, will be required for the faithful performance of the contract. The payment bond must be issued by an admitted surety insurer holding a certificate of authority to transact surety insurance in California issued by the Insurance Commissioner.

All bonds must be acknowledged before a Notary Public by both the bidder and the surety. Attorneys-in-fact who sign bid bonds or payment bonds and performance bonds must file with each bond a certified and effective dated copy of their power of attorney.

The Owner, within 15 days of receipt of the performance bond, payment bond and agreement signed by the party to whom the contract was awarded, shall sign the Agreement and return to such party an executed duplicate of the agreement. Should the Owner not execute the Agreement within such period, the bidder may, by written notice, withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

The Notice to Proceed shall be issued within 10 days of the execution of the Agreement by the Owner. Should there be reasons why the Notice to Proceed has not been issued within such period, the time may be extended by mutually agreed upon, and the bidder may terminate the Agreement without further liability on the part of either party.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout.

Subcontractors

The subcontractors listed by bidder in the bid shall list therein the name and address of each subcontractor to whom the bidder proposes to subcontract portions of the work in an amount in excess of one-half of one percent of the total bid or $10,000, whichever is greater, in accordance with the Subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the Public Contract Code. The bidder's attention is invited to other provisions of the Act related to the imposition of penalties for a failure to observe its provisions by using unauthorized subcontractors or by making unauthorized substitutions.

Registration with California Department of Industrial Relations (DIR)

A contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in this chapter, unless currently registered and qualified to perform public work pursuant to Section 1725.5. It is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded. Labor Code Section 1771.1(a) requires contractors and their subcontractors to possess and maintain such registration with DIR in order to be awarded and to perform on public works projects (regardless of funding source).

Pursuant to Section 1771.4, each contractor and subcontractor shall furnish certified payroll records to the Labor Commissioner at least monthly and in a format prescribed by the Labor Commissioner of the DIR. Until such time that the DIR gives awarding agencies direct access to all certified payrolls submitted by contractors and subcontractors, contractor and his subcontractors are also required to submit copies of payroll records to Owner on a monthly basis. Information on the above can be found at:

http://www.dir.ca.gov/Public-Works/PublicWorks.html

Prevailing Wage

This work is subject to prevailing wage requirements. If there is a difference between the minimum wage rates predetermined by the Secretary of Labor and the prevailing wage rates determined by the Director of the Department of Industrial Relations of the State of California for similar classification of labor, the contractor and his subcontractor shall not pay less than the higher wage rate. In accordance with the provisions of Section 1773 of the Labor Code of the State of California, the Owner has obtained from the Director of the Department of Industrial Relations, the general prevailing rate for each craft, classification, or type of workman required for execution of the Agreement. A copy of said prevailing rate of per diem wages is on file in the office of the Owner, and available from the California Department of Industrial Relations' Internet web site at **http://www.dir.ca.gov/DLSR/PWD**.

The Federal minimum wage rates for this work as predetermined by the United States Secretary of Labor may be examined at the offices described above where the Contract Documents may be seen. Addenda to modify the Federal minimum wage rates, if necessary, will be posted on the internet at **www.losbanos.org**. Future effective general prevailing wage rates, which have been predetermined are on file with the California Department of Industrial Relations and are referenced but not printed in the general prevailing wage rates.

Pre-Bid Meeting

Prior to submitting a sealed bid, bidder are encouraged to attend a non-mandatory pre-bid meeting at the project site. The date of the non-mandatory pre-bid meeting is May 29, 2025. The address for the non-mandatory meeting is 411 Madison Avenue in Los Banos, California. The start time for the meeting is 10 a.m., sharp.

Bids will be considered from bidders who were not physically in attendance at the non-mandatory pre-bid meeting.

Bidders must satisfy themselves as to the accuracy of the estimated quantities in the Bid Schedule by examination of the site and a review of the drawings and specifications including addenda. After bids have been submitted, the bidder shall not assert that there was misunderstanding concerning the quantities of work or the nature of the work to be done. The failure or omission of any bidder to do any of the foregoing shall not relieve any bidder from any obligation with respect to his bid.

The Contract Documents contain the provisions required for the construction of the project. The Owner will not be responsible for, nor be bound by, any oral instructions, interpretations, or explanations issued by the Owner or its representatives. Any request for clarifications or questions of the Contract Documents shall be made in writing or email and deliverable to:

City of Los Banos Public Works Department
Attn: Charles Bergson, P.E., Public Works Director/City Engineer
charles.bergson@losbanos.org
with cc: jelene.demelo@losbanos.org and mariah.martinez@losbanos.org
411 Madison Avenue
Los Banos, CA 93635

Requests for clarification or questions shall be delivered to the Owner before 5:00 p.m. PDST on June 4, 2025. Any Owner response to a request for clarification, questions and answers will be posted to the City's website at www.losbanos.org no later than 5:00 p.m. PDST on June 6, 2025 and if necessary, shall become a part of the bid as an addendum.

Proposed timeline of events associated with the awarding of bid:

Release of Advertisement for Bid		May 14, 2025
Pre-Bid Meeting – Non-Mandatory	10:00 a.m.	May 29, 2025
Deadline to Submit Questions/Clarifications	5:00 p.m.	June 04, 2025
Addendum/Questions/Clarifications posted	5:00 p.m.	June 06, 2025
Bid Opening	2:00 p.m.	June 12, 2025

City Council Considers Bid		July 02, 2025	(tentative)
Issuance of a Notice to Proceed	On or before:	July 14, 2025	(tentative)
Construction to Begin	On or before:	July 15, 2025	(tentative)

Qualification of Bidder

The Owner may make such investigation as it deems necessary to determine the ability of the bidder to provide the services requested, and the bidder shall furnish to the Owner all information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid should the evidence submitted by, or investigation of, the bidder fail to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the bid and to complete the requirements contemplated therein.

Governing Law and Venue

This bid, or any contract that may result from the award of this bid, shall be deemed to be made under, and shall be governed by and construed in accordance with, the laws of the State of California. Any action brought to enforce the terms, or provision of this bid or any contract that may result from the award of this bid, shall have venue in the County of Merced, State of California.

Mandatory Bid Protest Procedure

The lack of prompt procedure to resolve disputes regarding the bidding process would impair the Owner's ability to carry out its purpose of contracting this project in a timely manner. Therefore, to the maximum extent authorized by law and notwithstanding any other procedures specified in these Contract Documents, all disputes and/or protests regarding the bidding process shall be subject to the following procedure. In submitting a bid to the Owner for this work, the bidder agrees to comply with and to be bound by this procedure.

Any bid protest must be submitted in writing to the Owner before 5:00 p.m. on the fifth (5^{th}) business day following bid opening.

1. The initial protest document must contain a complete statement of the basis for the protest, and all supporting documentation. A non-refundable fee of One Thousand Dollars ($1,000.00) made payable to the "City of Los Banos" shall accompany the protest documents and will be used by the Owner to recover costs in evaluating the bid protest. A bid protest submitted without the requisite fee shall not be considered by the Owner.
2. The party filing the protest must have actually submitted a bid for the work. A subcontractor of a party submitting a bid for the work may not submit a bid protest. Only bidders who the Owner otherwise determines are responsive and responsible are eligible to protest a bid.
3. A party may not rely on the bid protest submitted by another bidder, but must timely pursue its own protest.
4. The protest must refer to the specific portion of the Contract Documents which forms the basis for the protest.
5. The protest must include the name, address and telephone number of the person representing the protesting party.
6. The party filing the protest must concurrently transmit a copy of the initial protest document and any attached documentation to all other parties with a direct financial interest which may be adversely affected by the outcome of the protest. Such parties shall include all other bidders who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest.
7. The Owner will give the protested bidder five (5) business days after the receipt of the protest to submit a written response. The responding bidder shall transmit the response to the protesting bidder concurrent with the delivery to the Owner.

8. The procedure and time limits set forth in this paragraph are mandatory and are the bidder's sole and exclusive remedy in the event of bid protest. The bidder's failure to comply with these procedures shall constitute a waiver of any right to further pursue the bid protest, including filing a Government Code Claim or legal proceedings.

If the Owner determines that a protest is frivolous, the protesting bidder may be determined to be non-responsive and/or non-responsible and that bidder may be determined to be ineligible for future contract awards.

Cancellation of Contract

The Owner may terminate any contract derived from this bid as follows:

- WITHOUT CAUSE at any time by giving thirty (30) calendar days written notice to the successful bidder;
- WITH CAUSE (Default) at any time by giving ten (10) calendar days written notice to the successful bidder. Cancellation for cause shall be at the discretion of the Owner and shall be, but is not limited to, failure to supply the items, materials, equipment or services specified within the time allowed or within the terms, conditions or provisions of this bid. The successful bidder may not cancel any contract derived from this bid, without prior written consent of the Owner.

Bid Form

TO: City of Los Banos
520 J Street
Los Banos, CA 93635

In compliance with the Advertisement for Bids the undersigned, as bidder, hereby offers to provide to the Owner, in accordance with the terms and conditions in the provisions set forth in the Contract Documents the stated total bid amount quoted on this Bid Form for the work of

ORCHARD TERRACE SEWER LIFT STATION REHABILITATION

Total Bid Amount: $_____

_____
(Total Bid Amount in Written Form)

The undersigned certifies under penalty of perjury under the laws of the State of California and the United States of America, that the above quotation constitutes a bona-fide offer for the work, that undersigned is a duly authorized representative of the company listed, that the quotation is in no way sham or collusive, and that the executed Agreement between the bidder and Owner constitutes acceptance of bidder's total bid for the work stated in the Contract Documents. The undersigned has read the General Provisions, Special Provisions, and Technical Specifications in these Contract Documents. The undersigned further certifies, under penalty of perjury that the Non-Collusion Affidavit required by Title 23 United States Code, Section 112 and Public Contract Code Section 7106; and the Title 49 Code of Federal Regulations, Part 29 Debarment and Suspension Certification are true and correct.

The undersigned acknowledges receipt of the following addenda: _____

_____

Signature: _____ Date: _____

Print Name: _____ Title: _____

Name of Business: _____

Doing business as: (*Circle One*): An Individual A Partnership A Corporation

Business Address: _____

Telephone No.: _____ Fax No.: _____

E-Mail Address: _____

License Number: _____ Class & Expiration Date: _____

List of Subcontractors

As of March 1,2015, Contractors (and sub-contractors) wishing to bid on public works contracts shall be registered with the State Division of Industrial Relations and certified to bid on Public Works contracts. Please register at: https://www.dir.ca.gov/Public-Works/Contractor-Registration.html

In accordance with Title 49, Section 26.11 of the Code of Federal Regulations, and Section 4104 of the Public Contract Code of the State of California, as amended, the following information is required for each sub-contractor who will perform work amounting to more than one half of one percent (0.5%) of the Total Base Bid of $10,000 (whichever is greater). **Photocopy this form for additional firms.**

Project: **Orchard Terrace Sewer Lift Station Rehabilitation**

The following work will be performed (or provided) by the following subcontractors, and coordinated by bidder:

Bid Item No.	Description of Work to be Performed	Percent of Total Contract	Subcontractor's License No.	DIR Registration No.	Subcontractor's Name and Address

Equal Employment Opportunity

Contractor hereby certifies that bidder and subcontractors

- ☐ Have
- ☐ Have Not

participated in a previous contract or subcontract subject to the equal opportunity clauses, as required by Executive Orders 10925, 11114, or 11246, and that, where required, have filed with the Joint Reporting Committee, the Director of the Office of Federal Contract Compliance, a Federal Government contracting or administering agency, or the former President's Committee on Equal Employment Opportunity, all reports due under the applicable filing requirements.

Note: The above certification is part of the bid. Signing this bid on the signature portion thereof shall also constitute signature of these certifications.

Non-Collusion Affidavit

PUBLIC CONTRACT CODE 7106

In conformance with Title 23 United States Code Section 112 and Public Contract Code 7106 the bidder declares that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Debarment and Suspension Certification

TITLE 49, CODE OF FEDERAL REGULATIONS, PART 29

The bidder, under penalty of perjury, certifies that, except as noted below, he/she or any other person associated therewith in the capacity of owner, partner, director, officer, and manager:

- Is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any federal agency;
- Has not been suspended, debarred, voluntarily excluded or determined ineligible by any federal agency within the past 3 years;
- Does not have a proposed debarment pending; and
- Has not been indicted, convicted, or had a civil judgment rendered against it by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past 3 years.

If there are any exceptions to this certification, insert the exceptions to an additional sheet of paper and include with the bid.

Exceptions will not necessarily result in denial of award, but will be considered in determining bidder responsibility. For any exception noted above, indicate on an additional sheet of paper to whom it applies, initiating agency, and dates of action.

NPDES/MS4 Compliance Certification

All construction projects within the City limits must comply with the National Pollutant Discharge Elimination System (NPDES) storm water regulation adopted by the EPA and the Phase II Small Municipal Separate Storm Sewer System (MS4) General Permit requirements, regardless of size.

The City is required under these permits to provide information to Contractors performing work within City limits about training opportunities to assist in managing potential pollutants from construction –related activities, selection, installation, implementation, and maintenance of Best Management Practices (BMPs), as well as overall program compliance. The City has provided such information and helpful links on their website at http://www.losbanos.org/city-government/departments/public-works/, under the Storm Water Management Plan tab.

The Bidder acknowledges that they are aware of the necessity to be in compliance with the NPDES and MS4 permits while working within City limits, and that information regarding such is available on the City's website.

Note: The above certifications are part of the bid. Signing this bid on the signature portion thereof shall also constitute signature of these certifications.

Experience

Bidder shall identify three (3) most recently completed projects similar to work described in these Contract Documents.

	1	2	3
Project Title			
Public Agency			
Address			
Telephone No.			
Engineer in Charge			
Project Value ($)			
Date Accepted			
Claims Filed?*			

* If yes, please explain below:

Bid Schedule
For
Orchard Terrace Sewer Lift Station Rehabilitation

Bidder agrees to perform all the work described in the Contract Documents for the following unit and lump sum prices and understands that the quantity of work shown is approximate only. The schedule shall be completed by the bidder with the unit and lump sum prices entered in numerals. The extensions shall be made by the bidder. In case of discrepancy between the unit prices and the extension thereof, the unit price shall be considered as correct when evaluating bids.

ITEM NO.	BID ITEM	QUANTITY AND UNIT		UNIT PRICE	AMOUNT
1	Mobilization, Shoring, Demobilization, Bonds and Insurance	1	LS	$	$
2	Sanitary Sewer Lift Station	1	LS	$	$
3	4-inch DIP Pipe, Bends and Fittings, F&I	1	LS	$	$
4	4-inch DIP Valves, F&I	1	LS	$	$
5	6-inch DIP Pipe, Bends, and Fittings, F&I	1	LS	$	$
6	6-Inch C900 PVC, F&I	32	LF	$	$
7	8-Inch C900 PVC, F&I	5	LF	$	$
8	Reconstruct Existing Lift Station Bottom, F&I	1	LS	$	$
9	Electrical (Wiring and Appurtenances), F&I	1	LS	$	$
10	Electrical Power & Control Panel	1	LS	$	$
11	Demolition (Removal: (E) Pumps, (E) Controls, and Piping)	1	LS	$	$
12	Wet Well Coating	17	VF	$	$
13	Bypass Pumping Vault and Manhole, F&I	1	LS	$	$
14	Remove Concrete	1,182	SF	$	$
15	Remove Asphalt Pavement	105	SF	$	$
16	Concrete, F&I	1,182	SF	$	$
17	Asphalt, F&I	105	SF	$	$
18	Christy Boxes and Irrigation, F&I	1	LS	$	$
19	Wrought Iron Gates, F&I	1	LS	$	$
			TOTAL:	**$**	

ITEM NO.	ADDITIVE ALTERNATE BID ITEM	QUANTITY AND UNIT		UNIT PRICE	AMOUNT
20	Temporary Dewatering Operation	1	LS	$	$

Note: The representations made herein are made under penalty of perjury. Any information contained in the bid which is proven false shall be considered non-responsive and this bid shall be rejected.

Bid Bond

We, _____

as Contractor, and _____

as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the **City of Los Banos** (herein called "Owner") for payment of the penal sum of _____

_____ Dollars ($_____),

lawful money of the United States. Contractor has submitted the accompanying bid proposal for the construction of: **Orchard Terrace Sewer Lift Station Rehabilitation**

If the Contractor is awarded the contract and enters into a written agreement, in the form prescribed by the Owner, at the price designated by Bid Schedule, and files a payment bond and performance bond with the Owner, or substitute security in lieu thereof, in the time and manner specified by the Owner, and carries all insurance in type and amount which conforms to the General Provisions, Special Provisions, and Technical Specifications in these Contract Documents and furnishes required certificates and endorsements thereof, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Forfeiture of this bond, or any deposit made in lieu thereof, shall not preclude the Owner from seeking all other remedies provided by law to cover losses sustained as a result of the Contractor's failure to do any of the foregoing.

Contractor and Surety agree that if the Owner is required to engage the services of an attorney in connection with the enforcement of this bond, each shall pay Owner's reasonable attorney's fees incurred with or without suit.

Executed on _____, 20____

_____
Contractor

(Seal if Corporation)

By: _____

Title _____

[SIGNATURE SHEET CONTINUES ONTO NEXT PAGE]

Any claims under this bond may be addressed to:

_____ (name and address of Surety)

_____

_____

_____ (name and address of Surety's agent for service of process in California, if different from above)

_____

_____

_____

_____ (phone number of Surety's agent in California)

(Attach Acknowledgment)

_____
Surety

By _____
(Attorney-in-Fact)

Notice: No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in California.

All bond forms must be acknowledged before a Notary Public by both the Contractor and the Surety. Attorneys-in-fact who sign bond forms must file with each bond a certified and effective dated copy of their power of attorney.

Agreement

SAMPLE

Note: Particulars left blank in this sample will be filled with project specific information as outlined in these bid documents.

THIS Agreement is dated as of the _____day of _____in the year 20__ by and between the **City of Los Banos, a California municipal corporation** ("Owner") and [ENTER NAME AND TYPE OF ENTITY] ("Contractor").

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

1. WORK. Contractor shall complete the work indicated in Owner's Contract Documents entitled "**Orchard Terrace Sewer Lift Station Rehabilitation Project**."

The work is generally described as follows:

- Rehabilitation of an existing sanitary sewer lift station located at 311 West I Street; in the City of Los Banos. Improvements will include the removal of existing electrical controls and conduit, lift station pumps and appurtenances. The installation of submersible pumps and appurtenances, onsite piping, force main, electrical service and motor control center, reconfiguration of existing wet well bottom, installation of protective lining to existing wet well, temporary sewer bypass pumping as required and removal and replacement of wrought iron fencing, minor concrete and asphalt above proposed underground improvements.

- Contractor shall furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the work described herein.

2. CONTRACT TIME. Contractor shall commence the work required by the Contract Documents within 10 calendar days after the date of the Notice to Proceed and will complete the same within the time period set forth in the bid, unless the period for completion is extended otherwise by the Contract Documents.

3. LIQUIDATED DAMAGES. Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the work is not completed within the time specified in Paragraph 2 herein, plus any extensions thereof allowed in accordance with Paragraph 21, Time for Completion and Liquidated Damages, of the General Provisions. The parties also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by Owner if the work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner Two Thousand Dollars ($ 2,000.00) for each day that passes after the time specified in Paragraph 2 herein.

4. CONTRACT PRICE. Owner shall pay Contractor for completion of the work in accordance with the Contract Documents in current funds the amount set forth in the Bid Schedule(s). The Contractor agrees to perform all of the work described in the Contract Documents for the unit and lump sum prices set forth in the Bid Schedule(s).

5. PAYMENT PROCEDURES. Contractor shall submit applications for payment in accordance with Paragraph 24, Progress Estimates, of the General Provisions. Applications for payment will be processed by Owner as provided in the General Provisions.

6. CONTRACT DOCUMENTS. The Contract Documents which comprise the entire agreement between Owner and Contractor concerning the work consists of this Agreement and the following attachments to this Agreement:

(A) Advertisement for Bids
(B) Information for Bidders
(C) Bid
(D) Bid Bond
(E) Agreement
(F) Payment Bond
(G) Performance Bond
(H) Notice of Award
(I) Notice to Proceed
(J) Change Order
(K) General Provisions
(L) Special Provisions
(M) Technical Specifications prepared by Provost & Pritchard Consulting Group entitled "**Orchard Terrace Sewer Lift Station Rehabilitation Project**", dated May 2, 2025.
(N) Drawings prepared by Provost & Pritchard Consulting Group numbered 1 through 18.
(O) Addenda No. _____, dated_____20__

There are no Contract Documents other than those listed in this Paragraph 6. The Contract Documents may only be amended by change order as provided in Paragraph 19, Changes in the Work, of the General Provisions.

7. MISCELLANEOUS.

A. Terms used in this Agreement which are defined in Paragraph 1 of the General Provisions will have the meanings indicated in the General Provisions.

B. No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

C. Owner and Contractor each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

D. The Laws of the State of California shall govern this Agreement. Venue is Merced County. The provisions of this paragraph shall survive expiration or other termination of this Agreement regardless of the cause of such termination.

E. All bids become property of the Owner. All bids, including the accepted bid and any subsequent contract become public records per the requirements of the California Government Code, Sections 6250-6270, "California Public Records Act". Proprietary material must be clearly marked as such. Pricing and service elements of the successful bid are not consider proprietary information. The Owner will treat all information submitted in a bid as available for public inspection once the Owner has selected a contractor. If you believe that you have a legally justifiable basis under the California Public Records Act (Government Section 6250 et. seq.) for protecting the confidentiality of any information contained within your bid, you must identify any such information, together with the legal basis of your claim in your bid. In order for the Owner to assess confidentiality of any such information on your behalf, you must request, execute and submit an Owner-prepared written agreement to defend and indemnify the Owner for any liability, costs, and expenses incurred in asserting such confidentiality as part of your bid. The final determination as to whether the Owner will assert your claim of confidentiality on your behalf shall be sole discretion of the Owner.

F. This Agreement shall not be interpreted in favor of any Party by virtue of said Party not having prepared this Agreement.

G. If any time period provided for in this Agreement ends on the day other than a Business Day, the time period shall be extended to the next Business Day.

IN WITNESS WHEREOF, Owner and Contractor have caused this Agreement to be executed the day and year first above written.

_____ By: _____
Date Authorized Representative of (City) Owner

Title: _____

ATTEST:

_____
Lucille L. Mallonee
City Clerk

APPROVED AS TO FORM:

_____
William A. Vaughn
City Attorney

_____ By: _____
Date Authorized Representative of Contractor

Title: _____

(Seal if Corporation)

(Attach Acknowledgement for Authorized Representative of Contractor)

Certificate of Contractor

I, _____
(Name)

certify that I am a/the _____
(Title)

designate sole proprietor, partner in partnership, or corporate officer with Contractor License Number _____ in the entity named as Contractor in the foregoing Agreement. I hereby expressly certify that the name of the entity to which I am associated is

_____
(Company Name)

that this entity is in good standing and has complied with all applicable laws and regulations, and that I have been expressly authorized by the proper parties in this entity to execute the Agreement on behalf of the above-named entity.

ATTEST:

Signature:_____

This form must be acknowledged before a Notary Public. The acknowledgement must be attached.

Payment Bond

We, _____

as Contractor, and _____

as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the **City of Los Banos** (herein called "Owner") for payment of the penal sum of _____

_____Dollars ($ _____),

lawful money of the United States. Owner has awarded the contract and entered into an Agreement with the Contractor for the construction of:

Orchard Terrace Sewer Lift Station Rehabilitation Project

If Contractor or any of his subcontractors fails to pay any of the persons named in Section 9100 of the California Civil Code, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract or during the one-year guarantee period, or for any amounts required to be deducted, withheld, and paid over to the Franchise Tax Board from the wages of employees of the Contractor and his subcontractors pursuant to Section 13020 of the Unemployment Insurance Code, with respect to such work and labor, then Surety will pay the same in an amount not exceeding the sum specified above, and also will pay, in case suit is brought upon this bond, such reasonable attorney's fees as shall be fixed by the court.

This bond shall insure to the benefit of any of the persons named in Section 9100 of the California Civil Code, so as to give a right of action to them or their assigns in any suit brought upon this bond.

Surety agrees that no change, extension of time, alteration, or addition to the terms of the Contract, or the work to be performed, or the Provisions shall in any way affect its obligation on this bond, and it does hereby waive notice thereof.

Contractor and Surety agree that should Owner become a party to any action on this bond that each will also pay Owner's reasonable attorney's fees incurred therein in addition to the above sum.

[SIGNATURE SHEET BEGINS ON NEXT PAGE]

Executed in four original counterparts on: _____, 20_____

_____
Contractor

(Seal if Corporation) By: _____

Title: _____

(Attach Acknowledgment of Authorized Representative of Contractor)

Any claims under this bond may be addressed to:

_____ (name and address of Surety)

_____

_____

_____ (name and address of Surety's agent for service of process in California, if different from above)

_____

_____

_____

_____ (phone number of Surety's agent in California)

(Attach Acknowledgment)

_____
Surety

By _____
(Attorney-in-Fact)

Notice: No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in California.

All bond forms must be acknowledged before a Notary Public by both the Contractor and the Surety. Attorneys-in-fact who sign bond forms must file with each bond a certified and effective dated copy of their power of attorney.

Performance Bond

We, _____

as Contractor, and _____

as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the **City of Los Banos** (herein called "Owner") for payment of the penal sum of _____

_____Dollars ($ _____),

lawful money of the United States. Owner has awarded the contract and entered into an Agreement with the Contractor for the construction of:

Orchard Terrace Sewer Lift Station Rehabilitation Project

The condition of this obligation is such that if the Contractor shall in all things abide by and well and truly keep and perform the covenants, and agreements in the said Contract Agreement, and any alteration thereof made as therein provided, on his part to be kept and performed at the time and in the manner therein specified, and shall faithfully fulfill the one-year guarantee of all materials and workmanship, and shall indemnify and save harmless the Owner and the Owner's Representative, and their consultants, and each of their directors, officers, employees and agents, as therein stipulated, this obligation shall become null and void, otherwise, it shall be and remain in full force and effect.

This Performance Bond shall remain in full effect during the one-year guaranty period following the completion of the work.

Surety agrees that no change, extension of time, alteration, or addition to the terms of the General Provisions, Special Provisions, and Technical Specifications in these Contract Documents shall in anyway affect its obligation in the bond, and it does hereby waive notice thereof.

Contractor and Surety agree that if the Owner is required to engage the services of an attorney in connection with the enforcement of this bond, each shall pay Owner's reasonable attorney's fees incurred with or without suit, in addition to the above sum.

[SIGNATURE SHEET BEGINS ON NEXT PAGE]

Executed in four original counterparts on : _____, 20_____

_____
Contractor

(Seal if Corporation) By: _____

Title: _____

(Attach Acknowledgment of Authorized Representative of Contractor)

Any claims under this bond may be addressed to:

_____ (name and address of Surety)

_____

_____

_____ (name and address of Surety's agent for service of process in California, if different from above)

_____

_____

_____

_____ (phone number of Surety's agent in California)

(Attach Acknowledgment)

_____
Surety

By _____
(Attorney-in-Fact)

Notice: No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in California.

All bond forms must be acknowledged before a Notary Public by both the Contractor and the Surety. Attorneys-in-fact who sign bond forms must file with each bond a certified and effective dated copy of their power of attorney.

Notice of Award

To: _____ Date: _____

_____ Project: _____

_____ _____

The Owner has considered the bid submitted by you for the above-described work dated_____, 20_____.

You are hereby notified that your bid has been accepted for the unit and lump sum prices set forth in the Bid Schedule totaling $_____.

You are required by the Information for Bidders to execute the Agreement and furnish the required Contractor's performance bond and payment bond within ten (10) calendar days for the date of this Notice to you.

Before the Notice to Proceed can be issued, all required certificates of insurance, as stated in Section 29 of the General Provisions, and a copy of your Los Banos Business License must be submitted.

If you fail to execute said Agreement and to furnish said bonds within ten days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your bid as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner.

_____
Owner

By _____

Title _____

ACCEPTANCE OF NOTICE

Receipt of the above Notice of Award is hereby acknowledged by

_____
(Name of Contractor)

this _____ day of _____ ,20_____

By _____

Title _____

Notice to Proceed

To: _____ Date: _____

_____ Project: _____

_____ _____

You are hereby notified to commence work in accordance with the Agreement dated _____, 20_____, on or before _____20_____, and you are to complete the work by _____, 20_____.

You are required to return an acknowledged copy of this Notice to Proceed to the Owner.

_____
Owner

By _____

Title _____

ACCEPTANCE OF NOTICE
Receipt of the above Notice to Proceed is hereby acknowledged by
_____
(Name of Contractor)

this _____ day of _____ ,20_____

By _____

Title _____

Change Order

Order No._____

Date: _____

Agreement Date:_____

Project: _____

Owner: _____

Contractor: _____

The following changes are hereby made to the Contract Documents:

Justification:

Change to Contract Price:

Original Contract Price:	$ _____
Current Contract Price adjusted by previous Change Order:	$ _____
The Contract Price due to this Change Order will be (increased) (decreased) by:	$ _____
The new Contract Price including this Change Order will be:	$ _____

Change to Contract Time:

The Contract Time will be (increased) (decreased) by calendar days.	_____
The date for completion of all work will be:	_____

The undersigned hereby agrees to the above-described amendment of the Agreement.

_____

Contractor

_____

Owner

This Change Order shall become a part of the Contract Documents only upon signature of both parties.

General Provisions

1. Terms and Definitions

Wherever used in the Contract Documents, the following terms shall have the meanings indicated, which shall be applicable to both the singular and plural thereof:

Addenda – Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, by additions, deletions, clarifications or corrections.

ANSI – American National Standards Institute, current designation as of the Bid date unless otherwise indicated.

ASME – American Society of Mechanical Engineers, current designation as of the Bid date unless otherwise indicated.

ASTM – American Society for Testing Materials, current designation as of the Bid date unless otherwise indicated.

AWWA – American Water Works Association, current designation as of the Bid date unless otherwise indicated.

Bid – The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.

Bidder – Any person, firm or corporation submitting a bid for the work.

Bonds – Bid, Performance and Payment Bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

Change Order – A written order to the Contractor authorizing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the contract price or contract time.

Completion – That date as certified by the Engineer when the construction of the project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the project or specified part can be utilized for the purposes for which it is intended.

Contract Documents – The contract, including Advertisement for Bids, Information for Bidders, Bid, including Bid Representations and Certifications, Bid Bond, Agreement, Payment Bond, Performance Bond, Notice of Award, Notice to Proceed, Change Order, General Provisions, Special Provisions, Technical Specifications, Drawings, and Addenda.

Contract Price – The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

Contract Time – The number of calendar or working days as stated in the Contract Documents for the completion of the work.

Contractor – The person, firm or corporation with whom the Owner has executed the Agreement.

Drawings – The part of the Contract Documents which shows the characteristics and scope of the work to be performed and which have been prepared or approved by the Engineer.

Engineer – City Engineer of the City of Los Banos, acting either directly or through properly authorized agents, such agents, acting within the scope of the particular duties entrusted to them.

Field Order – A written order effecting a change in the work not involving an adjustment in the contract price or an extension of the contract time, issued by the Engineer to the Contractor during construction.

IEEE – Institute of Electrical and Electronics Engineers, current designation as of the bid date unless otherwise indicated.

NEMA – National Electrical Manufacturers Association, current designation as of the bid date unless otherwise indicated.

Notice of Award – The written notice of the acceptance of the Bid from the Owner to the successful bidder.

Notice to Proceed – Written communication issued by the Owner to the Contractor authorizing him to proceed with the work and establishing the date of commencement of the work.

Owner – City of Los Banos.

Production Data – All illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the work.

Project – The undertaking to be performed as provided in the Contract Documents.

REA – Rural Electrification Association, current designation as of the bid date unless otherwise indicated.

Samples – Physical examples which illustrate materials, equipment or workmanship, and establish standards by which the work will be judged.

Shop Drawings – All drawings, diagrams, schedules and other data which are specifically prepared for the work by the Contractor, a subcontractor, manufacturer, supplier or distributor, to illustrate some portion of the work.

Specifications – A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

Standards – City of Los Banos Standard Specifications, The Standard Specifications of the Department of Transportation of the State of California (Caltrans) dated 2010 and subsequent updates to that 2010 edition, and The Standard Plans of the Department of Transportation of the State of California (Caltrans) dated 2010 and subsequent updates to this 2010 edition.

Subcontractor – An individual, firm or corporation having a direct contract with the Contractor or with any other subcontractor for the performance of a part of the work at the site.

Supplier – Any person or organization who supplies materials or equipment for the work, including that fabricated to a special design, but who does not perform labor at the site.

Work – All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the project.

Written Notice – Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the work.

2. Order of Precedence of Contract Documents

In resolving conflicts resulting from errors or discrepancies in any of the Contract Documents, the order of precedence shall be as follows:

1. Permits from other agencies as may be required by law
2. Change orders
3. Agreement
4. Addenda
5. Contractor's Bid (Bid Form)
6. Advertisement for Bids
7. Information for Bidders
8. Supplementary General Conditions
9. General Provisions
10. Special Provisions
11. Technical Specifications
12. Drawings
13. Referenced Standard Specifications

If the conflicts cannot be resolved by the precedence prescribed above, the most stringent requirements shall prevail.

3. Venue

Contractor, and any subcontractor, supplier and any other person or organization performing any part of work, agree that each of them will waive jurisdiction and venue and shall submit to the jurisdiction of the courts of the State of California in the County of Merced, regardless of residence or domicile, with respect to any actions or suits at law or in equity arising under or related to the bidding, award or performance of the work or with regard to any matter whatsoever arising out of or relating to the validity, construction, interpretation or reinforcement of the Agreement as against Owner or any of their consultants, and/or any of their respective directors, officers, employees, representatives or agents.

4. Giving Notice

Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

5. Cumulative Remedies

The duties and obligations imposed by these General Provisions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon Contractor by the General Provisions and all of the rights and remedies available to Owner thereunder are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

6. Non-discrimination

During the performance of the project, Contractor and subcontractors shall not unlawfully discriminate

against any employee or applicant for employment because of race, color, ancestry, religion, sex, national origin, marital status, age, medical condition (cancer related), physical handicap (including AIDS), or sexual orientation. Equal employment extends, but is not limited to recruitment, compensation, benefits, layoff, termination, and all other conditions of employment. Contractor and subcontractors shall ensure that the evaluation/treatment of their employees and applicants for employment are free of such discrimination. Contractor and subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Government Code, Section 12900 et seq.) and the applicable regulations promulgated there under (California Administrative Code, Title 2, Section 7285.0 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code, Section 12900, set forth in Chapter 5 of Division 4 of Title 2 of the California Administrative Code and incorporated into this agreement by reference and made a part hereof as if set forth in full.

Contractor and any subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.

Contractor shall include the nondiscrimination and compliance provisions of the clause in all subcontracts to perform work under the contract.

Contractor shall grant access by representative of the Department of Fair Employment and Housing and the Owner upon reasonable notice at any time during normal business hours, but in no case less than twenty-four (24) hours notice, to such of its books, records, accounts, other sources of information and its facilities as said Owner shall require to ascertain compliance with this clause.

7. Non-discrimination of the Disabled

The Owner will not aid or perpetuate discrimination against a qualified disabled individual by funding as an agency, organization, or person that discriminates on the basis of handicap in providing aid, benefit, or service to beneficiaries of the program or activity. The Owner is committed to provide access to all Owner services, programs, and meetings open to the public for people with disabilities. In this regard the Owner and all of its vendors and Contractor will take all reasonable steps to ensure that disabled individuals have the maximum opportunity for the same level of aid, benefit, or service as any other individual.

8. Additional Instructions and Detail Drawings

The Contractor may be furnished additional instructions and detail drawings by the Engineer, as necessary to carry out the work required by the Contract Documents. The additional drawings and instructions thus supplied will become a part of the Contract Documents. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions.

9. Schedules, Reports and Records

The Contractor shall submit to the Owner such schedules, reports, records and other data as the Owner may request concerning work performed or to be performed.

Prior to the first partial payment estimate, the Contractor shall submit schedules showing the order in which he proposed to carry on the work, including dates at which he will start the various parts of the work, estimated date of completion of each part and, as applicable:

A. A detailed cost breakdown of the work under each bid item awarded. The breakdown, after receiving favorable review by the Engineer, will become the basis for partial payment determination. Elements of work shall be grouped by building, structure, pipeline, system, etc. Within each grouping, work shall be itemized by readily measurable quantities of work completed in place. For example, concrete should be in units of cubic yard including form work and reinforcing steel. Mobilization costs, bond and insurance costs, and overhead costs shall not be prorated over items of work. In the event the cost breakdown is not favorably reviewed by the Engineer, another cost breakdown shall be submitted that is mutually acceptable to the Contractor and the Engineer.

B. The dates at which special detail drawings will be required; and respective dates for submission of shop drawings, the beginning of manufacture, the testing and the

installation of materials, supplies and equipment. The Contractor shall also submit a schedule of payments that he anticipates he will earn during the course of the work.

10. Drawings and Specifications

The intent of the drawings and specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary to complete the project in an acceptable manner, ready for use, occupancy or operation by the Owner.

In case of conflict between the drawings and specifications, the specifications shall govern. Figure dimensions on drawings shall govern over scale dimensions and detailed drawings shall govern over general drawings.

Any discrepancies found between the drawings and specifications and site condition or any inconsistencies or ambiguities in the drawings or specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

The Owner will furnish to the Contractor, free of charge, six copies of drawings and specifications for the work. The Contractor shall keep one copy of all current drawings and specifications on the job site, in good order, available to the Engineer and his representatives.

All drawings, specifications, and copies thereof furnished by the Owner are the property of the Owner. They are not to be used on other work, and, with the exception of the signed contract set, are to be returned to the Owner on request, at the completion of the work.

11. Shop Drawings, Production Data and Samples

The Contractor shall review, approve and submit to the Engineer all Shop Drawings, Production Data and Samples as may be necessary for prosecution of the Work and as required by the Contract Documents. The Contractor shall review and approve all Shop Drawings, Production Data and Samples prior to submitting them to the Engineer. By approving and submitting Shop Drawings, Production Data and Samples, the Contractor represents that he has determined and verified all materials, measurements and criteria related thereto, and that he has checked and coordinated the information contained within such submittals with the requirements of the Contract Documents. Any Shop Drawing, Production Data or Sample submitted to the Engineer without having been approved by the Contractor will be returned unreviewed to the Contractor.

For each item where shop drawings, production data or samples are required, the Contractor shall submit a minimum of six approved sets, hard copies, or one set, electronically. The Engineer shall review all shop drawings, production data and samples and retain three sets after his review. The remaining sets shall be returned to the Contractor with actions defined as follows:

A. NO EXCEPTIONS TAKEN – Accepted subject to its compatibility with future submissions and additional partial submissions for portions of the work not covered in this submission.

B. MAKE CORRECTIONS NOTED – Same as NO EXCEPTIONS TAKEN except that minor corrections as noted shall be made by the Contractor.

C. REVISE AND RESUBMIT – Rejected because of major inconsistencies or errors which shall be resolved by the Contractor prior to subsequent review by the Engineer.

D. REJECTED – Submitted material does not conform to Contract Documents in major respect.

The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. It shall not include review of quantities, dimensions, weights or gauges, fabrications processes, construction methods, coordination with other trades, or construction safety precautions, all of which are the responsibility of the Contractor.

The Engineer shall not be responsible for any deviations from the Contract Documents not brought to the

attention of the Engineer in writing by the Contractor and acknowledged in writing by the Engineer.

Portions of the work requiring shop drawings, production data and samples shall not begin until the submission has been favorably reviewed by the Engineer. A copy of each favorably reviewed shop drawing, product data and sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

12. Materials, Services and Facilities

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, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

Materials and equipment shall be so stored as to insure the preservation of their 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.

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

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

Materials, supplies or equipment to be incorporated into the work shall not be purchased by the Contractor or any subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

13. Inspection and Testing

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Contract Documents.

The Contractor shall provide, at his expense, the necessary testing and inspection services required by the Contract Documents, unless otherwise provided. (See Section 6 of the Special Provisions)

The Owner shall provide all other inspections and testing services not required by the Contract Documents. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction specifically require any work to be inspected, tested, approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

Neither observations by the Engineer nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

The Engineer and his representatives will at all times have access to the Work. In addition, authorized representatives and agents of the Owner and appropriate Federal or State agencies shall be permitted to inspect all work, material, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof.

If any work is covered contrary to the written request of the Engineer, it must, if requested by the Engineer be uncovered of his observation and replaced at the Contractor’s expense.

If any work has been covered which the Engineer has not specifically requested to observe prior to it being covered, or if the Engineer considers it necessary or advisable that covered work be inspected or tested by others, the Contractor, at the Engineer’s request, will uncover expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such work is not found to be defective, the Contractor will be allowed an increase in the contract price of an extension

of the contract time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate change order shall be issued.

14. Substitutions

Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance of other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the contract price or contract time.

15. Patents

The Contractor shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof, except that the Owner shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

16. Surveys, Permits and Regulations

The Engineer will furnish lines and grades as required for the construction of the work. The Contractor shall make a general check of all lines, dimensions and elevations and shall make all necessary rechecks during the progress of the work to avoid errors in construction. The Contractor shall be responsible for proper dimensions and fittings of all items of work being performed by him. Should any discrepancy be found in lines, dimensions or elevations, they shall be reported to the Engineer immediately.

The Contractor shall protect all existing property and survey monuments, including survey control monuments for this work. The Contractor is responsible for protecting and preserving survey monuments and other survey markers. Any survey monuments damaged as a direct or indirect result of construction activities shall be re-established by a duly licensed land surveyor at the Contractor’s sole expense. A corner record shall be filed in accordance with State law for any reset monuments at the Contractor’s sole expense.

The Contractor shall carefully preserve benchmarks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

Permits and licenses of a temporary nature necessary for the prosecution of the work shall be secured and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Paragraph 19 of these General Provisions, Changes in the Work.

17. Protection of Work, Property and Persons

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He will take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to all employees on the work and other persons who may be affected thereby, all the work and all materials or equipment to be

incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection. He shall notify owners of adjacent utilities when prosecution of the work may affect them. The Contractor shall remedy all damages, injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of the Owner or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.

In emergencies affecting the safety of persons or the work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He will give the Engineer prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby, and a change order shall thereupon be issued covering the changes and deviations involved.

18. Supervision by Contractor

The Contractor shall supervise and direct the work. He shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall employ and maintain on the work, a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the work.

19. Changes in the Work

The Owner may at any time, as the need arises, order changes within the scope of the work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the work, an equitable adjustment shall be authorized by written change order.

The Engineer may also, at any time, by issuing a field order, make changes in the details of the work. The Contractor shall proceed with the performance of any changes in the work so ordered by the Engineer unless the Contractor believes that such field order entitles him to a change in contract price or contract time, or both, in which event he shall give the Engineer written notice thereof within seven (7) days after the receipt of the ordered change, and the Contractor shall not execute such changes pending the receipt of an executed change order or further instruction from the Owner.

20. Changes in Contract Price

The contract price may be changed only by a written change order. The value of any work covered by a change order or of any claim for increase or decrease in the contract price shall be determined by one or more of the following methods in the order of precedence listed below:

A. Unit prices previously approved.

B. An agreed lump sum.

C. If a lump sum or unit price cannot be mutually agreed upon, the Contractor shall be entitled to the sum of the following costs of doing the extra work:

1. Direct Labor Costs. Charges for cost of all the labor furnished and used by the Contractor shall be made for manual classifications up to and including general foreman. It will not include charges for assistant superintendents, superintendents, office personnel, timekeepers, and maintenance and mechanics. The time charged to extra work shall be

subject to the daily approval of the Engineer and evidence of such daily approval shall be submitted with the billing. Labor rates used to calculate the costs shall be those so designated in the Advertisement for Bids. No time or charges will be allowed, except when the men are actually engaged in the proper, efficient, and diligent performance or completion of the extra work as authorized. Overtime shall not be worked without prior approval by the Engineer.

2. Equipment Costs. Charges for the rental and operation of the equipment furnished and used by the Contractor shall be made for all prime construction and automotive equipment. It will not include charges for equipment or tools with a new cost of $1,000.00 or less. Equipment time charges must be subject to the daily approval submitted with the billing. The equipment rental and operation rates used shall be those agreed upon by the Engineer and the Contractor prior to commencement of the extra work. No time or charges will be allowed except when equipment is actually being used for the proper and efficient performance or completion of the extra work as authorized.

3. Material Costs. Charges for the cost of materials furnished by the Contractor shall be made providing such furnishing was specifically authorized in the extra work order and the actual use verified by the Engineer. Charges must be net cost to the Contractor delivered at the job, and vendor's invoice must accompany the billing along with verification of use of such materials by the Engineer.

4. Tools, Supplies, Overhead, Supervision and Profit. A charge for tools, supplies, overhead, supervision and profit will be allowed in the amount of 15% of the Total Direct Labor Costs, and Material Costs, as defined above.

Any extra work performed hereunder shall be subject to all of the provisions of the contract and the Contractor's sureties shall be bound with reference thereto as under the Contract.

21. Time for Completion and Liquidated Damages

The date of beginning and the time for completion of the work are essential conditions of the Contract Documents and the work embraced shall be commenced on a date specified in the Notice to Proceed.

Time is of the essence in this Agreement. The Contractor shall proceed with the work at such a rate of progress to ensure full completion within the contract time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the contract time for the completion of the work described herein is a reasonable time.

The parties hereto agree that it is extremely difficult and impractical in this case to determine the actual damages the Owner will suffer if the Contractor fails to complete the work within the contract time and for said reason, if the Contractor shall fail to complete the work within the contract time, or extension of time granted by the Owner, then the Contractor will pay to the Owner the amount for liquidated damages as specified in the Agreement for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents. The time for completion of the work shall be extended, and the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to the following, and the Contractor has promptly given written notice of such delay to the Engineer:

A. To any preference, priority or allocation order duly issued by the Owner.

B. To unforeseeable caused beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics quarantine restrictions, strikes, freight embargoes, and climatic conditions which, in the opinion of the Engineer, make prosecution of the work unreasonably difficult.

C. To any delays of subcontractors occasioned by any of the causes specified in the above paragraphs.

22. Correction of Work

The Contractor shall promptly remove from the premises all work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

23. Suspension of Work, Termination and Delay

The Owner may, at any time and without cause, suspend the work or any portion thereof for a period of not more than ninety days, or such further time as agreed upon by the Contractor, by written notice to the Contractor and the Engineer, which notice shall fix the date on which work shall be resumed. The Contractor will resume that work on the date so fixed. The Contractor will be allowed an increase in the contract price or an extension of the contract time, or both, directly attributable to any such suspension.

If the Contractor is adjudged as bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver if appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he fails to make prompt payments to subcontractors or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction over the work or if he disregards the authority of the Engineer, or if he otherwise violates any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy and after giving the Contractor and his surety a minimum of ten (10) days from delivery of a written notice, terminate the services of the Contractor, and finish the work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance, the Contractor shall pay the difference to the Owner. Such costs incurred by the Owner will be determined by the Engineer and incorporated in a change order.

Where the Contractor's services have been so terminated by the Owner, said termination shall not affect any right of the Owner against the Contractors then existing or which may thereafter accrue. Any retention or payment of monies by the Owner due the Contractor will not release the Contractor from compliance with the Contract Documents.

After ten (10) days from delivery of a written notice to the Contractor and the Engineer, the Owner may without cause and without prejudice to any other right or remedy, elect to abandon the project and terminate the contract. In such case, the Contractor shall be paid for all work executed and any expense sustained plus reasonable profit.

If, through on act or fault of the Contractor, the work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after the (10) days from delivery of a written notice to the Owner and the Engineer stop the work until he has been paid all amounts then due, in which event and upon resumption of the work, change orders shall be issued for adjusting the contract price or extending the contract time or both to compensate for the costs and delays attributable to the stoppage of the work.

24. Progress Estimates

On or about the last day of the calendar month, the Contractor will, except as hereinafter provided, make in writing and certify to the Owner an estimate which, in his opinion, is just and fair of the amount and value of the work completed by the Contractor up to that time in the performance of the contract. In case of work for which unit prices are named in the contract, the estimate shall be computed on the basis of said unit prices. In the case of work for which a lump sum is named in the contract, the Engineer may use a breakdown of the lump sum price submitted by the Contractor, provided that such breakdown is submitted within 10 calendar days after the execution of the Agreement in a form acceptable to the

Engineer. No payment will be made to the Contractor until such schedule has been submitted to and reviewed by the Engineer. To the figure thus arrived at shall be added any amounts due the Contractor for extra work and the amount of any approved claims for extra costs to the date of the progress estimate the retained percentage hereinafter provided for shall be deducted from the total thus computed; and from the remainder, there shall be further deducted any amounts due the Owner from the Contractor for supplies or materials furnished or services rendered and any other amounts that may be due the Owner under the terms of the contract. In preparing estimates for partial payment, consideration shall be given to delivery on the site of pipe, and fittings which will become a part of the finished construction work and for which payment in full has been made by the Contractor, but no consideration will be given to preparatory work done or other materials on hand. From the balance thus determined shall be deducted the amount of all previous payments and the remainder shall constitute the partial estimate for that month. Such partial estimates shall not be required to be made by strict measurement, but may be made by measurement or by estimation or partly by one method and partly by the other and it shall be sufficient if they are approximate only. Partial estimates may be withheld or reduced if, in the opinion of the Engineer, the Contractor is not diligently and efficiently endeavoring to comply with the intent of the Agreement.

25. Progress Payments

The Owner will make payments on account of the contract as follows: Not later than the 30th day of the month following the month in which the contract is awarded, and the 30th day of each calendar month thereafter, the Owner will pay to the Contractor 95% of the amount earned by the Contractor during the preceding month at the rate of prices set forth in the contract, based on the estimate of the Engineer.

The retention will be held by the Owner until 35 days following filing of the Notice of Completion.

26. Prompt Payment

The Contractor shall promptly pay all subcontractors and suppliers within ten (10) days of receipt of any progress payment, final payment or retention paid by the Owner to the Contractor. Contractor shall advise all subcontractors and suppliers that all second-tier subcontractors and suppliers must be paid within then (10) days of their receipt of payment from the Contractor.

27. Acceptance and Final Payment

Upon receipt of written notice from the Contractor that the work is ready for final inspection and acceptance, the Engineer will promptly make such inspection, and when he finds the work acceptable under the contract, and the contract fully performed, he will promptly issue a final certificate, over his own signature, stating that the work required by this contract has been completed. The Owner then shall issue a formal Notice of Completion, and the entire balance found to be due shall be paid to the Contractor by the Owner 35 days from the date of recording by the Owner of the Notice of Completion of all work covered by this contract.

Before issuance of the Notice of Completion, the Contractor shall submit evidence satisfactory to the Owner that all payrolls, material bills, and other indebtedness connected with the work have been paid, or if not paid, then the Contractor shall submit evidence of the status of any unpaid indebtedness.

The making and acceptance of the final payment shall constitute a waiver of all claims by the Owner except the following:

A. those arising from unsettled liens;

B. those arising from faulty work appearing within 12 months after the date of filing of the Notice of Completion;

C. those arising from failure to meet the requirements of the Contract Documents or the specifications; or,

D. those arising from manufacturers' guarantees.

The acceptance by Contractor of the final payment referred to in this paragraph 27 herein, shall be a

release of Owner from all claims of liability to Contractor for anything done or furnished for, or relating to, the work or for any act or neglect of Owner or of any person relating to or affecting the work, except demands against Owner for the remainder, if any, of the amounts kept or retained under the provisions of Paragraph 25, Progress Payments, herein; and excepting pending, unresolved claims.

28. Quantities and Unit Prices

The quantities noted in the schedule are approximation for comparing bids, and no claim shall be made against the Owner for excess or deficiency therein. Payment at the unit prices set forth in the schedule will constitute payment in full for the completed work and will include materials, supplies, labor, tools, machinery, and all other expenditures incident to satisfactory compliance with the contract, unless otherwise specifically provided.

The quantities of work performed will be computed for payment by the Engineer on the basis of measurements taken by the Engineer, and these measurements shall be final and binding.

29. Insurance

The Contractor shall not commence work under this Agreement until he has obtained all the insurance required under this section and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until the insurance required of the subcontractor has been so obtained and approved. All insurance required under this section shall be maintained at the expense of the Contractor continuously during the life of the contract up to the date of acceptance of the work by the Owner.

Commercial General Liability and Automobile Liability Insurance – The Contractor shall provide and maintain the following commercial general liability and automobile liability insurance:

A. Coverage – Coverage for commercial general liability and automobile liability insurance shall be at least as broad as the following:

   1. Insurance Services Office Commercial General Liability coverage (Occurrence Form CG 0001)

   2. Insurance Service Office Form Number CA 0001 (ed. 1/87) covering Automobile Liability, Code 1 (any auto)

B. Limits – The Contractor shall maintain limits no less than the following:

   1. General Liability – Two million dollars ($2,000,000) per occurrence for bodily injury, personal injury and property damage. If Commercial General Liability Insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to the project/location (with the ISO CG 2501 or insurer's equivalent endorsement provided to the Owner) or the general aggregate limit shall be twice the required occurrence limit.

   2. Automobile Liability – One million dollars ($1,000,000) per accident for bodily injury and property damage combine single limit.

C. Required provisions – The general liability and automobile liability policies are to contain, to be endorsed to contain the following provisions:

   1. The Owner and its directors, officers, employees, agents and volunteers are to be covered as insured as respects: liability arising out of activities performed by or on behalf of the Contractor, products and completed operations of the Contractor, premises owned, occupied or used by the Contractor, or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Owner and its directors, officers, employees, agents, and volunteers.

2. For any claims related to this work, the Contractor's insurance shall be the primary insurance as respects the Owner and its directors, officers, employees, agents and volunteers. Any insurance, pooled coverage or self-insurance maintained by the Owner and its directors, officers, employees, agents and volunteers shall not contribute to it.

3. Any failure to comply with reporting or other provisions of the policies including breaches of warranties shall not affect coverage provided to the Owner and their directors, officers, employees, agents and volunteers.

4. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

5. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the Owner.

D. Deductibles and Self-Insured Retentions – Any deductible or self-insured retention must be declared to and approved by the Owner. At the option of the Owner, either the insurer shall reduce or eliminate such deductibles or self-insured retentions.

E. Acceptability of Insurers – Insurance is to be placed with insurers having a current A.M. Best's rating of no less than A-: VII or equivalent.

Workers' Compensation and Employer's Liability Insurance – The Contractor and all subcontractors shall cover or insure under the applicable laws relating to workers' compensation insurance, all of their employees working on or about the construction site, regardless of whether such coverage or insurance is mandatory or merely elective under law, and the Contractor shall defend, protect and save harmless the Owner and its directors, officers, employees, agents and volunteers from and against all claims, suits, and actions arising from any failure of the Contractor or any subcontractor to maintain such insurance. Before beginning work, Contractor shall furnish to the Owner satisfactory proof that Contractor has taken out for the period covered by the work under this Contract, full compensation insurance for all persons employed directly by Contractor or through subcontractors in carrying out the work contemplated under this Contract, all in accordance with the "Workers' Compensation and Insurance Act," Division IV of the Labor Code of the State of California and any Acts amendatory thereof.

The Contractor shall provide employer's liability insurance in the amount of, at least, $1,000,000 per accident for bodily injury and disease.

The Contractor shall provide the Owner with a certificate of Workers' Compensation and Employers liability insurance coverage.

In signing the Agreement, Contractor makes the following certification required by Section 1861 of the Labor Code:

"I am aware of the provisions of Section 3700 of the Labor Code which requires each employer to be insured against liability for workmen's compensation or to undertake self insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract."

Evidences and Cancellation of Insurance – Prior to execution of the Agreement, the Contractor shall file with the Owner evidence of insurance from an insurer or insurers certifying to the coverage of all insurance required herein. Such evidence shall include original copies of the ISO CG 2010 (or insurer's equivalent) signed by the insurer's representative and certificate of insurance (Accord Form 25-S or equivalent). All evidence of shall be certified by a properly authorized officer, agent or qualified

representative of the insurer and shall certify the names of the insured, any additional primary insurers, where appropriate, the type and amount of the insurance, the location and operations to which the insurance applies, the expiration date, and that the insurer will give by certified mail, written notice to the Owner at least thirty (30) days prior to the effective date of any cancellation, lapse or material change in the policy.

The Contractor shall, upon demand of the Owner, deliver to the Owner all such policy or policies of insurance and the receipts for payment of premiums thereon; and should the Contractor neglect to obtain and maintain in force any such insurance or deliver such policy or policies and receipts to the Owner, then it shall be lawful for the Owner to obtain and maintain such insurance, and the Contractor hereby appoints the Owner the true and lawful attorney-in-fact to do all things necessary for this purpose. All money paid by the Owner for insurance premiums under the provisions of this article shall be charged to the Contractor.

30. Contract Security

The Contractor shall, within ten (10) days after the receipt of the Notice of Award, furnish the Owner with a performance bond and a payment bond in penal sums equal to 100% of the contract price, conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the work provided by the Contract Documents. Such bonds shall be executed by the Contractor and corporate bonding company licensed to transact such business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these bonds shall be borne by the Contractor. If at any time a surety on any such bond is declared a bankrupt or loses its right to do business in the state in which the work is to be performed or is removed from the list of surety companies accepted on Federal bonds, Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond (s) shall be paid by Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable bond to the Owner.

Attached to the bonds shall be the original, or a certified copy, of the unrevoked appointment, power of attorney, bylaws or other instrument which entitles and authorizes the person to execute the bond to do so, a certified copy of the certificate of authority or the insurer issued by the Insurance Commissioner of the county in which the Owner is located which would state that the certificate of authority of the insurer (the bonding company) has not been surrendered, revoked, cancelled, annulled, or suspended.

The performance bond shall remain in full force and effect during the warranty period of 12 months from the date of acceptance of the work by the Owner.

If requested by the Owner or Engineer, copies of the insurer's most recent annual statement and quarterly statement filed with the Department of Insurance pursuant to Article 10 (commencing with Section 900) of Chapter 1 of Part 2 of Division 1 of the Insurance Code, shall be provided to the Owner or Engineer within 10 calendar days of the insurer's receipt of the request to submit the statements.

31. Assignments

Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the contract or any portion thereof, or of his right, title or interest therein, or his obligation thereunder, without written consent of the other party.

32. Indemnification

Contractor shall indemnify and hold harmless and defend the Owner and the Engineer and their directors, officers, employees, agents or volunteers, and each of them from and against:

A. Any and all claims, demands, causes of action, damages, costs, expenses, losses or liabilities, in law or in equity, of every kind and nature whatsoever for, but not limited to,

injury to or death of any person including Owner and/or Engineer and/or Contractor, or any directors, officers, employees, agents volunteers of the Owner, Engineer or Contractor, and damages to or destruction of property of any person, including but not limited to, Owner, Engineer and/or Contractor and their directors, officers, employees, agents or volunteers arising out of or in any manner directly or indirectly connected with the work to be performed under this Agreement, however caused regardless of any negligence of the Owner or the Engineer or their directors, officers, employees, agents, or volunteers, except the sole negligence of willful misconduct or active negligence of the Owner or the Engineer or their directors, officers, employees, agents or volunteers:

B. Any and all actions, proceedings, damages, costs, expenses, penalties or liabilities in law or equity, of every kind or nature whatsoever, arising out of , resulting from or on account of the violation of any governmental law or regulation, compliance with which is the responsibility of Contractor.

Contractor shall defend, at Contractor's own cost, expense and risk, any and all such aforesaid suits, actions or other legal proceedings of every kind that may be brought or instituted against the Owner and the Engineer or their directors, officers, employees, agents or volunteers.

Contractor shall pay and satisfy any judgment, award or decree that may be rendered against the Owner and their directors, officers, employees, agents, or volunteers in any such suit, action or other legal proceedings.

Contractor shall reimburse the Owner and their directors, officers, employees, agents and/or volunteers, for any and all legal expenses and costs incurred by them in connection therewith or in enforcing the indemnity herein provided.

Contractor agrees to carry insurance for this purpose as set out in the specifications. See Paragraph 29 of these General Provisions for insurance specifications and coverage. Contractor's obligation to indemnify shall not be restricted to insurance proceeds, if any, received by the Owner and the Engineer or their directors, officers, employees, agents and/or volunteers.

33. Separate Contracts

The Owner reserves the right to let other contracts in connection with this project. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs. If the proper execution or results of any part of the Contractor's work depend upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results.

The Owner may perform additional work related to the project by himself, or he may let other contracts containing provisions similar to these. The Contractor will afford the Contractors who are parties to such contracts (or the Owner, if he is performing the additional work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of work, and shall properly connect and coordinate his work with theirs.

In the performance of additional work by other contractors or the Owner is not noted in the Contract Documents prior to the execution of the Agreement, written notice thereof shall be given to the Contractor prior to starting any such additional work. If the Contractor believes that the performance of such requires additional expense or entitles him to an extension of the contract time, he may make a claim therefore as provided in Items 19 and 20 of these General Provisions.

34. Subcontracting

The Contractor may utilize the services of specialty subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty subcontractors.

The Contractor shall be fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is of the acts and omissions of

persons directly employed by him.

The Contractor shall cause appropriate provisions to be inserted in all contracts relative to the work to bind subcontractors to the Contractor by the terms of the Contract Documents in so far as applicable to the work of subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

Nothing contained in this contract shall create any contractual relation between any subcontractor and the Owner.

Contractor shall include all subcontractors as insured under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverage for subcontractors shall be subject to all of the requirements stated herein.

35. Employment of Apprentices

The Contractor and any subcontractor under him shall comply with the requirements of Sections 1777.5 and 1777.6 of the Labor Code in the employment of apprentices. The responsibility for compliance with the provisions of said Section 1777.5 for all apprenticeship occupations shall rest with the Contractor. Information relative to apprenticeship standards, wage schedules and other requirements may be obtained from the Division of Apprenticeship Standards, 455 Golden Gate Avenue, San Francisco, California, or from its branch offices.

36. Payment of Prevailing Wages

The Contractor and all subcontractors under him shall pay all laborers, workmen and mechanics on all work included in this contract no less than the general prevailing rate of per diem wages for work performed, (to-wit, within the limits of the City), and no less than the general prevailing rate of per diem wages for legal holiday and overtime work in said locality, which per diem wages shall not be less than the stipulated rate contained in a schedule thereof which has been ascertained and determined by the Council to be the general prevailing rate of per diem wages for each craft or type of workman or mechanic needed to execute this contract, and which is now on file with the City Clerk, as set forth in the Information for Bidders, and by reference it is incorporated herein and made a part hereof.

The Contractor shall forfeit, as a penalty to the Owner, two hundred dollars ($200.00) for each laborer, workman or mechanic employed for each calendar day or portion thereof such laborer, workman or mechanic is paid less than the said stipulated rates for any work done under this contract by him or by any subcontractor under him in violation of Articles 1 and 2 of Chapter 1 Part 7 of Division 11 of the Labor Code of the State of California, and said sums and amounts which shall have been so forfeited pursuant to the herein paragraph and the said terms of said Labor Code shall be withheld and retained from payments due to the Contractor under said contract, pursuant to this contract and the said terms of said Labor Code; but no sum shall be so withheld, retained or forfeited except from the final payment without a full investigation by either the Division of Labor law Enforcement of the State Department of Industrial Relations or by said Council.

The difference between such stipulated prevailing wage rates and the amount paid to each workman for each calendar day, or a portion thereof, for which each workman was paid less than the stipulated prevailing wage rate shall be paid to each workman by the Contractor. The Contractor shall comply with the provisions of Section 1775 of the Labor Code of the State of California.

The Contractor and his subcontractors shall submit certified payroll information electronically to the Department of Industrial Relations as well as a hard copy of said certified payrolls to the Owner on a monthly basis.

37. Registration to Train Apprentices

Pursuant to Labor Code Section 1777.5, all contractors shall file with the appropriate Joint Apprenticeship Training Committee, a DAS-140 form registering to train apprentices. This requirement to register to train apprentices is mandated by Section 1777.5 whether or not you are signatory to or a party of any approved training program. Only those programs approved by the California Apprenticeship Council are applicable to accept DAS-140 registration forms.

If the contractor is approved to train apprentices, then apprentices must be called in a ratio not less than one apprentice hour for each five journeyman hours.

However, if the entire contract may be completed within 20 working days or the entire contract (nor subcontracts) is less than thirty thousand ($30,000), then the Contractor is exempt from requesting apprentices under Labor Code Section 1777.5.

In addition, all contractors are required to make appropriate training contributions as set forth in the prevailing wage determination to each appropriate JATC, or in the alternative, to the California Apprenticeship Council. Payments shall be made not less than monthly, calculated and paid by the fifteenth of each month, for work performed that prior month.

The address for the applicable Joint Apprenticeship Training Committee and for the California Apprenticeship Council can be obtained by calling the Division of Apprenticeship Standards.

38. Penalties

Failure to pay the appropriate prevailing wage can result in penalties being assessed as follows:

A. Up to $50.00 per day per worker for each and every violation; and,

B. debarment from future public works for a period not to exceed three years.

C. $50.00 per day per worker for each failure to comply with the payment of overtime for all hours worked in excess of 8 in one day or 40 in one week.

Failure to register to train apprentices or failure to pay the appropriate training contribution can result in penalties being assessed as follows:

A. $100.00 per day for each day of violation; and,

B. debarment from future public works for a period not to exceed three years.

39. Engineer's Authority

The Engineer shall act as the Owner's representative. He shall decide questions which may arise as to quality and acceptability of materials furnished and work performed. He shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the work is proceeding in accordance with the Contract Documents.

The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship and execution of the work. Inspections may be made at the factory or fabrication plant of the source of material supply.

The Engineer will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

40. Land and Rights-of-Way

Prior to issuance of the Notice to Proceed, the Owner shall obtain all land and rights-of-way necessary for carrying out and for the completion of the work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

The Owner shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

The Contractor shall provide, at his own expense and without liability to the Owner, any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

41. Warranty and Guarantee

Contractor warrants and guarantees to Owner that all work will be in accordance with the Contract Documents and will not be defective. Prompt notice of defects known to Owner shall be given to Contractor. All defective work, whether or not in place, may be rejected, corrected or accepted as provided in Paragraph 19, Changes in the Work, of these General Provisions. Defective work may be rejected even if approved by prior inspection.

42. One (1) Year Warranty Period

The warranty period shall commence when the Notice of Completion is issued, at notice of beneficial occupancy or at notice of partial utilization of the work to be warranted has been issued, or a later date if so specified in the Agreement, or mutually agreed to, and extend until one (1) year after that date or whatever longer period may be prescribed by laws or regulations or by the terms of any applicable special guarantee or specific provision of the Contract Documents.

43. Correction of Defective Work

If within the designated warranty period, or such longer period as may be required by Laws or Regulations, the work, or any part of the work, is discovered to be defective, Contractor shall promptly, without an adjustment in contract price and in accordance with Owner's written instructions, either correct that defective work, or if it has been rejected by Owner, remove it from the site and replace it with non-defective work. If circumstances warrant it, including but not limited to, in an emergency, Owner may have the defective work corrected or the rejected work removed and replaced. In that event, Contractor shall not be allowed to recover any associated costs, and he shall reimburse Owner for all direct, indirect and consequential costs of Owner, and Owner shall be entitled to an appropriate decrease in contract price, to withhold a set-off against amount recommended for payment, or make a claim on Contractor's bond if Contractor has been paid in full. Where defective work (and damage to other work resulting therefrom) has been corrected, removed or replaced during the warranty period, the one (1) year warranty period with respect to such work will be extended for an additional period of one (1) year after such correction or removal and replacement has been satisfactorily completed.

44. Early Completion

The one (1) year warranty period will not begin until the Notice of Completion is filed. If Contractor completes the work or portions thereof prior to this time, he shall preserve the equipment and/or facilities by developing and implementing a preventive maintenance program in compliance with manufacturer's recommendations to maintain the equipment and/or facilities unless Owner has issued a notice of beneficial occupancy or notice of partial utilization for the warranted work. At start up, Contractor will be required to get his equipment and/or facilities ready to put into service.

45. Extended Warranties and Guarantees

Owner may at its sole discretion extend the one (1) year warranty period up to twenty-four (24) months, in which case Contractor shall maintain the warranties and guarantees. If such extension of the one (1) year warranty period causes an increase in the cost of the warranties and guarantees provided by Contractor, an adjustment in contract price shall be made as provided by the Contract Documents.

46. Arbitration

With the prior approval of the Owner and the Contractor, all claims, disputes and other matters in question arising out of, or relation to, the Contract Documents or the breach thereof, except for claims

which have been waived by the making and acceptance of final payment as provided by Item 27 of these General Provisions, may be decided by arbitration in accordance with the Arbitration Rules of the American Arbitration Association. If entered into, the agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

Notice of the request for arbitration shall be filed in writing with the other party to the Contract Documents and with the American Arbitration Association, and a copy shall be filed with the Engineer. The request for arbitration shall set forth specifically the dispute to be arbitrated. Acceptance by the other party of the request to arbitrate shall constitute the agreement to arbitrate and arbitration shall proceed forthwith. No legal proceedings other than to enforce arbitration shall be commenced on any issue covered by the arbitration agreement.

The Contractor shall carry on the work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

47. Taxes

The Contractor shall pay all sales, consumer, use and other similar taxes required by the law of the place where the work is performed.

48. Contractor's Understanding

It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and extent of the work, the character, quality, and quantity of the materials to be encountered, the character of the equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this contract. No verbal agreement or conversation with any officer, agent or employee of the Engineer or the Owner, either before or after the execution of this Agreement, shall affect or modify any of the terms or obligations herein contained.

49. Accidents

The Contractor shall provide, at the site, such equipment and medical facilities as are necessary to supply first-aid service to anyone who may be injured in connection with the work. The Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with the performance of the work, whether on or adjacent to the site which causes death, personal injury, or property damages, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Engineer and the Owner. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

50. Safety and Sanitation

The Contractor shall provide adequate safety and sanitation facilities according to State laws and local ordinances.

The Contractor will assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and equipment. This responsibility shall apply continuously and not be limited to normal working hours.

51. Climatic Conditions

The Engineer may order the Contractor to suspend any work that may be subject to damage by climatic conditions. The Contractor may suspend work if climatic conditions are such that the Contractor is unable to work. In such case, the Contractor, within seven days, shall request in writing a change order to extend the contract time.

52. Officials Not To Benefit

No official of the Owner shall receive any benefit that may arise by reason of this contract.

53. Clean-Up

During the progress of the work, the Contractor shall maintain the site and related structures and equipment in a clean, orderly condition and free from unsightly accumulations of rubbish. Upon completion of the work, the Contractor shall remove from the vicinity of the work all plants, buildings, rubbish, unused materials, concrete forms, temporary bridging, and other like material, belonging to him or used under his direction during construction, and in the event of his failure to do so, the same may be removed by the Owner after 10 calendar days notice to the Contractor at the expense of the Contractor, and his surety or sureties shall be liable therefore.

As part of the final clean-up, the Contractor shall dress up and grade the right-of-way to match existing ground surfaces, and shall remove therefrom all weeds and other growth. Where the construction has crossed yards or driveways, they shall be restored to a condition equivalent to the condition existing prior to the construction as determined by the Engineer.

No direct payment will be made to the Contractor for any clean-up work, but all compensation therefore shall be included in the prices bid in the schedule for the various items of work.

54. Notice to Owner

In the event this contract involves digging trenches or excavations that extend deeper that four feet below the surface, the Contractor shall promptly, and before the following conditions are disturbed, notify Owner, in writing, of any:

A. Material that the Contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law;

B. Subsurface or latent physical conditions at the site differing from those indicated;

C. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.

Owner shall promptly investigate the conditions. If Owner finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work, Owner shall issue a change order under the procedures described in the contract.

In the event a dispute arises between Owner and Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor, shall not be excused from any scheduled completion date provided for by the contract, but shall proceed with all work to be performed under the contract. The Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between Contractor and Owner.

55. Payment of Withheld Funds

The Owner shall retain 5**%** of each payment from Contractor and shall make prompt and regular incremental acceptances of portions, as determined by the Owner, of the agreed upon work, and pay retention to the Contractor based on these acceptances. The Contractor, or subcontractor, shall return all monies withheld in retention from a subcontractor within 30 days after receiving payment for work satisfactorily completed and accepted including incremental acceptances of portions of the contract agreement work by the Owner. Federal law (49CFR26.29) requires that any delay or postponement of payment over 30 days may take place only for good cause and with the Owner's prior written approval. Any violation of this provision shall subject the violating Contractor or subcontractor to the penalties,

sanctions and other remedies specified in Section 7108.5 of the Business and Professions Code. These requirements shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor, deficient subcontract performance, or noncompliance. When the work is complete, the Owner will issue a Notice of Completion to the County. The Owner will pay all retention funds to the Contractor thirty-five (35) Days after Notice of Completion has been recorded.

56. Storm Water Pollution Prevention Measures

Storm Water Pollution Prevention Measures shall be performed in accordance with the provisions in Section 13-3, "Storm Water Pollution Prevention Plan," of the Standard Specifications.

A. GENERAL

In compliance with the State and Federal regulations regarding storm water management during construction, the Contractor shall not allow any debris, waste materials or pollutants, originating from the Contractor's operations, to enter the storm drainage system, which leads to contamination of local creeks and ponding basins.

The Contractor shall properly dispose of all wastes and excess materials in a legal manner to the satisfaction of the Owner.

B. SELECTIVE BMPS FOR STORM WATER POLLUTION PREVENTION

As applicable to the project or directed by the Engineer, the Contractor shall implement any or all of the following Best Management Practices (BMPs):

1. Material Handling and Storage

a. Nonhazardous Materials

i. Designated Delivery and Storage Area

The Contractor shall propose areas in the vicinity of or within the project site or within the Contractor's staging site, which are suitable for material delivery and storage. To the maximum extent practicable, these areas shall be away from gutters, catch basins, drainage courses or creeks. The Contractor shall submit the proposed areas to and shall obtain the approval from the Engineer in writing prior to bringing in materials.

ii. Storage of Granular Materials

The Contractor shall store granular materials at least ten feet (10') away from any inlet or curb return and shall prevent the granular materials from entering the storm drain system, drainage courses or creeks. During wet weather or when rain is forecast within 24 hours, the Contractor shall cover granular materials with a tarpaulin and surround the material with sandbags or other approved heavy objects.

b. Hazardous Materials

i. Hazardous materials include, but are not limited to, petroleum products, antifreeze, paints, thinners, solvents, pesticides, herbicides and various other toxic chemicals.

ii. The Contractor shall propose, within the project site or the Contractor's staging site, an area that is suitable for hazardous material delivery and storage. To the maximum extent practicable, the area shall be away from inlets, gutters, drainage courses or creeks. The Contractor shall submit the proposed area to and shall obtain approval from the Engineer in writing prior to bringing in hazardous materials.

iii. The Contractor shall label and store all hazardous materials and hazardous wastes in accordance with secondary containment regulations, the City of Los Banos Hazardous Materials Storage Ordinance and all applicable Merced County, State and Federal laws and regulations.

iv. The Contractor shall keep all hazardous materials or waste in containers and fully covered to avoid contamination of storm runoff.

v. The Contractor shall keep an accurate, up-to-date inventory, including Materials Safety Data Sheets (MSDSs), of hazardous materials and hazardous wastes stored on-site to assist emergency response personnel in the event of a hazardous material incident.

2. Hazardous Material Usage

a. The Contractor shall follow all local, State and Federal policies, laws and regulations governing the use of hazardous materials.

b. The Contractor shall use only Category III pesticides for pest control. If Category III pesticides are unavailable, have been tried but proven ineffective, or when it is necessary to prevent a pest outbreak that poses an immediate threat to public health or significant economic loss, the City may consider allowing the use of Category II pesticides with a dose of up to LD50 (a dose that kills 50 percent of the targeted pest population in the laboratory) provided that the risk to the applicator and impact to the environment can be justified. Use of Category I pesticides is prohibited.

c. Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging non-degraded pesticides into storm water system, drainage courses and creeks.

d. Mix only as much material as is necessary for treatment. Calibrate application equipment prior to and during use to ensure desired application rate. Do not mix or load pesticides adjacent to storm drain system, drainage courses or creeks.

e. The Contractor shall not overapply herbicides, pesticides or fertilizers and shall follow the manufacturer's instructions regarding uses, protective equipment, ventilation, flammability and mixing of chemicals. Over-application of a pesticide is a "label violation" subject to an enforcement action by the Merced County Agriculture Department.

f. When rain is forecast within 24 hours or during wet weather, the Contractor shall not apply chemicals in outside areas unless otherwise allowed by the Engineer in writing.

3. Integrated Pest Management Methods

The Contractor shall employ, in place of pesticides, integrated pest management methods including:

a. No control

b. Physical or mechanical methods

c. Least toxic chemicals (insecticidal soaps and oil, etc.)

4. Vehicle and Equipment Cleaning, Maintenance and Fueling

a. Cleaning

The Contractor shall not clean or wash vehicles or equipment on- site or in the streets. If allowed by the Engineer in writing, cleaning and washing shall be

performed in a designated and bermed area approved by the Engineer using water only. No soaps, solvents, degreasers, steam cleaning equipment or similar methods are permitted. The Contractor shall not allow wash water to flow into streets, gutters, storm drain system, drainage courses or creeks.

b. Maintenance and Fueling

i. The Contractor shall perform maintenance and fueling of vehicles or equipment in a designated, bermed area or over a drip pan that will prevent waste, leaks or spills from entering streets, gutters, storm drain system, drainage courses or creeks.

ii. The Contractor shall inspect all vehicles and equipment arriving on-site for leaking fluids and shall promptly repair leaking vehicles and equipment. Drip pans shall be used to catch leaks until repairs can be made. Shut-off valves on equipment must be working properly.

5. Spill Prevention and Control

a. If hazardous materials are used on the project, the Contractor shall keep a stockpile of spill clean-up materials, such as rags or absorbents, readily accessible on-site.

b. Above-ground storage tanks and their installations shall comply with City, State and Federal requirements.

c. The Contractor shall immediately contain and prevent spills or leaks from entering storm drain system, drainage courses or creeks and shall properly clean up and dispose of the spills or leaks. The Contractor shall not wash the spills or leaks into streets, gutters, storm drain system, drainage courses or creeks and shall not bury the spills or leaks.

d. In case of a hazardous material spillage, the Contractor shall immediately call 911 and shall handle the spilled material in accordance with the requirements of 6, “Disposal of Hazardous Waste,” below.

6. Disposal of Hazardous Waste

a. Unless the Contractor is a licensed hazardous waste handler, the Contractor shall contract with a licensed hazardous waste handler to remove and dispose of hazardous waste materials unless the waste quantities to be transported are below threshold limits for transportation as specified in the State and Federal regulations.

b. The Contractor shall arrange for regular hazardous waste collection to comply with limits for storage of hazardous waste.

c. The Contractor may dispose of dry, empty paint cans, buckets, paintbrushes, rollers, rags and drop cloths in the trash.

d. The Contractor shall dispose of hazardous waste at facilities authorized for treatment, storage and disposal of hazardous waste only.

7. Street Sweeping

At the end of each day or as directed by the Engineer, the Contractor shall sweep roadways of all debris and excess materials attributed to the Contractor’s operations.

8. Water Usage

a. The Contractor shall use the least amount of water necessary for dust control and street sweeping operations.

b. The Contractor shall not use water to flush dust and debris down the

street in place of street sweeping.

9. Dumpsters and Portable Sanitary Facilities

a. If dumpsters or portable sanitary facilities are used, they shall be stationed at least ten feet (10') away from storm drain facilities.

b. The Contractor shall arrange for regular waste collection to keep dumpsters and portable sanitary facilities from overflowing and shall regularly inspect these facilities for leaks. If a leak is discovered, the Contractor shall arrange for the repair or replacement of facilities that leak. The Contractor shall not wash the dumpsters or portable sanitary facilities on-site.

10. Earthwork

The Contractor shall maximize the control of erosion and sediment by using the Best Management Practices for erosion and sedimentation control described in the California Storm Water Best Management Practice Handbook—Construction Activity or ABAG Manual of Standards for Erosion and Sediment Control Measures.

11. Dewatering

a. The Contractor shall route water through a control device, such as a sediment trap, sediment basin or Baker tank, to remove settleable solids prior to discharging the water into the storm drain system. Refer to the California Storm Water Management Practice Handbook for these sediment control measures.

b. Approval of the control device shall be obtained in advance from the Engineer.

c. Filtration of the water following the control device may be required on a case-by-case basis.

d. If the Engineer determines that the dewatering operation would not generate an appreciable amount of settleable solids, the control device may be waived.

12. Saw Cutting

a. During saw cutting or grinding operation, use as little water as possible.

b. During saw cutting, the Contractor shall cover or barricade catch basins using filter fabric, straw bales, sandbags or fine gravel dams to keep slurry out of the storm drain system. When protecting a catch basin, the Contractor shall ensure that the entire opening of the catch basin is covered. Refer to California Storm Water Best Management Practice Handbook for these control measures.

c. The Contractor shall shovel, absorb or vacuum saw cut slurry and pick up the waste as the work progresses prior to moving to the next location, as specified elsewhere in these specifications or as directed by the Engineer.

d. If saw cut slurry enters catch basins, the Contractor shall, at the Contractor's cost, clean up the storm drain system immediately.

13. Concrete, Grout and Mortar Related Work

a. Material Handling

i. The Contractor shall avoid mixing excess amounts of fresh concrete or cement mortar on-site.

ii. The Contractor shall store concrete, grout and mortar away from storm drain facilities or drainage courses and shall ensure that these materials do not enter the storm drain system.

b. Washing of Concrete Truck and Tools

i. The Contractor shall not wash out concrete trucks or equipment into streets, gutters, storm drain system, drainage courses or creeks.

ii. The Contractor shall perform washing of concrete trucks and tools off-site or in a designated area on-site where the water will flow onto dirt or into a temporary pit in a dirt area. The Contractor shall let the water percolate into the soil and dispose of the hardened concrete in a trash container. If a suitable dirt area is not available, the Contractor shall collect the wash water and dispose of it off-site.

14. Asphalt Concrete Paving

a. Project Site Management

i. When rain is forecast within 24 hours or during wet weather, the Engineer may prevent the Contractor from paving.

ii. The Engineer may direct the Contractor to protect drainage courses by using earth dike, straw wattle or sandbag to trap and filter sediment. Refer to California Storm Water Best Management Practice Handbook for these control measures.

iii. The Contractor shall place drip pans or absorbent material under paving equipment when not in use.

iv. The Contractor shall cover catch basins and manholes when paving or applying prime coat, tack coat, seal coat, fog seal or slurry seal.

v. If the paving operation includes an on-site mixing plant, the Contractor shall comply with Merced County NPDES General Industrial Activities Storm Water Permit requirements.

vi. The Contractor shall preheat, transfer or load hot bituminous material away from storm drain system, drainage courses or creeks.

b. Paving Waste Management

The Contractor shall not sweep or wash down excess sand (placed as part of a sand seal or to absorb excess oil) into streets, gutters, storm drain system or creeks but shall collect the sand and dispose of it off-site. The Contractor shall not wash fresh asphalt concrete pavement.

15. Painting

a. General

i. The Contractor shall remove as much excess paint as possible from brushes, rollers and other tools before starting cleanup.

ii. The Contractor shall conduct cleaning of painting equipment and tools in a designated area approved by the Engineer.

iii. The Contractor shall not allow wash water from cleaning of painting equipment and tools into streets, gutters, storm drain system, drainage courses or creeks.

b. Water-Based Paint

To the maximum extent practicable, the Contractor shall dispose of wash water

from water cleaning of brushes, rollers and other tools used in water-based painting work to the sanitary sewer or direct wash water onto dirt area and spade in.

c. Oil-Based Paint

The Contractor shall dispose of waste thinner and solvent and sludge from cleaning of brushes, rollers and other tools used in oil- based painting work as hazardous waste and the Contractor shall handle the waste as described in Section 6, "Disposal of Hazardous Waste," above. To the maximum extent practicable, the Contractor shall filter paint thinner and solvents for reuse.

16. Thermoplastic

a. The Contractor shall transfer and load hot thermoplastic away from drainage systems or drainage courses or creeks.

b. The Contractor shall sweep thermoplastic grindings into plastic bags. Yellow thermoplastic grindings may require special handling as they may contain paint.

C. CONTRACTOR TRAINING AND AWARENESS

1. The Contractor shall train all employees and subcontractors on the storm water pollution prevention requirements contained in these specifications.

2. The Contractor shall inform subcontractors of the storm water pollution prevention contract requirements and include appropriate subcontract provisions to ensure that these requirements are met.

3. The Contractor shall post warning signs in areas treated with chemicals.

D. BMP IMPLEMENTATION

The Contractor shall be responsible throughout the duration of the construction period for installing and maintaining the applicable BMPs and for removing and legally disposing of temporary control measures. Unless otherwise directed by the Engineer or specified elsewhere in these specifications, the Contractor's responsibility for BMP implementation shall continue throughout any temporary suspension of work ordered in conformance with the provisions in Section 8-1.06, "Suspensions," of the Standard Specifications.

Throughout the rainy season, all soil-disturbed areas of the site shall be fully protected with soil stabilization and sediment control device approved by the Engineer at the end of the same day the soil is disturbed unless fair weather is predicted the next day and the protective measures are exempt by the Engineer. The Contractor shall monitor the weather forecast on a daily basis and inform the Engineer of the forecast. The National Weather Service forecast shall be used for this purpose. If precipitation is predicted for the following day, construction schedule shall be altered as required to install appropriate BMPs or to ensure that the already installed BMPs are in good operating condition prior to the onset of rain.

E. BMP MAINTENANCE

To ensure proper implementation and effectiveness of the BMPs, the Contractor shall regularly inspect and maintain the deployed BMPs throughout the construction site. The Contractor shall identify corrective actions and the time needed to address any deficient BMPs or reinitiate any BMPs that have been discontinued. The Contractor shall keep written records of all BMP inspections, maintenance and corrective actions.

The frequency of the BMP inspection shall be as follows:

1. Prior to a forecast storm;

2. After any precipitation that causes runoff;

3. At 24-hour intervals during extended rain events; and

4. Routinely, at a minimum of once every week.

If the Contractor or the Engineer identifies a deficiency in the deployment or functioning of a BMP, the deficiency shall be corrected immediately. If requested by the Contractor and approved by the Engineer in writing, the deficiency may be corrected at a later time or date but the corrective action shall not be later than the onset of the subsequent rain event. The correction of deficient BMPs shall be at no additional cost to the City.

F. RESPONSIBILITIES, CONSEQUENCES, AND REMEDIES

1. Conformance with the provisions of this section or other requirements in various other sections of these specifications shall not relieve the Contractor from the Contractor's responsibilities as provided in various relevant articles of Section 7, "Legal Relations and Responsibilities to the Public," of the Standard Specifications, and as specified herein.

2. For purposes of this section, costs and liabilities include, but are not limited to, fines, penalties and damages, whether assessed against the City or the Contractor, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Act.

3. If solid or liquid materials or waste, hazardous or otherwise, or pollutants originating from the Contractor's operation enter the storm drain system or water courses, the Contractor will be required to thoroughly clean up the affected storm drain facilities and water courses to the satisfaction of the Engineer. If the Contractor fails to clean up the affected facilities as required, the City will issue a stop-work order and take necessary actions to effect the cleanup of the affected facilities.

4. The Contractor shall be responsible for all costs, including fines, the City's cost of defense, the cost of cleanup by others ordered by the City, and liabilities imposed by law as a result of the Contractor's failure or negligence in complying with the requirements specified herein.

5. In accordance with the provisions of Section 7-1.05, "Indemnification," of the standard Specifications if the Contractor fails to accept or reject a tender of defense and indemnity within fifteen (15) calendar days, the City may, in addition to the remedies authorized by law, retain any sum due the Contractor until disposition has been made of all claims or suits for damages or until the Contractor accepts or rejects the tender of defense, whichever occurs first.

G. PAYMENT

Full compensation for storm water pollution control shall be considered as included in the payment for various other items of work and no additional compensation will be made therefore.

Special Provisions

1. Requirements

It is required that there be constructed and completed in accordance with the Contract Documents for "Construction of **Orchard Terrace Sewer Lift Station Rehabilitation Project**" for the City of Los Banos, all work as described in these Contract Documents.

2. Description of Work

The principal components of the work to be performed under these Contract Documents include the following:

> The major work consists of furnishing and installing a pumping bypass and valve vault and standby generator with associated concrete pads, and replacing the wet well of an existing sanitary sewer lift station located at 100 Willmott Avenue; in the City of Los Banos. Improvements will include the removal of an existing wet well, sewer pipelines, electrical controls, conduit and appurtenances. The installation of a wet well, onsite piping, generator, installation of protective lining to wet well, temporary sewer bypass pumping as required, minor concrete and asphalt above proposed underground improvements.

Any incidental work not described in the Contract Documents which is necessary to complete the Work shall be furnished and installed as part of this contract at no additional cost to the Owner. The work shall be complete and ready for service to the satisfaction of the Owner. The Contractor shall have had the opportunity to inspect the site and observe actual working conditions during the non-mandatory pre-bid meeting.

3. Commencement, Prosecution and Completion of Work

The Contractor shall commence work and shall complete all of the work in accordance with the schedule and within the time stated in the bid. The capacity of the Contractor's construction plant, sequence of operations, method of operations, and the forces employed shall at all times during the continuance of the contract, be subject to the approval of the Engineer and shall be such as to ensure the completion of the work within the time specified.

4. Hours of Work

Construction work shall be completed between the hours of 7:00 a.m. and 9:00 p.m. Monday through Friday using normal construction practices. No work shall be performed on Saturday or Sunday. The Contractor may request to the Owner to perform construction outside of these specified hours.

5. Permits and Business Licenses

The Contractor will need an Encroachment Permit from the Public Works Department prior to start of construction. The Contractor and all subcontractors working within the city limits of Los Banos shall apply for and have issued a business license from the City of Los Banos (209-827-7000) prior to commencement of work.

6. Testing

Field density tests shall be made of each compacted layer (subbase and aggregate base) as directed by the Engineer. When these tests indicate that the density of any layer of fill or portion thereof is less than the specified density, that layer shall be reworked unit the required density has been obtained.

Field density tests (compaction testing) shall be performed by a geotechnical laboratory retained by the Owner and under the supervision of a registered geotechnical engineer.

Initial compaction testing will be paid by the Owner. Retesting of areas that failed the initial testing will be paid for by the Contractor.

7. Responsibility Regarding Existing Utilities and Private Property

The existence and location of public and private utilities indicated on the drawings are not guaranteed and any additional utilities and facilities not shown on the drawings shall be investigated and protected by the Contractor. The Contractor shall be held responsible for damage to and for maintenance and protection of existing pipelines, public utilities, drives, curbs and gutters, sidewalks, and fences. Excavation in the vicinity of existing public utility structures, underground electrical or telephone cable, oil or gas pipelines, and waterlines shall be carefully done by hand. The Contractor shall adequately protect all adjoining property and structures from damage, whether within or without of the Owner furnished rights-of-way, and shall be fully responsible for any damage to adjoining property and structures which may result from work done under this contract. The Contractor shall use extreme care during construction to prevent damage from dust to crops and adjacent property. The Contractor shall sprinkle the areas where the passage of operation of vehicles and equipment creates a dust problem, or take other preventive measures as directed by the Engineer. The Contractor shall furnish all labor, equipment, materials and means required to control dust which is in any way a result of the Contractor's operations.

The Contractor shall be responsible for all damage or injury which may result to any property, outside of the construction right-of-way or within the right-of-way where so noted, from the Contractor's operations hereunder, or otherwise, from the performance of the Agreement by said Contractor or any of his subcontractors or employees.

The Contractor shall attempt to maintain access to the residential and commercial driveways within the construction area at all times during working hours and shall provide access during non-working hours, weekends and holidays.

Payment for all work specified above shall be included in the unit or lump sum prices bid in the schedule for the various items of work.

8. Obstructions

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installation at least 3 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Failure to contact the notification center prohibits excavation. Regional notification centers include but are not limited to the following:

NOTIFICATION CENTER	TELEPHONE
Underground Service Alert Northern California (USA) www.usanorth811.org	811 or 1-800-227-2600

9. Materials Furnished By Owner

No labor, material, or other facilities shall be provided by the Owner unless otherwise indicated on the drawings or in the Contract Documents.

10. Materials Furnished By Contractor

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary for the execution and completion of the work.

11. Schedule of Values, Material List and Substitutions

Prior to the commencement of work, and within 10 days following the signing of the contract by the Owner and the Contractor, the Contractor shall submit 2 copies of a Schedule of Values for all lump sum bid items in the Bid Schedule and a *complete* list of equipment and materials to be furnished, including all substitutions proposed to the Engineer for approval. Partial or incomplete material lists will not be considered. No substitutions will be considered thereafter. Only one request for substitution will be considered on each item of material or equipment.

12. Request for Extension of Time

All extension of time requests shall be made in writing to the Engineer within seven (7) calendar days from the delay occurrence date. In the case of continuing cause of delay, only one claim is necessary.

13. Rights-of-Way

The Contractor shall not be entitled to extra compensation for hardships and increased cost caused by the work being adjacent to telephone-telegraph lines and guy wires, power lines and guy wires, buildings, fences, pipelines, ditches, roadways, and other obstacles which may physically restrict or limit the use of construction equipment. In some cases, such physical confinement may necessitate special methods of construction of the work. If the Contractor desires to utilize additional area, he shall obtain the necessary approvals from the landowner. No additional compensation shall be paid to the Contractor for the cost of obtaining additional right-of-way or for the inability to obtain such.

14. Coordination with Other Work

Other work including but not necessarily restricted to relocation of power and telephone poles, installation of a gas line and relocation of water meters may be in progress near or at the construction site at the time the Contractor is in performance of the work specified herein. The Contractor shall coordinate his work with that of others so that prosecution of all work will proceed smoothly.

15. Closure of Streets

The Contractor will be allowed to temporarily close the streets being paved to vehicular traffic between the hours 7:00 a.m. and 5:00 p.m. on the day the streets are being paved. All street closure dates shall be coordinated with and approved by the Engineer for approval no later than 10 working days prior to the earliest proposed closures and detours.

16. Construction Signs, Barricades, Lights and Flagmen

The Contractor shall furnish, erect and maintain adequate barricades, lights, signs and other devices and take other protective measures to prevent damage to the public. The Contractor shall also furnish adequate warning to the public of dangerous conditions to be encountered. Where one lane of a public road is closed, the Contractor shall furnish flagmen at each end of the closed lane to control traffic in the open lane. The Contractor shall also furnish adequate warning to the public of dangerous conditions to be encountered.

Payment for traffic control and other safety measures shall be included in the Traffic Control Plan lump sum price bid in the Bid Schedule.

17. Traffic Control Plan

It is the Contractor's sole responsibility to establish and implement a Traffic Control Plan conforming to Sections 7-1.08, "Public Convenience" 7-1.09, "Public Safety", and Section 12, "Construction Area Traffic Control Devices", of the Caltrans Standard Specifications. Nothing in these Contract Documents shall be construed as relieving the Contractor from his responsibility.

The Traffic Control Plan shall be prepared, stamped and signed by a professional engineer registered in California, and three copies provided to the Engineer before the Contractor is issued a Notice to Proceed.

Payment for the preparation and implementation of the Traffic Control Plan shall be made at the applicable lump sum price bid in the Bid Schedule.

18. Disposal of Waste Materials

Waste material shall be disposed of in accordance with local regulatory requirements. Provide watertight conveyance for liquid, semi-liquid or saturated solids which tend to bleed during transport. Liquid loss from transported materials is not permitted, whether being delivered to construction site or hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at selected disposal site.

19. Noise Control

Conduct operations to cause least annoyance to residents in vicinity of work, and comply with applicable local ordinances. Equip compressors, hoists, and other apparatus with mechanical devices necessary to minimize noise and dust. Equip compressors with silencers on intake lines. Equip gasoline or oil-operated equipment with silencers or mufflers on intake and exhaust lines.

20. Water Supply

Water will be available to the Contractor in performance of the work without charge from all Owner fire hydrants. Prior to the use of any hydrant the Contractor shall notify the Owner and obtain and install a meter furnished by the Public Works Department on the fire hydrant. It will be the Contractor's responsibility to convey the water to the work site. Regardless of the method of conveyance chosen, it shall not be cause for closure of any streets nor shall it create a nuisance to nearby residents. An air gap shall be maintained between the hose or pipe discharge to prevent possible backflow in the event of distribution system pressure loss. The Contractor shall pay a One Thousand Dollar ($1,000) deposit per meter for the use of the fire hydrant meter. The deposit may be refunded in full if the fire hydrant meter is returned undamaged.

21. Notifications

The Owner will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Owner, of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Owner or from the regulatory agency through the Owner, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance**.**

22. Work Not Listed in Proposal

It is the intent of the plans, specifications and contract documents to provide for the construction of completed and finished facilities and works of improvement unless otherwise specifically provided. Except for authorized changes in the work, payment for said complete and finished facilities and works of improvement will be made only on the basis of the contract items of work listed in the proposal. All other work, including the furnishing of plants, labor, materials, tools, equipment, and incidentals, provided for in the plans, specifications and contract documents, or required for the proper completion of the work as a whole, for which no separate payment has been provided shall be a supplementary obligation of the Contractor and payment therefore shall be considered included in the prices paid for the various contract items of work listed in the proposal.

23. Submittals

The Contractor shall submit to the Engineer, a minimum of six sets, hard copies, or one electronic copy of the following submittals for review and approval:

1. Sewer Pipeline and Appurtenances (Pipe, Fittings, Bends, Couplings, Saddles, Valves, Warning Tape etc.)
2. Precast Concrete Structures Concrete Linings
3. Vault Lids and Access Hatches
4. Electrical Controls and Appurtenances
5. Aggregate Base
6. Concrete Mix Design
7. Asphalt Concrete Mix Design
8. Pumping Bypass Plan

Within 10 days after the effective date of the Agreement and before starting to perform any work, the Contractor shall submit to the Engineer for review and approval:

1. A work schedule indicating the times for starting and completing the various stages of the work. No progress payment shall be made to Contractor until an acceptable schedule has been submitted to the Engineer.
2. Traffic Control Plan
3. Notice to Residents in English and Spanish
4. A Schedule of Values - a breakdown of each lump sum price to be used to determine deductive change orders, if necessary.
5. A complete list of equipment and materials to be furnished
6. City of Los Banos Business License for Contractor and all subcontractors

If more than TWO submittals for a single item are required because of incorrect or insufficient data, or the submittal is unacceptable, or because the Contractor wishes to change previously approved material, then all costs incurred by the Owner for the additional review shall be deducted from monies due the Contractor.

A revised work schedule shall be submitted within 5 days of request by the Engineer. No future progress payments shall be made to Contractor until an acceptable schedule has been submitted to Engineer.

24. Bid Item Descriptions

See Section 01 22 00 of the Technical Specifications.

Technical Provisions

City of Los Banos
At the Crossroads of California

Technical Specifications
for
Construction of

ORCHARD TERRACE SEWER LIFT STATION REHABILITATION PROJECT

MAY 2025

DATE SIGNED 5/2/2025

Civil Divisions

DATE SIGNED 5/2/2025

Electrical Divisions

City of Los Banos
520 J Street
Los Banos, CA 93635

City of Los Banos
Public Works Department

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SECTION 00 01 10

TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

01 11 01 Owner-Furnished Contractor-Installed Items
01 22 00 Explanation of Bid Items
01 77 00 Contract Closeout

DIVISION 02 – EXISTING CONDITIONS

02 01 20 Protection of Underground Facilities and Survey Monuments
02 41 00 Demolition

DIVISION 03 – CONCRETE

03 30 01 Cast-in-Place Concrete (Site Work)
03 36 00 Concrete Lining for Corrosion Protection
03 41 00 Precast Concrete Structures

DIVISION 08 – OPENINGS

08 30 01 Sewer Lift Station Access Hatches

DIVISION 26 – ELECTRICAL

26 05 00 Common Work Results for Electrical
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 33 Raceways and Boxes for Electrical Systems
26 05 53 Identification for Electrical Systems
26 08 00 Commissioning of Electrical Systems
26 27 00 Low-Voltage Distribution Equipment
26 18 11 Overcurrent Protection Devices
26 29 13 Reduced-Voltage Motor Controllers
26 50 00 Lighting

DIVISION 31 – EARTHWORK

31 23 17 Trenching Backfilling and Compacting
31 23 19 Structure Excavation and Backfilling

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 11 23 Aggregate Base
32 12 16 Asphalt Concrete Paving
32 31 00 Fencing

DIVISION 33 – UTILITIES

33 01 31 Sewer Bypass
33 01 36 Sewer Reconstruction
33 05 26 Utility Line Marking

DIVISION 40 – PROCESS INTEGRATION

40 05 00 Pipe & Fittings
40 05 23 Valves & Appurtenances
40 61 00 Common Work Results for Process Control and Instrumentation Systems
40 61 14 Process Control and Instrumentation System Loop Descriptions
40 63 43 Programmable Logic Controllers
40 67 16 Free-Standing Panels
40 91 06 Level Measuring

DIVISION 43 – PROCESS GAS AND LIQUID HANDLING PURIFICATION AND STORAGE

43 21 63 Submersible Pumps

END SECTION

SECTION 01 11 01

OWNER-FURNISHED CONTRACTOR-INSTALLED ITEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. Certain items required for the project will be furnished by the City of Los Banos 1500 and installed by the Contractor. Such items are referred to as “Owner-Furnished Contractor-Installed”. Items shall be transported to the project site by the Contractor at the Contractor’s expense. The Contractor shall coordinate pickup, drop-off and storage locations with the owner.

B. Contractor’s installation of items shall include attaching or anchoring items, connecting utilities and controls, lubricating and necessary adjustment, touch-up painting, startup, testing, placing items in service. If items are new, Contractor shall turn over operation and maintenance manuals and equipment warranties to the Owner.

C. The Contractor shall guarantee the equipment installed will function satisfactorily for a period of two (2) years from the date of initial operation. Parts, mechanisms or equipment found to be defective due to unsatisfactory workmanship/installation during this period shall be resolved until the lift station is satisfactorily operational by the Contractor without cost to the Owner.

*1.2 **OWNER-FURNISHED CONTRACTOR-INSTALLED ITEMS***

A. Specification section 43 21 63.

END SECTION

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SECTION 01 22 00

EXPLANATION OF BID ITEMS

PART 1 GENERAL

The Contract payment for the specified items of work as set forth in the Bid Schedule shall be full compensation for furnishing all labor, materials, methods or processes, implements, tools, equipment and incidentals and for doing all work involved as required by the provisions of the Contract Documents for a complete in place and operational system.

A. Unless otherwise specified in the Specifications, quantities of work shall be determined per each, or from measurements or dimensions in a horizontal plane. All materials shall be measured on the basis of "in place" quantities and paid for using the units listed in the bid schedule.

B. Except as noted, the Engineer will make field measurements of unit price items in order to determine the quantities of the various items as a basis for payment. On all unit price items, the contractor will be paid for the actual amount of the work performed in accordance with the contract documents, as computed from field measurements.

1. Work or quantities not listed in the description of bid items are considered incidental to other construction and will not be separately measured or paid for. Compensation for such work and/or material shall be included in the prices paid for other items of work.

1.2 BID ITEMS

Bid Item 1 – Mobilization, Shoring, Demobilization, Bonds and Insurance: Payment for this item shall include full compensation for all labor, materials, tools, equipment and incidentals making up the cost of mobilization, move-in, move-out, all necessary bonds, insurance, permits, licenses, and fees required during the performance of the work as specified. This item also includes mobilization, shoring, demobilization, including the removal of all equipment, supplies, personnel and incidentals from the project at the end of construction. Payment for mobilization shall be made with the first progress payment and shall not exceed 80 percent of the bid item amount. Payment for demobilization shall be made with the last progress payment and shall not be less than 20 percent of the bid item amount. This bid item will be paid for by Lump Sum.

Bid Item 2 – Sanitary Sewer Lift Station, F&I: This bid item includes installing owner furnished sanitary sewer lift station pumps and appurtenances including associated controls; anchorages, concrete structures, valve vaults, piping connections, testing, excavation, bedding, placement, trench backfilling, compaction and start-up services and shall be full compensation for furnishing all labor; equipment and materials to complete the installation as per the Plans and Specifications. This bid item will be paid for by Lump Sum, prorated, based on percentage of contract work completed.

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Bid Item 3 – **4-inch DIP Pipe, Bends and Fittings, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install 4" ductile iron pipes, bends and fittings to the lines and grades shown. Payment for this item shall be made on a Lump Sum basis, and shall include payment for all excavation, trench preparation, backfill, compaction, supports and other work required to result in a complete project. This bid item will be paid for by Lump Sum, prorated, based on percentage of contract work completed.

Bid Item 4 – **4-inch DIP Valves, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install 4" ductile iron valves to the lines and grades shown. Payment for this item shall be made on a Lump Sum basis, and shall include payment for all excavation, trench preparation, backfill, compaction, supports and other work required to result in a complete project. This bid item will be paid for by Lump Sum, prorated, based on percentage of contract work completed.

Bid Item 5 – **6-inch DIP Pipe, Bends, and Fittings, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install 6" ductile iron pipe, bends, fittings and restrained flange adapter to the lines and grades shown. Payment for this item shall be made on a Lump Sum basis, and shall include payment for all excavation, trench preparation, backfill, compaction, supports and other work required to result in a complete project. This bid item will be paid for by Lump Sum, prorated, based on percentage of contract work completed.

Bid Item 6 – **6-inch PVC, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install 6" PVC force main and restrained joints (including restrained joints on straight/horizontal pipe runs) to the lines and grades shown. Payment for this item shall be made on a Lineal Foot basis, and shall include payment for all excavation, trench preparation, backfill, compaction, supports, bedding, placement; trench backfilling, compaction and other work required to result in a complete project. This bid item will be paid for per Lineal Foot.

Bid Item 7 – **8-inch PVC, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install 8" PVC pipeline from proposed manhole to wet well and restrained joints (including restrained joints on straight/horizontal pipe runs) to the lines and grades shown. Payment for this item shall be made on a Lineal Foot basis, and shall include payment for all excavation, trench preparation, backfill, compaction, supports, bedding, placement; trench backfilling, compaction and other work required to result in a complete project. This bid item will be paid for per Lineal Foot.

Bid Item 8 – **Reconstruct Existing Lift Station Bottom:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to reconstruct the existing lift station bottom, as shown in plans and specified by the pump manufacturer plus all other work necessary to result in a complete and operating wet well in accordance with the Plans and Specifications. This bid item will be paid for by Lump Sum, prorated, based on percentage of work

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completed.

Bid Item 9 – **Electrical (wiring & appurtenances), F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install electrical meter conductor termination, scheduling deenergize/reenergize with PG&E, site power distribution, conduit, cable, grounding, light reconnection, and appurtenances as specified and all other work necessary to complete the installations in accordance with the Plans and Specifications. This bid item will be paid for by Lump Sum, prorated, based on percentage of work completed.

Bid Item 10 – **Electrical Power & Control Panel, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install the Electrical Power & Control Panel, and the communications/SCADA ready panel. This includes the cost for all components inside of the Power & Control Panel, including level elements, motor starters, pilot controls, PLC's, and appurtenances as specified and all other work necessary to complete the installations in accordance with the Plans and Specifications. This bid item will be paid for by Lump Sum, based on percentage of work completed.

Bid Item 11 – **Demolition (Removal: (E) Controls and Piping):** Payment under this item shall be considered full compensation for all tools, equipment and incidentals required to remove controls, piping and appurtenances as indicated on the drawings and specified. This bid item will be paid for by Lump Sum, prorated, based on percentage of work completed.

Bid Item 12 – **Wet Well Coating, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment, special inspections and incidentals required to apply a protective Wet Well Coating as indicated on the drawings. Bid quantity shown is estimated from approximate dimensions. This bid item will be paid for per Vertical Foot.

Bid Item 13 – **Bypass Pumping Vault and Manhole, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to furnish and install bypass valve vault, valves and appurtenances and bypass sanitary sewer manhole to the lines and grades shown. Payment for this item shall be made on a Lump Sum basis, and shall include payment for all excavation, trench preparation, backfill, compaction, supports, bedding, placement; trench backfilling, compaction and other work required to result in a complete project. This bid item will be paid for by Lump Sum, prorated, based on percentage of work completed.

Bid Item 14 – **Remove Concrete:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to remove concrete as indicated in plans. This bid item includes saw-cutting, concrete removal, excavation, and all other work required to result in fully removed concrete. Bid quantity shown is estimated from approximate dimensions. This bid item will be paid for per Square Foot.

Bid Item 15 – **Remove Asphalt Pavement:** Payment under this item shall be considered

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full compensation for all labor, materials, tools, equipment and incidentals required to remove asphalt pavement to install 6-inch force main. This bid item includes saw-cutting, pavement removal, excavation, and all other work required to result in fully removed asphalt pavement as indicated on the drawings. Bid quantity shown is estimated from approximate dimensions. This bid item will be paid for per Square Foot.

Bid Item 16 – **Concrete, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to replace the removed concrete (including slab, drive approach, sidewalk, curb and gutter) and match existing concrete as indicated on plans. This bid item includes preparation and compaction of subgrade, furnishing, grading and compacting the granular base material, forming, furnishing the portland cement concrete, placement, finishing and all other work required to result in a complete concrete construction. Bid quantity shown is estimated from theoretical dimensions. This bid item will be paid for per Square Foot.

Bid Item 17 – **Asphalt, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to replace the removed asphalt concrete pavement and replace the asphalt concrete section as indicated on plans. This bid item will include any necessary surface preparation such as compaction and grading of the existing base or native material, furnishing, spreading and compacting the aggregate base, furnishing, placing and compacting asphalt concrete pavement material, prime coat, asphaltic emulsion coating on vertical surfaces to abut the new pavement, and all other work required to result in an asphalt pavement meeting the requirements of the specifications. This bid item will be measured by the Square Foot of material placed within the limits shown on the Drawings. This bid item will be paid for per Square Foot.

Bid Item 18 – **Christy Boxes and Irrigation, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to remove and replace Irrigation lines and install proposed christy boxes and irrigation facilities as shown on plans. This bid item will be paid for by Lump Sum, prorated, based on percentage of work completed.

Bid Item 19 – **Wrought Iron Gates, F&I:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to remove and disposal of the existing chain link fence gates and replace with wrought iron gates with privacy sheet metal. This bid item will be paid for by Lump Sum, prorated, based on percentage of work completed.

1.3 ADDITIVE ALTERNATE BID ITEMS

Bid Item 20 – **Temporary Dewatering Operations:** Payment under this item shall be considered full compensation for all labor, materials, tools, equipment and incidentals required to dewater the project site necessary to complete construction. This bid item will be paid for by Lump Sum, prorated, based on percentage of work completed.

END SECTION

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SECTION 01 77 00

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 GENERAL

A. It is the intent of these Contract Documents that the Contractor shall deliver a complete and operable facility capable of performing its intended functions and ready for use.

1.2 CLEANING

A. Throughout the period of construction the Contractor shall keep the Work site free and clean of all rubbish and debris, and shall promptly remove from the site, or from property adjacent to the site of the Work, all unused and rejected materials, surplus earth, concrete, plaster, and debris, excepting select material which may be required for refilling or grading.

1.3 FINAL SITE CLEAN-UP

A. Upon completion of the Work, and prior to final acceptance, the Contractor shall remove from the vicinity of the Work all paint, surplus material, and equipment belonging to him or used under his direction during construction.

B. The Contractor shall restore to original condition all property not designated for alteration by these Contract Documents.

1.4 FINAL BUILDING CLEAN-UP

A. On all building projects and wherever else applicable, besides general broom cleaning, the following special cleaning shall be performed at completion of the Work:

1. Hardware shall be cleaned and polished of all traces of stains, dust, dirt, paints, and blemishes.

2. Equipment shall be cleaned and stains, paint, dirt and dust shall be removed.

3. Dust, cobwebs, and traces of insects and dirt shall be removed.

1.5 WASTE DISPOSAL

A. The Contractor shall dispose of surplus materials, waste products, demolition materials, and debris. The Contractor shall transport and dispose of waste materials in accordance with applicable laws and regulations.

1.6 PROJECT RECORD DOCUMENTS

A. The Contractor shall maintain at the site, available to the Owner and Engineer, one copy of the Contract Documents, Drawings, Shop Drawings, Change Orders, and other modifications in good order and annotated to show all changes made during construction. These Documents shall be delivered to the Engineer for the Owner upon completion of the Work.

B. Record documents shall be reviewed during progress meetings to ascertain that all changes have been recorded.

C. Store Record Documents separate from documents used for construction.

1.7 TOUCH-UP AND REPAIR

A. The Contractor shall touch-up or repair finished surfaces on structures, equipment, fixtures, or installations that have been damaged prior to final acceptance. Surfaces on which such touch-up or repair cannot be successfully accomplished shall be completely refinished or in the case of hardware and similar small items, the item shall be replaced. Such items shall include, but not be limited to, the following:

1. Road surfaces

2. Sidewalk and Driveway surfaces

3. Exposed equipment surfaces

4. Exposed piping surfaces

1.8 EQUIPMENT START-UP

A. After all acceptance tests have been completed by the Contractor and Owner but prior to final acceptance, the Contractor shall recheck all equipment for proper alignment and adjustment, check oil levels, re-lubricate all bearings and wearing points, and in general assure that all equipment is in proper condition for continuous operation.

1.9 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The contractor shall provide operations and maintenance manuals for all equipment to the City prior to final project acceptance.

1.10 FINAL EQUIPMENT CHECK

A. After testing and before acceptance, all equipment shall be test run by the Owner for a minimum of 7 days to ensure proper operation. At the end of the test run each piece of machinery shall be lubricated and all components and couplings checked for proper alignment and adjustment.

B. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

C. Provide submittals to the Owner required by other governing authorities.

1.11 MANUFACTURER'S CERTIFICATES OF PROPER INSTALLATION

A. The Contractor shall submit manufacturers' certificates of proper installation for all items of equipment.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

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SECTION 02 01 20

PROTECTION OF UNDERGROUND FACILITIES AND SURVEY MONUMENTS

PART 1 GENERAL

1.1 UNDERGROUND FACILITIES

A. Shown or Indicated*:* The information and data shown or indicated in the Contract Documents with respect to existing underground facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such underground facilities, including Owner, or by others.

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and

2. The cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. Reviewing and checking all such information and data,

b. Locating all Underground Facilities shown or indicated in the Contract Documents,

c. Coordination of the Work with the owners of such underground facilities, including Owner, during construction, and

d. The safety and protection of all such underground facilities and repairing any damage thereto resulting from the Work.

B. Not Shown or Indicated: If an underground facility is uncovered or revealed at or contiguous to the Project site which was not shown or indicated with reasonable accuracy in the Contract Documents, the following shall apply.

1. Contractor shall develop and execute a workplan, subject to Engineer's approval to protect underground facilities.

2. The Contractor shall expose, prior to staking and trenching, all existing utilities and existing facilities which may control proposed facility grades, and alignment. A two working day notice shall be given to the Engineer prior to commencing this work.

3. Full compensation for all costs involved in locating, verifying, protecting, exposing, and otherwise providing for utilities shall be included in the amounts bid for the various items of work, and no separate payment shall be made therefore.

1.2 PROTECTION

A. The Contractor shall not interrupt the service function or disturb the supporting base of any Utility by disrupting any facility identified in the Plans and Specifications without authority from the Owner or order from the Engineer. Where protection of such facilities is required (including existing irrigation facilities) to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at the Contractor's expense.

B. The Contractor shall be prepared at all times with labor, equipment and materials to make repair on damaged mains or Utility facilities. The Contractor shall immediately notify the Engineer and the Utility owner if he disturbs, disconnects or damages any Utility. The Contractor shall bear the costs of repair or replacement of any utility facility described with reasonable accuracy in the Plans and Specifications that is damaged by the Contractor. No extra compensation will be made for the repair of any services or mains damaged by the Contractor, nor for any damage incurred if the neglect or failure of providing protective barriers, lights and other devices or means required to protect such existing utilities or facilities described with reasonable accuracy in the Plans and Specifications.

1.3 SURVEY MARKERS AND PERMANENT REFERENCE POINTS

A. Surveying and Permanent Survey Markers

The Engineer will take measurements to assure the preservation of survey markers (monuments and bench marks). The Contractor shall not disturb permanent survey markers without the consent of Engineer and shall bear the expense of replacing any that may be disturbed without permission.

1. Replacement of survey markers shall be done only by the Engineer.

2. If disturbing of markers cannot be avoided, the Owner shall pay the cost of replacing said markers.

B. Lot Corner Monuments

The Contractor shall preserve property line and corner survey markers except where their destruction is unavoidable and the Contractor is proceeding in accordance with accepted practice. Markers that are lost or disturbed by his operations shall be replaced at the Contractor's expense by the Engineer. A corner record shall be filed in accordance with State law for any reset monuments at the Contractor’s sole expense.

END SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.1 DESCRIPTION

A. The work of this section consists of demolition and removal of pavements, slabs, miscellaneous debris, pumps, control boxes, barriers, salvaged items, and portions of abandoned utilities.

1.2 WORK INCLUDED

A. Repair and restoration of areas damaged due to demolition work.

B. Salvaging of equipment as directed by the Owner.

C. Removal of demolished materials from site.

D. Remove existing piping and other existing structures as shown on the Plans to be removed.

E. Properly dispose of all removed materials which are not salvaged for Owner.

1.3 RELATED WORK

A. Section 03 30 01 – Cast-In-Place Concrete (Site Work)

B. Section 31 23 17 – Trenching, Backfilling and Compaction

C. Section 32 12 16 – Asphalt Concrete Paving

1.4 SEQUENCING

A. Sequence work to minimize interference with sewer lift station operations.

1.5 REGULATORY REQUIREMENTS

A. Obtain required permits from City of Los Banos.

1. Business License

B. Dispose of removed materials in an approved disposal or salvage facility.

C. Contractor and all subcontractors shall obtain City of Los Banos business license.

1.6 REFERENCES

A. Section 19 – Earthwork, State Standard Specifications

B. Section 39 – Asphalt Concrete, State Standard Specifications

C. Section 90 – Portland Cement, State Standard Specifications

1.7 SUBMITTALS

A. Submittals shall be in accordance with the General and Special Provisions.

B. Demolition plan including sequence of operations. The plan shall specifically address methods of demolition, schedule, sequence of demolition, and procedures for archeological monitoring. Demolition shall not proceed until the plan has been approved.

1.8 QUALITY ASSURANCE

A. General: Take all necessary precautions with regard to safety in carrying out the demolition and site work. Erect suitable barriers around open excavations and fulfill all appropriate requirements of CAL/OSHA. Comply with safety requirements for demolition, ANSI A10.6-90.

1.9 PROJECT CONDITIONS

A. Underground utilities exist at this site. Contractor shall take all necessary precautions to protect said utilities. Notify Engineer of any deviation in utility location from that which is shown on the drawings.

B. Keep dust to a minimum at project site. Use sprinklers or water trucks as necessary or as directed by the Engineer.

C. Ensure safety of persons in demolition area. Provide temporary barricades as required.

D. Excavations may encounter groundwater and require dewatering depending on the time of year and amount of seasonal run-off. Loose sands exposed in excavation sidewalls may be unstable and require shoring or lying back in accordance with OSHA requirements. Flowing sands may also be encountered in excavations below groundwater levels. If dewatering is necessary due to shallow groundwater, Additive Alternate bid item 21 will be added to contract.

1.10 CLOSEOUT SUBMITTALS

A. As specified in Section 01 77 00 – Contract Closeout.

B. Show all capped and abandoned utility terminations and location of remaining facilities on project Record Drawings.

PART 2 PRODUCTS

2.1 REPAIR AND RESTORATION MATERIALS

A. Asphalt and concrete shall match existing materials and conditions.

B. Asphalt and concrete shall be replaced in conformance with project specification and City of Los Banos Standards.

2.2 MATERIALS

A. Salvaged Materials: Materials to be salvaged shall remain the property of the Owner and shall be stockpiled as directed by the Engineer. Contractor shall inventory all salvaged materials. Stockpiled materials shall be free of hazardous substances.

B. Items to be Salvaged and Relocated shall be salvaged and/or relocated as shown on the drawings, or as directed by the Engineer.

C. Materials and items demolished and not designated for reuse, salvage or transfer to the Owner, as well as all debris, rubbish and other materials resulting from the demolition operations, shall become the property of the Contractor and shall be removed from the site within 48 hours of demolition.

D. Storage or sale of the removed items will not be permitted at the site.

PART 3 EXECUTION

3.1 INSPECTION

A. Prior to demolition, inspect the site conditions, verifying all governing dimensions, notes and specifications. Notify the Engineer of any errors or omissions in the contract documents.

B. Make such explorations and probes as are necessary to ascertain any required protection measures before proceeding with the demolition and removal work.

3.2 PREPARATION

A. Protect existing, appurtenances, structures, which are not to be demolished.

3.3 DEMOLITION REQUIREMENTS

A. Conduct demolition to protect and minimize damage to structures and existing improvements.

B. Conduct salvaging to protect and minimize damage to salvaged equipment.

C. All work within City right of way shall conform to Section 15 of the State Standard Specifications.

D. Execute the work in a careful, orderly and safe manner, with the least possible disturbance to the public. Cease operations immediately if adjacent work appears to be endangered. Do not resume operations until corrective measures have been taken.

E. Pavement and Slabs:

1. Remove completely all Portland cement concrete slabs-on-grade including, but not limited to, equipment pads, sidewalks, etc.

2. Saw cut existing asphalt concrete pavements cleanly in straight continuous lines. Remove asphalt concrete pavement as shown on the drawings.

F. Items to be Salvaged: Remove as directed by the Engineer. Remove carefully. All salvaged material remains the property of the Owner. Store where directed by the Engineer.

3.4 SALVAGE EQUIPMENT

A. Items to be salvaged will be directed by the owner.

B. Salvaged equipment shall be delivered to the Owner at a designated site within the project site. Salvaged equipment shall be placed on wood or concrete blocks so the equipment will be 4 inches minimum above ground elevation.

3.5 ORDER OF WORK

A. Contractor to install operate and maintain bypass pumping to ensure that the existing force main and gravity sewer remain in operation until the rehabilitated lift station system is in operation. Contractor shall submit temporary bypass pumping plans to Owner for approval at least 10 days prior to bypass pumping. Contractor shall not begin work until the bypass plan is approved by the City. Bypass pumping will remain in effect until the lift station has been deemed operational by the City.

3.6 PRESERVATION

A. If indicated or required, preserve trees, plants, rock outcroppings, or other features designated to remain. Protect trees and plants from damage; fell trees in a manner which shall not injure standing trees, plants and improvements which are to be preserved.

3.7 RESTORATION

A. All demolition areas, staging/stockpiling, and open excavations shall be filled in accordance with the Plans. Fill all open excavations deeper than one foot to an elevation to match the surrounding topography.

3.8 DISPOSAL

A. As specified in the General and Special Provisions.

END SECTION

SECTION 03 30 01

CAST-IN-PLACE CONCRETE (SITE WORK)

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work required under this section consists of furnishing all materials, supplies, equipment, tools, transportation, and facilities, and performing all labor and services incidental to furnishing and installing concrete work as described in this section of the Specifications, shown on the accompanying Plans, or reasonably implied therefrom, except as hereinafter specifically excluded. The work shall include, but is not necessarily limited to:

1. All form work including special forms as required for any special construction and/or to accommodate the work of others and removal of forms.

2. All concrete reinforcement, placement, bending and forming thereof.

3. All concrete and cement finishing, all surface treatment and curing including non-slip finishes.

4. Installation of all reglets, bolts, anchors, cans, sleeves, column bolts, etc., whether furnished under this section or by others.

5. The furnishing of all items required to be or shown on the Plans as embedded in concrete, which are not specifically required under other sections.

6. Setting headers and screens finishing, curing, and protecting concrete.

B. Where prior inspection and test of materials are required, documentary evidence, in the form of test reports, shall be furnished prior to the time the material is incorporated into the work. All rejected material shall be promptly removed from the premises.

1.2 REFERENCES

A. American Concrete Institute (ACI)

B. American Society for Testing and Materials (ASTM)

C. State Standard Specifications

D. California Building Code (CBC)

1.3 DEFECTIVE WORK

A. Work considered to be defective may be ordered, by the Engineer, to be replaced in which case the Contractor shall remove and replace the defective work at his

expense. Work considered to be defective shall include, but not be limited to, the following:

1. Concrete incorrectly formed, or not conforming to details and dimensions on the Plans or with the intent of these documents or concrete the surfaces of which are out of plumb or level.

2. Concrete in which defective or inadequate reinforcing steel has been placed.

3. Concrete containing wood, cloth, or other foreign matter, rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the Plans.

4. Concrete below specified strength.

1.4 SUBMITTALS

A. Provide material certificates, mix designs including laboratory testing, shop fabrication and placement drawings, and schedule for all reinforcing steel, embedded items, form release and curing compounds.

PART 2 PRODUCTS

2.1 CONCRETE

A. Concrete shall conform to Section 90 of the State Standard Specifications. Unless otherwise shown on the plans or specified in other sections, all concrete shall conform to the following table of Portland cement mix requirements and minimum 28-day compressive strength. Portland cement shall be Type II.

Location	Mix Requirements
Paving, Exterior Slabs, and Sidewalks Exposed to Freezing	3,500 PSI, F1, S0, W1, C1 (W/C Max 0.55)
Paving, Exterior Slabs, and Sidewalks	2,500 PSI, F0, S0, W1, C1
Structural Footings and Interior Slabs	3,000 PSI, F0, S0, W1, C1
Walls, Beams, and Columns Where there is Human Occupancy	4,000 PSI, F0, S0, W0, C0
Buildings for Ag Occupancy Only (i.e., Commodity Barn)	4,000 PSI, F0, S1, W1, C1 (W/C Max 0.40)
Structural Concrete Exposed to Sewage/Manure (5.5 Sack Minimum)	4,500 PSI, F0, S1, W2, C1 (W/C Max 0.50)
Structural Concrete for (Check) Structure (5.5 Sack Minimum)	4,000 PSI, F0, S0, W2, C1 (W/C Max 0.50)
All Other Structural Concrete	4,000 PSI, F0, S0, W0, C0

1. Water/cement ratio shall not exceed 0.45 (by weight).

2. Slump at placement shall be 4 inches +/- 1 inch.

2.2 AGGREGATE

A. Aggregate for normal weight concrete shall conform to Section 90-1.02C, “Aggregates” of the State Standard Specifications. Aggregates shall be free of dirt, clay balls, roots, bark and other deleterious substances and shall be thoroughly washed before use.

B. The combined aggregates for concrete shall conform to the grading limits for the one-inch, maximum size specified in Section 90-1.02C(4)(d), “Aggregate Gradation” of the State Standard Specifications, Combined Aggregate Gradings.

2.3 WATER

A. Water shall comply with Section 90-1.02D, “Water” of the State Standard Specifications, and shall be clean and free from injurious amounts of acids, alkalis, salts, oils, organic materials or other deleterious substances.

2.4 FLYASH

A. Fly Ash: Shall comply with SSS Section 90-1.02B(3), “Supplementary Cementitious Materials”, and shall comply with AASHTO M 295, Class F or N.

1. Type of fly ash shall be compatible with the type of cement and the intended use of the concrete.

B. The combined weight of fly ash conforming to AASHTO M 295, Class F or N shall not exceed the amount provided for in Section 90-1.02B(3), “Supplementary Cementitious Materials” of the State Standard Specifications.

2.5 ADMIXTURES

A. Admixtures shall comply with Section 90-1.02E, “Admixtures”, of the State Standard Specifications

B. Air Entraining: ASTM C260

C. Water Reducing: ASTM C494, Type A, D or F

D. Accelerating: ASTM C494, Type C or E

1. No admixture containing any chloride ions is acceptable.

E. Retarding: ASTM C494, Type B, D or G

2.6 REINFORCING STEEL

A. Rebar shall be ASTM A615, Grade 60.

B. Welded wire fabric shall conform to ASTM A1064.

2.7 EXPOSED-TO-VIEW CONCRETE

A. For exposed-to-view concrete, where legs of metal supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I).

B. Metal bar supports in slab covers for sewage-containing structures shall also be provided with plastic coated legs.

2.8 FORM MATERIALS

A. Exposed Concrete: Plywood complying with U.S. Plywood Standard PS-1 “BB (Concrete Form) Plywood” Class I, or better.

B. Textured Finish Concrete: Units of face design, size arrangement and configuration to match control sample.

C. Form Release Agent shall leave behind a paintable concrete surface.

1. Release #1, The Burke Co., or Engineer approved equivalent.

2.9 CURING MATERIALS

A. Polyethylene film

B. Reinforced waterproof paper

1. Sisal Kraft, Orange Label, or approved equal.

C. Liquid-membrane curing compound

1. Curing compound shall comply with ASTM C309, Type 2.

a. White pigmented material

b. Clear pigment may be used for concrete that will be exposed to public view.

PART 3 EXECUTION

3.1 REINFORCING STEEL

A. Comply with CRSI, “Placing Reinforcing Bars” and as specified herein.

B. Place reinforcing steel and embedded items in accordance with approved shop drawings.

C. Splicing of bars shall be by lapping. Lapped splices shall be 50 bar diameters for bar size through #6 and 62 bar diameters for larger bars, unless otherwise shown on the Plans.

D. Splicing of the wire fabric shall be by lapping. Lapped splices shall be two full mesh, minimum.

E. All rebar in vertical walls shall be supported by concrete block spacers or metal chairs.

F. Prior to placement of the concrete, reinforcing steel shall be cleaned and free of all concrete, dirt, oil, mill scale, rust or other coatings that would reduce or destroy the bond.

G. All reinforcing steel and embedded items shall be reviewed and approved by the Engineer prior to concrete placement.

3.2 FORMS

A. All forms shall be cleaned and an approved agent applied each time they are used and shall be so constructed and set as to resist, without springing or settlement, the pressure of the concrete and the placing operations.

B. In designing forms and falsework, the concrete shall be treated as a liquid weighing at least 150 lbs. per cubic foot for vertical loads and not less than 85 lbs. per cubic foot for horizontal pressure. The design of the forms and falsework system shall include allowances for temporary construction loads. The rate of placement of concrete shall be so regulated that the pressures caused by the wet concrete will not exceed the designed form pressure. The unsupported length of wooden columns and compression members shall not exceed 30 times the width of the least side.

C. All forms shall be set and maintained in true alignment, grade and section until the concrete has sufficiently set. The interior surfaces of forms shall be adequately treated with an acceptable material to insure non-adhesion of mortar. All forms shall be mortar-tight. When forms appear to be unsatisfactory in any way, concrete placement shall be stopped until the defects have been corrected.

D. All exposed outside corners, including the top edges of all walls, machinery bases and curbs shall have a ¾-inch chamfer.

E. Metal tie rods or anchorages within the forms shall be fitted with suitable cones or comparable devices. Metal tie rods or anchorages shall be removed to a depth of 1" from the surface without injury to the concrete. All fittings for metal ties shall be of such design that upon their removal, the cavities which are left will be of the smallest possible size, but of sufficient diameter to allow the cavity to be "dry packed" with cement mortar. The cavities shall be filled with cement mortar and the surface left sound, smooth and even.

F. Form release agent shall be applied to the form so that no agent comes in contact with reinforcing steel.

3.3 PLACING

A. All concrete shall be placed before it has taken its initial set and shall be placed in horizontal layers and in such a manner as to avoid segregation. The concrete adjacent to the forms and joints shall be thoroughly consolidated with a vibrator operating at not less than 4,500 vibrations per minute.

1. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity.

2. Loss of slump in pumping shall not exceed $1^1/_2$ -inch.

3. Concrete shall not be placed through reinforcing that may cause separation of aggregates.

B. The concrete shall be deposited as nearly as possible in its final position. Drop chutes and elephant trunks shall be used on drops greater than 5 feet. Concrete shall be placed at such a rate that all concrete in the same lift will be deposited on plastic concrete. The concrete comprising each unit of work shall be placed in a continuous lift.

C. The Contractor shall notify the Engineer 24 hours (1 working day) prior to concrete placement.

1. The form work and reinforcing steel placement shall be approved by the Engineer prior to ordering concrete.

D. Form Removal. Minimum times for removal after concrete placement are as follows:

Beam sides but not shoring	3 days
Column forms and wall forms	2 days
Forms for supported slabs but not shoring	14 days

E. Construction Joints

1. At ends of the first concrete pour, ensure the end forms of walls are removable without releasing the side forms. Provide seals around reinforcement and water stop to prevent mortar leaks.

2. Overlap the hardened concrete of the first pour with forms for the second pour. Brace the ends of the forms against the hardened concrete to prevent joint offsets and mortar leakage. Align any exterior features required on the finished surface.

3.4 CONCRETE JOINTS

A. Control Joints:

1. Space typical control joints in slabs on grade or suspended slabs not exceeding 10 feet. Control joints shall not be provided in water containment structures.

2. If cast-in with the concrete, positively locate the preformed joint filler and hold rigidly in place during concreting.

3. If saw-cut, use a wheeled power saw as soon as the concrete surface is firm enough. Saw-cut control joints must be constructed within 8-hours after concrete placement. Fill the groove with sealant over a backer rod.

B. Construction Joints:

1. Produce quality concrete, with full continuity of reinforcing and water tightness across the joints.

2. Space typical slab joints not exceeding 20 feet in the direction of the transverse or secondary reinforcing, typically the smaller reinforcing nearer to the center of the slab thickness. Space typical vertical wall joints no more than 30 feet apart.

3. After the first concrete placement at the joint, do not walk on or disturb any reinforcing extending into the second placement area for at least 48 hours.

4. Before depositing new concrete on or against concrete that has hardened, clean and roughen the entire surface of the joint exposing clean coarse aggregate solidly embedded in mortar matrix. Provide typically 1/4-inch roughness or amplitude of the concrete surface measured from the top of the exposed aggregate to the bottom of pockets between stones.

5. Drench the prepared joint with clean water and remove prior to the concrete pour.

6. Cover horizontal wall joints and wall-to-slab joints with a minimum thickness of 2 inches and a maximum of 6 inches of the modified concrete mix, consisting of the designated concrete mix with one-half of the coarse aggregate removed.

7. For joints that are shown on architectural drawings as having a continuous reveal or recess, leave the wood form or pour strip used to create the reveal or recess in place or re-insert before roughening. Prevent the next concrete placement from filling the reveal or recess.

C. Expansion Joints

1. Stop all steel reinforcing clear of the joint at each side.

2. Prepare a smooth first concrete surface with all voids filled.

3. Provide preformed joint filler, securely fastened to the existing concrete as directed by the Manufacturer.

4. Install bond breaker and sealant after curing is completed and when directed.

D. Bonding to Pre-existing Concrete: Mechanically roughen the old surface to a 1/4-inch amplitude, as defined in construction joint paragraph above. Apply epoxy bonding material prior to concreting, as recommended by the manufacturer.

3.5 CONCRETE CURING

A. Exposed concrete surfaces shall be protected from premature drying by covering as soon as possible with canvas, plastic sheets with sealed joints, burlap, sand or other satisfactory materials and kept continuously moist; or, if the surfaces are not covered, they shall be kept continuously moist by flushing or sprinkling.

1. Curing shall continue for a period of not less than 7 days after placing the concrete. If curing compound is used, two (2) applications will be made for even coverage. Curing methods must be approved by the Engineer.

3.6 FINISHING

A. Defective and honeycombed surfaces shall be chipped back to such a depth to expose solid concrete. The surface shall be dampened and coated with a bonding agent and packed with mortar.

B. Concrete Finishes for Vertical Wall Surfaces:

1. Form facing material shall produce a smooth, hard, uniform texture.

a. Use forms specified for surfaces exposed to view in accordance with the Plans and other Specification Sections.

2. At a minimum, repair the following surface defects:

a. Tie holes

b. Honeycombs deeper than ¼”

c. Air pockets deeper than ¼”

d. Rock holes deeper than ¼”

e. Scabbing

3. Chip or rub off fins exceeding 1/8” in height.

4. Provide SF/ESF 3.0 finish and a smooth-rubbed finish for:

a. Walls being waterproofed, painted, coated with some other material.

b. Use at all exposed surfaces not specified to receive another finish.

C. Concrete Finishes for Horizontal Slab Surfaces:

1. General: Tamp concrete to force coarse aggregate down from surface. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains. Dusting of surface with dry cement or sand during finishing processes not permitted.

2. Slab Finish shall be as follows:

a. Surfaces intended to receive damp proofing or water proofing membranes: Float finish.

b. Floors intended to receive floor coverings and MCC rooms: Trowel finish.

c. Sidewalks, garage floors, drive-throughs and ramps: Broom finish.

d. Exterior slabs, platforms, steps and landings, exterior and interior pedestrian ramps and interior stairs and all process equipment areas, not covered by other finish materials: Broom finish.

3. Deviation in finish surface shall not exceed ¼" in 10 ft.

4. No tolerance will be allowed that will result in the maximum running, or cross, slope exceeding the requirements of the Americans with Disabilities Act.

3.7 TESTING

A. Testing of concrete shall be as required by the Engineer and in accordance with ACI 301, Chapter 1.6.

1. All costs of initial testing will be paid by the Owner unless otherwise noted.

2. All costs involved, including those required by the Engineer, in retesting of concrete required because of a failure to meet these Specifications shall be at the expense of the Contractor.

3.8 WATERTIGHTNESS OF CONCRETE WORK

A. It is the intent of this Specification to obtain concrete and grout with homogenous structure, which when hardened will have the required strength, is watertight, and resistance to weathering.

END SECTION

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SECTION 03 36 00

CONCRETE LINING FOR CORROSION PROTECTION

PART 1 GENERAL

1.1 WORK INCLUDED

A. This specification includes furnishing at the contractor's price, all permits, insurance, labor, materials, supervision, equipment, tools, and associated quality control tests necessary to perform the required cleaning, surface preparation, linings application, and clean up to designated areas identified in this specification, on drawings, or "job walks" provided at the jobsite for new linings on the interior of concrete structures as shown on the plans and as identified by the City.

1.2 QUALITY ASSURANCE

A. Any conflicts or inconsistencies found to exist in this specification should immediately be brought to the City's attention in writing. The Contractor shall provide a City approved third-party lining inspector qualified N.A.C.E. III to provide inspection services for the lining application.

B. The Supplier's latest published instructions for the proper use and application of the lining materials are a part of this specification.

C. All welding, burning, cutting, grinding, and other such repairs shall be complete prior to commencing abrasive blasting and/or application of the lining material.

D. This specification requires Contractor compliance with all environmental safety and worker safety regulations affecting the scope of this work.

E. The contractor shall demonstrate, by reference or other suitable means, the capability to provide the craftsmanship, experience, and equipment necessary to perform satisfactorily to this specification. This shall include detailed procedures describing how the following will be accomplished: Surface preparation, lighting, ventilation, material storage, heating, material mixing, and application of the lining materials to the City's satisfaction. The contractor shall be a licensed lining contractor and shall be approved by the manufacturer of the proposed lining system. The contractor shall have a minimum of 5 years experience applying the approved lining system and shall show by reference 5 projects of similar size and scope with contact names and phone numbers at the request of the engineer. The contractor shall possess a C-33 license. The contractor shall be licensed and certified as an approved applicator by the proposed lining material manufacturer and shall provide this certification with their bid. The contractor shall be licensed to apply the polyurethane system proposed using the gas injection method known as ECOSYSTEM® and shall provide this documentation with their bid.

F. The proposed material manufacturer shall have been in the regular business of manufacturing the approved lining system for a minimum of 15 years. They shall

show by reference a minimum of five projects that are 15 years old and in service today including contact names and phone numbers at the request of the engineer.

G. This specification requires that the environmental conditions shall be controlled from start to finish of this job to help assure quality work is completed in a timely manner or specified time as may be stated elsewhere in this specification.

H. All materials and equipment brought to the jobsite to perform work shall be promptly removed from City's property at the completion of work except the installed lining, unless otherwise specifically agreed to with the City.

I. Used grit generated during abrasive blasting may be classified as hazardous waste. Laboratory testing, classification, and determination of disposal methods are mandatory. Documentation of the above items shall be submitted and approved by City before removal from the jobsite.

J. Abrasive blasting operations, cleaning operations, and lining material applications are not permitted in the same area at the same time or before lining materials have dried.

K. All surfaces subject to damage by blasting, cleaning and lining operation, such as, exterior coated surfaces, machined surfaces, valve stems, nameplates, pump shafts, meters, sight glasses, machinery bearings, and other such items shall be protected. All protective wraps or tape shall be removed upon completion. All damaged external areas shall be repaired to the original condition.

L. All work shall be scheduled and performed in cooperation with the City to maintain effective operations within "NORMAL WORKING HOURS."

M. All workmanship shall be of journeyman quality, performed by skilled and competent craftsmen. The City reserves the right to have the Contractor remove any workman who, in the opinion of the City's representative, refuses to perform or is incapable of performing satisfactory and acceptable work, or who violates any safety rules or practices of the City, County, and/or State ordinances and laws.

1.3 REFERENCED STANDARDS

A. Referenced standards shall be the latest revision unless otherwise specified.

B. Steel Structures Painting Council, National Association of Corrosion Engineers, and American Society for Testing and Materials Standards as follows:

DESIGNATION	**DESCRIPTION**
SSPC-SP1	Solvent Cleaning
SSPC-SP2	Hand Cleaning
SSPC-SP3	Power Tool Cleaning
SSPC-SP5	White Metal Blast Cleaning
SSPC-SP6	Commercial Blast Cleaning
SSPC-SP10	Near White Blast Cleaning
SSPC-SP 12	Low Pressure Water Jet
SSPC-SP13	(1999) Surface Preparation of Concrete NACE No. 6
SSPC-VIS1	Pictorial Surface Preparation Standards

NACE-Std.-RPO178-78	Design, Fabrication & Surface Finish Metal Tanks & Vessels Lined for Chemical Immersion Service
NACE-Std.-RPO188-88	Discontinuity (Holiday) Testing of Protective Coatings
NACE-Std.-RPO288-88	Inspection of Linings on Steel and Concrete
ASTM D 4263-83	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ANSI/ASTM D4541	Test Method for Pull-Off Strength of Coatings Using Portable Adhesion-Testers

C. Technical Definitions:

1. 100 Percent Solids: Coatings containing zero volume solvent: zero VOC

2. VOC: Volatile Organic Compound

3. Plural Component: An application unit that will pump, heat, proportion, mix, and deliver the two (or more) component materials utilizing airless or conventional spray guns, or pour nozzles. The individual components are supplied to the heaters and proportioning pump through separate feed pumps, with the materials being pressurized and metered by the proportioning pump and then transferred to the mixer/manifold through individually heat-traced material lines. At the mixer/manifold, materials meet and are intimately blended before deposition onto the substrate by airless or conventional spray, or pour nozzles, as a non-stressed, seamless monolithic lining system.

4. Single Coat: A deposition of the material to the required thickness through multiple passes comprising of a single application in which no period greater than one hour is required to allow the material to "set" before continuing to build to specified thickness.

5. Recoat Window: The period of time that has passed when it is acceptable to apply succeeding coats without additional surface preparation.

6. Durometer: An inspection tool used to determine the hardness (indicative of level of cure) in an applied polyurethane film.

PART 2 PRODUCTS

2.1 LINING SYSTEM:

A. The applied lining material shall be a two-component (2:1 mix by volume) chemically reactive product specially formulated 100 percent solids, aromatic, MDI, pure elastomeric polyurethane lining system, ASTM type V, and shall be applied using a heated "plural component" proportioning equipment system designed for high pressure airless spray (maximum 2500 psi) for a minimum distance from the proportioner to meet job conditions. 1:1, 3:1 or any proportion other than 2:1 ratio polyurethane formulations shall not be considered as equal to the 2:1 ratio material. The lining material shall contain no extenders or fillers, shall not be a hybrid and shall exhibit the following physical properties and test values.

Tensile strength per ASTM D638..... 2800-3000 psi

Elongation per ASTM D638 ..... 40%-65%
Abrasion resistance per ASTM D4060..... < 54 mg loss
Impact resistance per ASTM G-14.....210 inch pounds
Water Vapor permeability per ASTM D1653-91A.....048grms/24 hours/ft2
Atlas Cell test NACE TM-04-74 Test Procedure A ..... 12 months No Effect

B. Maximum recoat window of 24 hours.

C. The liner material shall be Endura Flex EF1988®. No substitutes allowed.

D. The Contractor shall name the Supplier and provide written certification from the manufacturer of the proposed materials, compliance with current Contractor approvals and licenses to apply the material at the time of bid submittal.

E. All materials shall be received at the jobsite in their original unopened containers with labels intact. Batch numbers for all components of the lining system shall be recorded and copies made available for the City.

F. All materials shall be stored where they are protected from the weather and dampness. Storage temperatures shall be those recommended by the manufacturer.

2.2 EQUIPMENT REQUIREMENTS

A. Contractor shall utilize Plural Component proportioning equipment capable of pumping two separate streams of polyurethane components at the required ratio volumetrically.

B. Contractor shall have capability to heat the two different liquid components to a process temperature range from 100^0 to 110^o Fahrenheit (38^0 to 42^o C). The use of band heaters is NOT acceptable.

C. Contractor shall have capability to maintain process temperature to spray through a gun or pour through the nozzle. The use of insulated heat-trace fluid lines is mandatory.

D. Contractor shall have capability to pump at pressures ranging from 1200 PSI to 3000 PSI.

E. Contractor shall have capability to bring the two separately proportioned streams together as one stream and mix them together to provide a homogeneous mixture for reacting into a solid polymer of known properties.

F. Contractor shall provide spray atomization tip sizes matched to the pumping equipment output which provides a fully atomized spray pattern, free of "fingers" without the addition of solvents of any kind.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Concrete General: Voids, bug holes, tie holes, or cracks in the concrete should be filled/sealed using the following methods:

1. Cracks that exceed 1/16” shall be filled with industry recognized epoxy injection procedures.

2. Surface voids shall be filled per approved lining manufacturer’s recommendations.

3. Form fins and sharp offsets, protrusions, or similar irregularities projecting from the concrete surface shall be removed by chipping, bush hammering, needle gunning, wire brushing, or other mechanical means.

4. Water seepage into or through the concrete shall be stopped and concrete thoroughly dried by suitable means before the system is applied.

B. Expansion Joints and Terminations:

1. Expansion Joints: Expansion joints shall be sealed with a bond breaker tape (polyethylene-backed adhesive tape such as used for wrapping pipe joints is acceptable). Before installation of the bond breaker tape, remove sharp protrusions, verify the surface is clean and dry, and inspect to assure that joint filling material is reasonably flush with top of expansion joint. The tape shall be installed centered over the joint and be of sufficient width to extend a minimum of one inch onto the concrete on both sides of the joint. Tape thickness should be no more than 60 mils maximum. The bond breaker tape shall be top coated with EF-1988 to the minimum specified thickness plus an extra 20 mils for added strength since there is no bond to the substrate in these areas.

2. Leading Edges/Terminations: All surfaces specified for lining application that do not include a well defined beginning or ending shall be mechanically anchored to a dry, clean saw cut to a minimum depth of 1/4 inch and width of 1/8 inch. The EF-1988 solid base coat shall be applied into the saw cut to full depth. After installation of the leading edge, the area shall be top coated with EF-1988 material. Adjacent areas not scheduled for lining shall be taped off and protected from overspray.

C. Abrasive Blast Cleaning:

1. Concrete Surface Cleanliness: Sprinkle water on the dried suspect concrete surface. If the water spreads out immediately instead of standing as droplets, it may be concluded that the surface is not contaminated by oils or dust. If droplets are found, use the procedure stated in Paragraph 3.1 C.2 or C.3, as appropriate.

2. Chemical Cleaning: The site shall be maintained free of debris, water, oil, grease, silicones, wax, pitch, and other types of oily substances. Surfaces showing evidence of such contaminants shall be cleaned using solutions of caustic soda or trisodium phosphate. They should be applied with vigorous scrubbing, followed by flushing with fresh water to remove all traces of both the detergent and contaminant and shall then be thoroughly dried.

3. Abrasive Blast Cleaning: Oil and grease that have soaked into the surface should be removed prior to blast cleaning. Abrasive blast cleaning shall be utilized in accordance with SSPC SP13 to obtain a surface in which a textured finish is achieved. If the surface of the concrete is weak, more material should be removed. Sufficient material shall be removed to result in a strong, sound substrate. The compressed air used for blasting or blow downs shall be clean and free of oil particles. This means that the air compressor shall be equipped with efficiently-operating oil and water traps. Refer to NACE procedure for "Blotter Testing" of compressed air.

4. Surface Cleanliness, Dusty Condition: Wipe the surface with a dark, clean cloth. If a white powder is on the cloth, the surface is considered to be too dusty and therefore unsatisfactory for lining. Blow down the areas with clean, dry air.

5. Surface Cleanliness, pH Condition: Use either pH paper or a pH Meter to determine the pH at the concrete surface. A pH range of seven-to-nine is considered acceptable.

D. Existing Bare Concrete; Dry, Deteriorated, with Exposed Aggregate:

1. Surfaces to be coated shall be abrasive blasted, hydro-blasted, or a combination of both in order to remove all loose, soft, and contaminated concrete back to sound and structurally stable material, as stated in Paragraph 1.04.C.

2. All surfaces to be coated shall be completely dry, clean, and contaminant-free before application. Surface dryness shall be verified according to ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

E. Steel Surfaces:

1. All existing bare steel surfaces shall be abrasive blasted to a cleanliness level of SSPC-SP 10.

2. All existing bare steel surfaces shall exhibit an anchor profile of 3.5-4 mils as measured by testex tape.

3.2 APPLICATION

A. Before start of application and at such times when long breaks are involved or application equipment malfunctions, the following four material quality tests shall be performed for the Inspector.

1. A ratio check to verify required volumetric proportioning.

2. A mixed material check to verify proper mixing of components.

3. Curing cycle test to verify the proper reaction is under way. At least a pint sample is to be utilized. First Durometer results should be determined in 15 minutes.

4. A weight check (10 oz. container with solid material and a 10 oz. container with expanded material) to verify proper expansion rate.

B. All surfaces receiving the lining shall be visually dry and at least 50º Fahrenheit (3º C.) above the Dew Point prior to starting the installation to prevent moisture entrapment. The Relative Humidity shall not exceed 85%. Successive topcoats, if necessary, shall be applied within 24 hours so as to not exceed the recoat window.

C. The compressed air shall be clean and free of oil and water. Refer to NACE Blotter Test procedure.

D. Base component shall be mixed thoroughly with a power mixer. Base and Activator shall be heated to 100-110º Fahrenheit (38-43º C.) prior to use.

E. **Thinning of Material is Prohibited.**

F. The applied repair lining shall be a uniform system applied to a minimum thickness of 250 mils TDFT, of which 200 mils is expanded and 50 mils is solid, utilizing ECOSYSTEM® technology for the gas injection of polyurethane films.

G. The lining shall be installed as a liquid seamless system by spray or pour directly to the substrate, allowing the material to conform to the profile of the substrate, creating a non-stressed, seamless monolithic film.

H. Wet film thickness shall be monitored throughout the installation by means of frequent measurements with a high-range wet film thickness gage.

I. If the project is not completed, then at the end of the work day a three-to-twelve inch "returning edge" of material will be left tapered to the substrate for the start of the next workday. The "returning edge" shall be cleaned free of any visible contaminates before proceeding to spray on start up the following workday.

J. The spray application shall be according to the principles of good workmanship outlined in SSPC-PA1-82, and shall provide a finish which is continuous, uniform in thickness, and verified free of pores or other defects using electrical discontinuity testing (high voltage spark testing).

3.3 INSPECTION AND QUALITY CONTROL

A. The Contractor shall enlist the aid of various field tests and implement those tests to verify the integrity of the applied lining to his satisfaction. The City shall be permitted full access at all times to observe and be satisfied that the specification is being followed.

B. The City shall be given sufficient notice so as to be present, if desired, when the following hold points are reached:

1. Completion of surface preparation.

2. Prior to lining application.

3. During wet and dry film thickness measurements.

4. During pinhole detection testing.

5. During lining repairs.

C. The following quality control tests shall be performed by the Contractor with results recorded and made available to the City:

1. Compressed air quality per blotter test.

2. Environmental conditions prior to lining application, including substrate temperature, ambient temperature, relative humidity and dew point.

3. Observation of surface preparation, including anchor pattern, prior to lining application.

4. Results of ratio check of plural component proportioning equipment.

5. Wet and dry film thickness measurements.

D. The multi-component lining material shall be verified as to proper proportioning of materials at the start of each day and at any time of equipment malfunction before resuming operations. Any necessary site clean-up due to installing improperly reacted materials shall also be made at that time.

E. The following inspection equipment (or City approved equal) shall be utilized by the contractor for performing quality control testing:

1. Sling psychrometer

2. Surface temperature thermometer

3. Ambient temperature thermometer

4. Psychrometric charts for determining relative humidity and dew point

5. High range wet and dry film thickness gages

6. Micrometer

7. Durometer; A and D Scale

8. Sample cans

9. Inspection glass (30 power minimum)

10. High voltage pinhole detector

F. The lining shall be 100% visually inspected for holes, voids, and thin areas.

G. High-voltage discontinuity testing to be performed by Contractor to assure a "pinhole-free" lining system shall be in accordance with NACE Standard RPO188-86, "Discontinuity (Holiday) Testing of Protective Coatings."

H. The contractor shall verify that the applied lining material has reached cure, as evidenced by hardness, prior to placing into service.

I. When verification of adhesion is required, testing shall be done in accordance with ANSI/ASTM D4541.

3.4 REPAIRS

A. Any damaged areas, faulty areas, or discontinuities (pinholes) found during quality control inspection within a 24-hour (within the recoat window) period of application, and which can be completely repaired within the recoat window, shall be corrected as follows. If repairs will extend beyond the recoat window, use the procedures in Section 3.4.B below.

1. Damaged or Faulty Areas (i.e., impact damage, off-ratio application, etc.): Solvent clean area thoroughly, extending at least six inches beyond damaged area with MEK, Xylene, or Naptha (as allowed) dampened cloth (do not apply excessive solvent to repair area, the intent is to clean only), allow solvent to thoroughly dry. When thoroughly dry to touch, spray area with the lining material to the specified thickness, feathering the material into the existing lining. Note - In the event that the damaged area exhibits a rusty or discolored substrate substandard to the specified requirements, these areas shall receive the same degree of surface preparation required by the original project specifications prior to application of the lining material.

2. Discontinuity (Pinhole) Repair: Solvent clean the immediate area around the detected discontinuity with MEK, Xylene, or Naptha (as allowed) dampened cloth (do not apply excessive solvent to pinhole area, the intent is to clean only), allow solvent to thoroughly dry. Hand apply (putty knife, etc.) a small amount of mixed material directly to the pinhole. For pinhole repairs, hand mix and thoroughly blend a small amount (normally two or three ounces at a time, for each applicator) of Part A and Part B in correct ratios.

B. Any damaged areas, faulty areas, or discontinuities (pinholes) found during quality control inspection AFTER 24 hours of lining installation (exceeding recoat window) shall be corrected as follows:

1. Abrade the surface using abrasive blast or power tools, as practical, down to and including exposed bare steel to remove surface shine, to roughen the surface, and to prepare the substrate to the original standard. Abraded area

shall extend at least six inches (15 cm.) beyond damaged or faulty area. After abrading the surface, vacuum or blow down with clean, dry compressed air thoroughly to remove all loose particles. Solvent clean the area thoroughly, extending at least six inches (15 cm.) beyond the damaged area with MEK, Xylene, or Naptha (as allowed) dampened cloth (do not apply excessive solvent to pinhole area, the intent is to clean only), allow solvent to thoroughly dry. When thoroughly dry to touch, spray area with the lining material to the specified thickness, feathering the material into the existing prepared lining.

2. Discontinuity (Pinhole) Repair shall be completed following the guidelines listed in Section 3.4.A.2 above.

END SECTION

SECTION 03 41 00

PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work required under this section consists of furnishing and installing precast, reinforced concrete structures of the sizes and types called for on the Plans, complete with openings, inserts, and hardware.

1.2 RELATED WORK

A. Section 08 30 01 – Access Hatches

B. Section 31 23 17 – Trenching, Backfilling and Compacting

C. Section 40 05 23 – Valves and Appurtenances

1.3 REFERENCES

A. American Concrete Institute (ACI)

B. American Society for Testing and Materials (ASTM)

C. State Standard Specifications

D. California Building Code (CBC)

1.4 SUBMITTALS

A. Submittals shall be in accordance with the General and Special Provisions.

B. Manufacturer's descriptive details of the manufacturer's latest standard product proposed for use on this project, including, but not limited to:

1. All principal dimensions.

2. Knockout locations and dimensions.

3. Hardware details.

4. Certification that the cement conforms to ASTM C150.

C. Shop and erection drawings, including design criteria and calculations, locations and types of all inserts, and the locations of all openings and location and type of joints.

1. The calculations and design drawings shall be stamped and signed by a civil or structural engineer registered in the State of California.

1.5 DEFECTIVE WORK

A. Work considered to be defective may be ordered, by the Engineer, to be replaced in which case the Contractor shall remove and replace the defective work at his expense.

PART 2 PRODUCTS

2.1 GENERAL

A. Design all precast structures as specified herein and in accordance with the applicable requirements of ASTM C913, except that Type II modified Portland cement shall be used.

B. Structures shall be of the sizes and configurations shown on the Drawings, with openings as shown. Wall and floor thickness, roof thickness and joint location shall be determined by the fabricator.

C. Precast concrete Pumping Bypass Vault B2436 Christy Box w/ B2436-52JH cover (H20 Traffic Rated) and 1-B2436x12 extension or approved equivalent.

D. 5'x5' Jensen Precast Concrete Vault Model 6060-U or approved equivalent.

PART 3 EXECUTION

3.1 GENERAL:

A. Precast structures shall be set vertically and in true alignment, at the elevations indicated and at the locations shown on the Plans.

B. All holes in sections used for handling purposes shall be thoroughly plugged with rubber plugs or mortar.

C. If starter couplings are not supplied, place pipe sections flush on the inside of the structure wall, projecting outside sufficiently for proper connection with the next pipe section.

D. Follow manufacturer's recommended installation procedures.

END SECTION

SECTION 08 30 01

SEWER LIFT STATION ACCESS HATCHES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Lift Station, and valve vault access hatches.

1.2 RELATED WORK

A. Section 03 41 00: Precast Concrete Structures

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.4 SUBMITTALS

A. Submit shop drawings in accordance with the General and Special Provisions.

B. Product Data: Fully describe all items proposed for use.

C. Shop Drawings: Show dimensions, attachments, inserts and relationship of work to adjoining construction.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Applicable Occupational Safety and Health Regulations, latest edition of California Building Code.

1.6 GUARANTEE

A. Furnish a written guarantee effective for a period of one year after final acceptance of the project that floor hatches will not leak and will be free of defects in materials and workmanship.

PART 2 PRODUCTS

2.1 ACCESS HATCHES

A. Hatch BPS 48” ID x 54” OD Aluminum 24”x36” U.S.F. Fabrication Inc. Hatch. Reference Drawing #1000238665 when ordering from manufacturer.

B. Door Leaves: 1/4-inch (6.35 mm) thick aluminum floor plate.

C. Frame: 1/4-inch (6.35 mm) skirt plate around perimeter.

D. Doors: Equip with stainless steel hinges, stainless steel pins, spring operators and an automatic hold-open arm that will secure the door in the open. Provide slamlock plug and key. Provide steel recessed staple where required for padlock.

E. Odor Control Gasket: A continuous EPDM gasket shall be affixed to the frame and form an odor-resistant barrier around the entire perimeter of the cover.

F. Provide stainless steel automatic hold-open arms to insure against accidental hatch closure. Attach pin to hatch with a short stainless-steel chain to prevent loss.

G. Safety Grate: Provide a stainless-steel safety grate bolted to hatch and painted with safety orange powder coat.

H. All hardware: Stainless steel throughout. Provide four (4) keys as spares.

I. Warning Sign: Provide a 10-inch x 12-inch minimum size sign permanently attached to the underside of hatch doors reading: "Danger: Make Sure Hold-Open Arm is Positively Engaged Before Using. Insert Pin in Holes in Hold-Open Arms to Hold Door Open.

J. Check valve access hatch shall be Halliday Products H1R3048 or approved equivalent.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Deliver hatch to job site in time for installation.

B. Set frame level and true to plane at all four corners, and flush with adjacent finished surfaces. Doors, when closed, shall be flush with frames and flush with each other.

C. Install warning sign.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for all electrical work and submittals. Provide materials and equipment as indicated on the drawings and as specified.

B. Related work under this section:

1. Labor and materials required to furnish and install the electrical systems in a complete and operational fashion.

2. Carpentry, masonry, steel and concrete materials and labor required for construction of proper stands, bases, and supports for electrical materials and equipment.

3. Cutting and patching of holes required by installation including flashing and counter-flashing of roof and exterior wall penetrations.

4. Excavating, pumping, and backfilling required for installation.

5. Repair of damage to the premises resulting from construction activities under this Section to Owner's satisfaction.

6. Removal of work debris from construction activities to Owner's satisfaction.

7. Testing and cleaning of equipment installed.

C. Work not included under this section:

1. Furnishing of equipment motors, fans, compressors, water heaters, thermostats and motor starters that are detailed under other specification sections, or as noted otherwise.

D. Related Sections:

1. Where items specified in other Division 26 sections or contract documents conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR – California Code of Regulations

a. Title 8 – Industrial Relations; Division 1 – Department of Industrial Relations

1) Chapter 3.2 – California Occupational Safety and Health Regulations (CAL/OSHA)

2) Chapter 4 – Division of Industrial Safety

a) Subchapter 4 – Construction Safety Orders (CSO)
b) Subchapter 5 – Electrical Safety Orders (ESO)

b. Title 24 – California Building Standards

1) Part 1 – Building Standards Administration Code

2) Part 2 – California Building Code (CBC); International Building Code (IBC) with California amendments

3) Part 3 – California Electrical Code (CEC); NFPA 70 National Electrical Code (NEC) with California amendments

4) Part 4 – California Mechanical Code (MEC); IAPMO Uniform Mechanical Code (UMC) with California amendments

5) Part 5 – California Plumbing Code; IAPMO Uniform Plumbing Code (UPC) with California amendments

6) Part 6 – California Energy Code

7) Part 7 – California Elevator Safety Construction Code

8) Part 9 – California Fire Code; International Fire Code (IFC) with California amendments

9) Part 12 – California Reference Standards Code

2. CPUC – California Public Utilities Commission

a. GO-95; Rules for Overhead Electric Line Construction

b. GO-128; Rules for Construction of Underground Electric Supply and Communication Systems

3. IEEE – Institute of Electrical and Electronic Engineers

a. C2; National Electrical Safety Code (NESC)

4. NECA – National Electrical Contractors Association

    a. 1; Standard Practices for Good Workmanship in Electrical Contracting

    b. 4090; Manual of Labor Units

5. All applicable local municipal codes and ordinances

6. Applicable rules and regulations of local utility companies

1.3 DEFINITIONS

A. HMI: Human Machine Interface

B. ISP: Internet Service Provider

C. MCC: Motor Control Center

D. PLC: Programmable Logic Controller

E. VFD: Variable Frequency Drive

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Provide materials and equipment required to construct the project, as shown in the plans and specifications.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Provide two keys for each lockable enclosure.

C. General:

1. Indicate the manufacturer name, model number, optional accessories/features, catalog numbers, and any other identifying details for equipment and materials.

2. Scaled shop drawings and cut sheets indicating equipment placement, orientation, footprint, conduit and cable provisions, grounding provisions, and anchoring provisions.

3. As-Built Drawings: As-Built Drawings shall be prepared for sheet set. All shop drawings shall be modified to indicate the final as-built configuration of the system.

    a. Submit half-size and full-size drawings in digital PDF format.

4. List of spare equipment/parts provided.

5. Training schedule and materials.

6. Test Reports: Including a description of the test, list of equipment used (make/model/date of last calibration), name of the individual conducting the test, date and time test was conducted, all raw data, all processed data and calculated results, and any other information requested by Owner.

7. Schedule of Values: Labor and per unit material costs for equipment and materials.

8. Conduit and Cable: Wire, conduit, and terminal identification labeling/tagging.

9. Conduit: Penetration locations on scaled site plan and profile drawing and proposed sealing compound.

10. Equipment Schedules: Complete scheduling detailing all materials proposed for use.

11. Seismic: Manufacturers statement of seismic qualification that states the equipment satisfies indicated seismic design criteria. Equipment anchorage design calculations shall be prepared by a California licensed Structural Engineer or the equipment manufacturer.

    a. Seismic Test Data with seismic certification statements.

    b. Anchoring design calculations and details.

1.6 CHANGE ORDER PROPOSALS

A. Shall comply with the requirements set forth by the General Conditions.

B. All change order proposals and requests, both additive and deductive, shall be based upon and be accompanied by a detailed materials and labor breakdown for each specific task and/or item. The breakdown shall include actual materials costs plus overhead and profit, as well as labor units base upon the most recent NECA Manual of Labor Units (NECA Index #4090) or equivalent publication for each specific task and item. Labor costs shall be computed as outlined within the General Conditions, based upon the NECA labor tables for each task required. Materials costs shall include actual Contractor invoice plus no more than 15% markup. The Owner and Contractor agree to the above change order cost procedure, for both additive and deductive change orders.

1.7 QUALITY ASSURANCE

A. Work and materials shall be in full accordance with the latest rules and regulations of applicable state or local laws or regulations and standards of the following:

1. National Fire Protection Association (NFPA)

2. California Electrical Code (CEC)

3. California Occupational Safety Health Act (Cal-OSHA)

4. California Sate Fire Marshall (CSFM)

5. California Code of Regulations (CCR)

6. Electrical Safety Orders, CAC Title 8 (ESO)

7. California Public Utilities Commissions, General Order 95, (GO-95)

8. Applicable rules and regulations of local utility companies

9. NECA 1-2000, Standard Practices for Good Workmanship in Electrical Contracting

B. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

2. All Contractor provided equipment/material shall be new. Refurbished or used equipment will not be accepted and will not be paid for by the Owner. Provide receipt of equipment/material purchase at Owner's request.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. All equipment shall be packed in protective housing and enclosed in envelopes that protect it from dust, moisture, and damage. Place dehumidifiers (when required by manufacturer or Owner) within protective envelope.

2. Equipment shall be skid-mounted and shall have lifting rings that are accessible without removing the protective envelope. Deliver products in manufacturers original packaging with identifying labels intact and legible. Labels shall include the manufacturer name, model number, and date of manufacture.

3. Attach equipment-specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

4. Comply with Division 1 requirements with regards to waste management and disposal.

B. Storage and Protection:

1. Equipment and materials shall be stored and installed per manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

1.9 PROJECT/SITE CONDITIONS

A. Project/Site Environmental Requirements

1. Verify all power and communication utilities' requirements prior to commencement of any utility work. Make proper adjustments to the construction to satisfy the serving utility.

2. Electrical Equipment shall be suitable and rated to operate in ambient temperature and humidity conditions.

3. Provide heating, cooling, and dehumidifying devices included with equipment to maintain the enclosures within the equipment's rated environmental operating range.

    a. Provide power and control conduits and wiring for all temperature control devices (heaters, fans, dehumidifiers, etc.) whether indicated on drawings or not.

B. Ratings detailed in plans are estimated, ensure all equipment/conduit/cable is sized to meet CEC requirements and manufacturer recommendations.

1.10 SEQUENCING

A. Prior to mobilization, coordinate work with associated utilities onsite.

B. Before substantial completion, perform all maintenance activities recommended by manufacturer and required by Owner including any calibrations, component replacements, or routine service.

C. Before final completion, ensure all equipment is dust-free and clean. Remove all foreign material, vacuum enclosures to remove debris. Furnish spare parts, as required in plans and specifications, and submit list of spare parts provided.

D. System startup and testing shall be scheduled and coordinated with Owner, 5-working days prior to proposed startup/testing date.

E. Contractor shall coordinate with PG&E for a disconnect/reconnect, to allow for termination of the new main breaker line side conductors.

1.11 SCHEDULE

A. All work shall be coordinated with other work related to or physically near the project, to prevent interference and facilitate coordinated work.

B. All communications to utilities shall include Owner's representative. Contractor is responsible for coordinating all work with Utility power provider, ISP, site developer, and any other pertinent utilities.

C. Submit schedule for training and all training materials at least 10-business days prior to proposed training day.

1.12 OWNER'S INSTRUCTIONS

A. Contractor shall attend Owner required safety training prior to starting work onsite and shall retain a copy of documentation detailing staff have attended and passed Owner required safety training.

1. Contractor will ensure staff meet all safety, operations, and access requirements of Owner.

B. Deliveries of equipment and arrival of Contractor staff onsite shall be coordinated with Owner. Contractor shall notify Owner of any equipment deliveries or staff arrivals 2-working days prior to expected arrival/work date.

1. Staff shall check in an Owner security center, when arriving and leaving site.

2. Contractor shall deliver, store, and stage equipment in an area detailed by Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. All material and equipment shall be new, free from defects, and bear approvals and labels, as required by the Owner or specifications. All materials and equipment shall be new and of the best quality used for the purpose in good commercial practice.

2.2 MATERIALS

A. Stainless steel shall be ANSI Type 316.

1. 316 Stainless steel shall be used in areas requiring NEMA 4X construction.

2.3 MANUFACTURERED UNITS

A. Lockable enclosures shall all have two keys, that will be turned over to Owner upon final completion.

1. Ensure keys provided meet Owner's requirements.

2.4 SOURCE QUALITY CONTROL

A. Calculations

1. Seismic Anchorage of Equipment: All mechanical and electrical equipment shall be braced or anchored to resist horizontal force acting in any direction using the following criteria:

Fixed Equipment on Grade	33% of operating weight
Fixed Equipment on Structure	50% of operating weight

Emergency Power and Communication Equipment	75% of operating weight
Equipment Mounted to Flexible Supports	200% of operating weight

2. Submit calculations prepared and signed by a Structural Owner licensed in the State of California, showing compliance with the above for all electrical equipment weighing more than 50 pounds, excepting items corresponding exactly in configuration and weight to those specified and detailed. Where anchorage details are not shown in drawings, the field installation shall be subject to the approval of the Owner.

PART 3 EXECUTION

3.1 PROTECTION

A. Ensure all penetrations are watertight.

3.2 INSTALLATION

A. Equipment identification

1. Properly identify panelboards, remote control switches, push buttons, terminal boxes, etc. with a descriptive nameplate. Make nameplate with 3/32" laminated plastic with black background and white letters. Machine engraved letters 1/8" high for equipment in device box(es) and 1/4" high for panelboards, terminal cabinets or larger items. Punched strip type nameplates and cardholders in any form are not acceptable. Fasten nameplates with oval head machine screws, tapped into front cover/panel.

B. Working spaces

1. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders and CEC/NEC 110.26. In general, provide 78" of headroom and 30" wide minimum clear workspace in front of panelboards and controls. In addition to the above, provide the following minimum working clearances:

a. 0V – 150V (line-to-ground) provide 36" minimum clear distance

b. 151V – 600V (line-to-ground) provide 42" minimum clear distance

C. Excavating and backfilling

1. Dig trenches straight and true to line and grade, with bottom clear of any rock points. Support conduit for entire length on undisturbed original earth. Minimum conduit depth of pipe crown shall be 24" below finished or natural grade, unless otherwise noted.

D. Forming, cutting and patching

1. In new construction, General Contractor shall provide any special forming, recesses, chased, etc., and provide wood blocking, backing and grounds as necessary for the proper installation of electrical work. Be responsible for notifying the Owner that such provision is necessary; layout work and check to see that it suits the Owner's requirements.

a. Provide metal backing plates, anchor plates and such that are required for anchorage of electrical work under Division 26; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

2. Contractor shall be responsible for proper placement of pipe sleeves, hangers, inserts and supports for this Work.

E. Drawings for all equipment are intended to be diagrammatic only. Any location that is not dimensioned is not final or accurate. Exact locations must be determined in the field from the requirements of the equipment that is to be installed.

F. Locations of electrical, control devices, and instrumentation are approximate only. Confirm final layout with Owner prior to installation. The Contract includes typical installation details, for cases where a typical detail does not apply, develop installation details, and submit to Owner for review.

3.3 REPAIR/RESTORATION

A. Cutting, patching and repairing of existing construction to permit installation of work under Division 26 is the responsibility of Contractor. Repair or replace all damage to existing work in kind to Owner's satisfaction.

B. Obtain Engineer's approval prior to performing any cutting or patching of concrete, masonry, wood or steel structure within building.

3.4 APPLICATION

A. All electrical devices and equipment installed in exposed locations shall be protected by suitable NEMA type 3R enclosures (unless otherwise noted), cast boxes with gasketed covers, or other Owner approved methods.

B. All ferrous metal portions of electrical work exposed to weather including conduits, clamps, supports, etc. shall be hot dip galvanized.

3.5 CONSTRUCTION

A. Special Techniques

1. Conduit that crosses structural separation between buildings or building units shall be installed with flexible connections, suitable to accommodate longitudinal and transverse displacements.

3.6 FIELD QUALITY CONTROL

A. Inspection of work:

1. Test rotation of Motors to ensure correct rotation.

3.7 ADJUSTING

A. Replace/modify equipment, materials, software, or hardware that does not achieve the design requirements. Ensure final installation complies with design requirements. Following replacement/modification, retest the system and obtain approval from Owner that installation is satisfactory and meets Owner's requirements.

3.8 CLEANING

A. Repair or replace all broken, damaged or otherwise defective parts without additional cost to Owner, and leave entire work in a condition satisfactory to Engineer. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work; leave systems and equipment in satisfactory operating condition.

B. Installation shall be left clean, free of dust, debris, and cobwebs and shall be sealed.

3.9 DEMONSTRATION

A. Provide manufacturers' representatives to be present at start-up and commissioning testing, at request of Owner.

END SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. 600-volt class or less conductor and cable

2. 600-volt class or less splices

3. Wire pulling lubricant.

B. Related Sections:

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ASTM – American Society for Testing and Materials

B3; Standard Specification for Soft or Annealed Copper Wire

a. B8; Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

b. B787/B787M; Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation

c. D1000; Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications

2. CCR – California Code of Regulations, Title 24

a. Part 3 – California Electrical Code (CEC); NFPA 70 National Electrical Code (NEC) with California amendments

3. UL – Underwriters Laboratories, Inc.

a. UL 83; Thermoplastic-Insulated Wire and Cables

b. UL 486A 486B; Wire Connectors

c. UL 486C; Splicing Wire Connectors

d. UL 486D; Standard for Insulated Wire Connector Systems for Underground Use or In Damp or Wet Locations

e. UL 486E; Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

f. UL 493; Thermoplastic-Insulated Underground Feeders and Branch Circuit Cables

g. UL 510; Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

h. UL 854; Service-Entrance Cables

4. NEMA – National Electrical Manufacturer's Association

a. WC 70-1999; Nonshielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy

5. IEEE – Institute of Electrical and Electronic Engineers

a. 82; Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors

1.3 DEFINITIONS

A. ASTM: American Society of Testing and Materials

B. AWG: American Wire Gauge

C. PVC: Polyvinyl chloride

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Provide conductors, as detailed in plans, and ensure jackets have no damage, and all conductors and continuous.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Cut Sheets: Manufacturer, Model, Insulation Type, Insultation Temperature Rating, Insulation Voltage Class, AWG Size, Conductor Material, Pulling Compounds.

1. Proposed pulling compounds for XHHW-2 cable.

C. Calculations for Mechanically pulled cables:

1. Cable pulling calculations for all cables that will be installed with mechanical pulling devices. Calculations shall include maximum cable tension and sidewall pressure and shall detail manufacturer recommended values and ensure they are not exceeded.

a. Calculations shall be submitted at least 10 business days prior to conduit installation.

1.6 QUALITY ASSURANCE

A. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

B. Testing:

1. Wire Insulation Integrity - Megohm test reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

B. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed according to the manufacturer’s recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

C. Wire shall be in original unbroken package, prior to installation.

D. Wire and cables shall be purchased within 2 years of contract award date.

1.8 SEQUENCING

A. Substantial completion will not be issued until conductor/cable markers are applied to both ends of each conductor/cable.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. 600V or less cable and wire: Southwire, Cerrowire, Okonite Co., Belden CDT, General Cable, or approved equal.

B. Wire Pulling Lubricant: Ideal, 3M, Greenlee products, Klein Wools, or approved equal.

C. Additional Manufacturers: Killark, Dayton, USA Industries, or approved equal.

2.2 METAL-CLAD CABLE (MC CABLE)

A. Shall be two or more THHN/THWN conductors and a full-sized green insulated grounding conductor.

2.3 FLEXIBLE CORDS AND CABLES

A. Provide wire mesh strain relief grips to support cables.

B. Provide springs to reduce tension on flexible cords.

C. Wire-lubricating compound

1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.

2. Shall not be used on wire for isolated type electrical power systems.

2.4 MANUFACTURED WIRING SYSTEM (MWS)

A. Cable assembly

1. Shall have factory pre-wired connectors and shall be clearly marked and color coded to detail cable voltage and insulation rating.

2.5 MATERIALS

A. Wires shall bear the UL label, be color-coded and marked with gauge, type and manufacturer’s name on 24” centers.

B. Building Wire – Copper (annealed), if larger than #8AWG conductor shall be stranded. 600VAC rated for all systems under 600VAC.

C. Signal/Control – Copper (annealed), XHHW or XHHW-2 depending on the application and installation.

D. Flexible Cords and Cables – Shall have wire mesh strain relief grips and shall be supported, listed as Type S flexible cords.

E. Strain Relief – Galvanized steel.

F. Wire Connections and Terminations

1. Compression type terminating lugs – Copper (tin plated). Single-point crimps not permitted.

a. Tin plated.

G. Splicing and insulating tape

1. Shall be UV-resistant, self-extinguishing, 7-mil-thick general purpose electrical tape per UL 510.

a. Color of tape shall match the color code of the conductor.

2. Terminal strips

a. Provide box-type terminal strips in the required quantities plus 25% spare terminals.

3. Splicing and insulating tape – Colored to match conductor, UV resistant, self-extinguishing, 7 mil thick vinyl general purpose electrical tape per UL 510 and ASTM D1000.

4. Insulating material – Self-fusing rubber, per UL 510.

5. Insulating resin – Insulation shall be equivalent to rating of conductor and shall be a two-part epoxy.

6. Bolt termination hardware

a. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE Grade 5.

b. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.

c. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, conforming to ANSI B27.2. SAE.

H. Cables and Conductors shall be permanently marked with the conductor material, AWG size, voltage rating, insulation type, manufacturer's name, and UL listing.

I. Cables, Conductors, and splices shall be rated to withstand the environment they are in (sunlight, temperature, moisture level, burial style, application).

J. Minimum Cable Size #12AWG for Power conductors, #16AWG for instrumentation conductors.

K. Cable insulation rating shall match or exceed terminal rating. Cable ampacity shall meet or exceed ampacity rating of overcurrent protective device. Cable ampacity

requirements shall be determined by the state adopted version of the National Electrical Code.

L. Cable Ties shall be nylon.

2.6 EQUIPMENT

A. Cable insulation and type shall be listed for use with appropriate application.

a. Wet Locations: 90 degrees Celsius rated

b. Dry Locations: 75 degrees Celsius rated

B. Power:

1. Type XHHW-2, 600V rated, stranded, 90 degrees Celsius rated.

C. Instrumentation: 600V rated, UL listed, Type TC-LS, approved for outdoor installation use and direct burial, continuous operation at 90 degrees Celsius, sunlight resistant, aluminum-polymer tape shield with copper drain wire, copper stranded conductors.

D. Network: Industrial ethernet Cat 5e or Cat6 cable (as detailed in plans), outdoor rated.

1. Network cable connectors – RJ45, unless otherwise noted.

2.7 ACCESSORIES

A. Splices: Splice with compression type butt splices and a heat shrink insulating system listed for submersible applications or an epoxy resin splice kit.

PART 3 EXECUTION

3.1 INSTALLATION

A. Prior to installing conductors, mandrel all conduits that are routed underground or are encased in concrete.

B. Do not make intermediate conductor/cable terminations, unless noted on drawings.

C. Equipment locations may vary slightly from drawings, including allowances of appx. 20 linear feet for location of equipment and materials.

D. Protect conductors/cables from damage during installation. Listed and approved pulling lubricant shall be used for all installations with conductors/cables larger than 1AWG. Cables larger than 1AWG may be mechanically installed if cable tension monitoring equipment is utilized during the installation to ensure the cable mechanical properties are not exceeded.

1. If mechanical installation is used, calculations must be prepared to evaluate pulling tension and sidewall pressure, calculations shall be submitted prior to

the pull, as detailed in the submittal section of this specification. Provide report detailing cable tension used, cable tension shall be less than 75% of the manufacturers maximum tension limit.

E. Conductors shall be installed after conduit installation is complete, and all enclosures have been vacuumed clean, and conduit runs, and concrete work is complete.

F. All conductors installed mechanically with a machine:

1. Shall ensure installation mechanism does not cut or damage insulation, and shall not exceed the manufacturer's recommended tension.

a. Pulling line attachment shall be vis woven bracket grips or pulling eyes.

G. All conductors and terminations shall be installed per manufacturer's recommendations.

1. Terminations shall be made using listed fittings, and per best practices and manufacturer and CEC requirements. Terminations shall be made neatly with no excess.

H. Seal all conduits when transitioning into cabinets from underground locations, with duct seal.

I. Entry and exit points of conductors shall be sealed with a duct seal that is non-toxic and non-corrosive and non-curable.

1. EYS seals are exempted from this requirement.

J. Splice cables and wires only in junction boxes, outlet boxes, pull boxes manholes or handholes, and ensure splice box is labelled "SPLICE" on exterior.

1. In wet locations, splice kits shall be rated for use in wet locations.

K. Provide a cable tie to group neutral wire with phase conductor wires.

1. All conductors in a conduit shall be installed at the same time.

2. Parallel circuit conductors all have equivalent length,

3. Install conductors within raceways.

L. Conduits that are being reused shall be mandrel prior to conductor installation.

M. Clean conductors and terminations prior to making termination.

N. Contractors shall replace conductors that are installed in the incorrect raceway, were damaged during installation or testing, or have insufficient length to terminate per manufacturer's recommendations.

3.2 WIRING METHODS

A. Install wires and cable in accordance with manufacturer's written instructions, as shown on Drawings and as specified herein.

B. Install all single conductors within raceway system, unless otherwise indicated.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all aspects.

D. Provide adequate length of conductors within electrical enclosures and neatly train to termination points with no excess. Terminate such that there is no bare conductor at the terminal.

E. Splice cables and wires only in junction boxes, outlet boxes, pull boxes, manholes or handholes.

3.3 METAL-CLAD (MC) CABLE INSTALLATION

A. MC Cable shall be installed where clearly indicated on Drawings or with explicit, written permission by Owner.

B. Install MC cable in accordance with manufacturer's instructions and the California Electrical Code. Follow manufacturer's instruction when connecting the cable to fittings and boxes. Connectors and boxes shall be firmly secured to the cable but not overtightened.

3.4 MANUFACTURED WIRING SYSTEM (MWS) INSTALLATION

A. Install MWS in accordance with manufacturers' instructions and the California Electrical Code.

B. System shall be furnished complete with all accessories and hardware required for a completely operational system.

C. Do not rest cables on ceiling tiles or allow contact with metal piping systems.

D. Provide interconnection conduit, cables, and termination devices required to interconnect MWS with equipment.

3.5 WIRE SPLICES, JOINTS AND TERMINATIONS

A. Splice and terminate wire, conductors and cables in accordance with UL 486, NEC and manufacturer's instructions.

B. Clean wires before installing lugs and connectors.

C. Interconnections and terminals shall be rated to carry full conductor's ampacity.

D. When not specified or included in equipment, terminal strips shall be used for terminations.

E. Insulate spare conductors with electrical tape and leave 8 ft of conductor length, coiled in cabinet for future termination.

1. Bolt assemblies shall be torque to manufacturer's recommendations.

3.6 APPLICATION

A. XHHW-2 shall only be used with manufacturer approved/recommended pulling compounds.

1. Submit data sheets for all proposed pulling compounds.

3.7 CONSTRUCTION

A. Special Techniques

1. Wire Color:

a. Wires shall be manufactured in the colors detailed below, or shall be continuously half-lapped wrapped for 6-inches from the termination point, with color tape, following the tables listed below:

VOLTAGE	***PHASE A***	***PHASE B***	***PHASE C***	***NEUTRAL***	***GROUND***
1-PHASE *240V/120V*	*BLACK*	*RED*	-	*GRAY*	*GREEN*
1-PHASE *208V/120V*	*BLACK*	*RED*	-	*GRAY*	*GREEN*
3-PHASE (HI-LEG) *240V/208V/120V*	*BLACK*	**ORANGE (HI-LEG)*	*RED*	*GRAY*	*GREEN*
3-PHASE *480V/277V*	*BROWN*	*ORANGE*	*YELLOW*	*GRAY*	*GREEN*
CONTROL WIRING *120VAC*	*RED*			*GRAY*	*GREEN*

b. Color code - DC systems:

	UNGROUNDED CONDUCTOR	***GROUNDED CONDUCTOR***	***GROUND***
CONTROL WIRING *DC-VOLTAGE*	*BLUE*	*WHITE WITH BLUE STRIPE*	*GREEN*

2. Instrumentation:

   a. Install instrumentation cables in a separate raceway from power cables. Unless noted on drawings, provide separate pull and junction boxes for instrumentation cables. Separate instrumentation cable from power cable with a 12-inch minimum clearance.

3. Cable Support:

   a. Provide kellems grips to support submersible cable weight or approved equal.

   b. Provide stainless steel mesh to protect cables transitioning into vault, to protect cable from mechanical damage caused by rodents.

4. Lighting:

   a. Each lighting circuit shall have a dedicated neutral.

5. Splices:

   a. All splices shall be in a dedicated pullbox or junction box that is marked “SPLICE LOCATED WITHIN”

3.8 FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection

1. Inspect exposed sections of cables for physical damage and evidence of overheating and report damage or discrepancies in writing to owner prior to substantial completion.

2. Inspect bolted electrical connections for high resistance using one of the following methods:

   a. Use of a low-resistance ohmmeter.

   b. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.

B. Test Values – Visual and Mechanical

1. Bolt-torque levels should be in accordance with the manufacturer's published data.

C. Test Values – Electrical

1. Insulation-resistance values should be not less than two megohms.

2. Deviations in resistance between parallel conductors shall be investigated and damage and discrepancies should be reported to the owner prior to substantial completion.

3. If any failure is detected, locate failure, determine cause and replace or repair cable to Owner's satisfaction at no additional costs.

END SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding Electrodes:

a. Ground Rods

b. Metal Underground Water Pipe

c. Metal In-Ground Support Structures

d. Concrete Encased Grounding Electrode

e. Grounding Electrode Mesh

f. Grounding Electrode Ring

g. Rod and Pipe Electrodes

2. Ground Conductors

3. Electrical Grounding Boxes

4. Electrical Connectors

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. California Electrical Code

B. National Fire Protection Association (NFPA)

1. NFPA 70E – Standard for Electrical Safety in the Workplace

2. NFPA 70 – National Electrical Code

3. NFPA 101 – Life Safety Code

4. NFPA 780 – Lightning Protection Code

C. UL 467 – Standard for Safety, Grounding and Bonding Equipment.

D. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

E. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.

F. Institute of Electrical and Electronic Engineers (IEEE)

1. 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding system.

2. 142 - Recommend Practices for Grounding of Industrial and Commercial Power Systems

1.3 DEFINITIONS

A. Electrical definitions not specified below shall adhere to the definitions detailed in NFPA 70 and IEEE 80.

B. Bonded: Connected to establish electrical continuity and conductivity.

C. Bonding Conductor: A conductor that ensures the required electrical conductivity between metal parts that are required to be electrically connected.

D. Damp Location: Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. Examples of such locations include partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold storage buildings.

E. Dry Locations: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

F. Ground: A conducting connection, whether intentional or accidental, by which an electric circuit or equipment is connected to the earth, or to some conducting body of relatively large extent that serves in place of the earth.

G. Grounding Electrode: A conductor embedded in the earth and used for collecting ground current from or dissipating ground current into the earth.

H. Wet Locations: Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Grounding installations shall comply with all NFPA and CEC code requirements. Grounding conductors shall be sized per NFPA 70, National Electrical Code (minimum).

B. Provide a complete electrical grounding system, including but not limited to:

1. Grounding Electrodes

2. Grounding Conductors

3. Bonding Jumpers, Clamps, and Bushings, and associated hardware

4. Grounding the electrical service system neutral at service entrance equipment as shown on the Drawings.

5. Grounding each separately derived system, as defined in CEC 250.5 (D) and on the Drawings, unless specifically noted otherwise.

6. If the existing grounding electrode system is not able to be used, provide a new grounding electrode system.

a. Contractor to recommend replacement to Owner prior to PG&E disconnect/reconnect, based on condition of existing grounding electrode system.

b. Grounding electrode system shall meet the requirements of the California Electrical Code.

C. Performance Requirements:

1. At request of Owner, provide fall-of-potential test to ensure a ground resistance of less than 5 ohms.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Product Data:

1. Equipment/Material Cut Sheets

2. Site Plan: Scaled and dimensioned, detailing locations for Equipment Grounding Conductor and System Grounding equipment, showing grounding electrode locations, ground box locations, bonding locations, jumper locations, and proposed bonding method.

C. Shop Drawings: Detailing grounding terminations and ground and neutral buses.

D. Plans detailing locations of ground rods, grounding connections, embedded grounded conductors.

E. Grounding and Bonding connection schematic drawings.

F. Manufacturer Motor Controller Drive Installation Data Motor Cable Shield grounding instructions.

G. Sensitive Equipment Grounding Data Submit manufacturer recommended grounding practice for variable frequency drives, telephone system's radio's, antennas, and communication systems.

H. Installation, Operation, and Maintenance Data: Manufacturer Installation Instructions, and Operation and Maintenance Manuals

I. Fall-of-Potential Test Results

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Unless otherwise specified all work specified herein and as shown on the drawings shall conform to the applicable requirements of the following codes:

a. California Electrical Code (State Adopted Version at date of Engineer Stamp)

b. NFPA 70 (State Adopted Version at date of Engineer Stamp)

c. NFPA 70E (State Adopted Version at date of Engineer Stamp)

d. NFPA 101 (State Adopted Version at date of Engineer Stamp)

B. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

C. Field Samples:

1. Photo of grounding cable/conductor terminations

D. All materials, equipment and parts comprising the materials specified herein shall be new with UL labels clearly applied.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

B. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed per manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

1.8 SEQUENCING

A. Submit written notice of system grounding equipment placement to Owner and Inspector at least 5 working days prior to encasement/burial.

1. Do not conceal or cover any ground connections until Owner has provided written confirmation that grounding system meets criteria. Provide photo of system grounding prior to encasement/burial. Encasement/burial shall not proceed until photos have been submitted to Owner and accepted by Owner.

2. Submit photos of system grounding, prior to encasement/burial.

B. Submit photo of Variable Frequency Drive Grounding.

1.9 SCHEDULING

A. Utility Coordination shall be completed by Contractor, utility grounding shall be coordinated with utility and adhere to Utility requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Ground electrodes, conductors, and connectors: Erico, Harger, Galvan, Southwire, Encore, Burndy, Thomas & Betts, Blackburn, or approved equal.

B. Ground Boxes: Christy, Quazite, or approved equal.

2.2 EXISTING PRODUCTS

A. Ensure grounding system is bonded and continuous with existing grounding system.

B. Ensure neutral to ground bond is only present in one location, for each grounding system.

2.3 GROUND RODS

A. Copper-clad steel, minimum ¾" diameter by 10'-0" length, or as detailed in contract documents.

2.4 MATERIALS

1. Components encased in concrete or installed in wet locations shall be listed and labeled for Direct Buried applications.

2. Grounding systems shall be electrically continuous and conductive.

3. UL 467 listed.

B. Grounding Electrodes:

1. Ground Rods: Copper coated steel that is .25mm thick at any point, ¾" diameter x 10 ft length, minimum.

2. Ground Mesh: UL 467, 8 AWG Copper, minimum, 20 ft (minimum) of conductor installed with a 4" x 4" grid pattern, welded Intersections.

3. Plate Electrode: Steel, ¼" thick with a 2 ft^2 (minimum) surface area.

C. Equipment Ground Conductors: Same type and insulation as ungrounded conductors, green.

D. Ground Conductors, Bonding Jumper, Ground Ring: Soft Drawn (annealed), Concentric Lay stranded that meets ASTM B8, Bare Copper meets ASTM B3, sized per NFPA 70, National Electrical Code (minimum), green in color.

E. Connection to Pipe

1. Cable to pipe connections; OZ/Gedney G-100B series, Thomas & Betts #290X series or equal.

F. Connections to Structural Steel, Ground Rods or Splices

1. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds, Cadweld or equal, or high-pressure compression type connectors, Cadweld, Thomas & Betts or equal.

2.5 MANUFACTURERED UNITS

A. Electrical Grounding Boxes: Precast, 10" interior diameter (minimum), cover permanently marked "GROUND", traffic rated cast iron cover.

2.6 COMPONENTS

A. Connectors: Ground Clamps, Locknuts: UL 467 listed, Copper Bolts shall be the same material as the clamp, or stainless steel. Ground Clamps shall be rated and marked for use with the applicable wire, Copper. If equipment is in contact with the ground or embedded in concrete, it shall be rated and marked "DB" (or equivalent) for direct burial in earth and embedded in concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions

1. If existing grounding system is present, in presence of Owner's Representative, detail the bonding of the new grounding system to the existing grounding system.

3.2 INSTALLATION

A. All equipment shall be grounded and bonded with a continuous connection to the equipment grounding system.

B. Grounding system, if above grade, shall be located in a manner that will not create tripping hazards.

1. Cables shall not be routed along walking surfaces.

C. Provide exothermically welded or compression-type terminal lugs for buried or embedded connections. Lugs shall be listed and rated for application.

D. Bolted connections shall not be buried or embedded.

E. Equipment Grounding Conductor

1. Provide an equipment grounding conductor in each raceway, regardless of raceway material. Provide a separate grounding conductor in each raceway, for parallel feeders.

2. Bond to metal water pipe, building frame/structure, reinforcing metal, fence per NFPA 70, National Electrical Code.

F. Variable Frequency Drive Grounding:

1. Comply with manufacturer recommendations for Variable Frequency Drive Grounding.

2. Adhere to manufacturer recommendations for motor cable shield grounding requirements.

G. Provide a grounding bushing with lug to connect grounding conductor in various sections of the switchboard or motor control center.

H. Bond the system neutral bus to the ground bus at one point, at the service entrance (meter).

I. When grounding conductors are not concrete encased or directly buried, provide PVC-40 conduit for protection.

J. All connections to the ground system (grid, rod, duct bank, equipment) shall be made using UL listed compression type grounding connectors or approved equal.

K. Provide a bare copper grounding conductor in duct banks, bond the ground conductors together where the ducts join or split to provide a continuous grounding path.

L. Grounding Electrode:

1. Ground Rings: Conductor shall be in direct contact with the earth and buried a minimum of 36” below grade. Native fill shall be used, and neatly compacted above conductor.

2. Ground Rods: Drive ground rods and install conductors before construction of concrete slab. Install ground rods in precast ground wells, unless indicated otherwise in drawings.

3. Ufer Ground

a. Encase grounding electrode in concrete, at the bottom of the concrete foundation, footing, or trench and shall extend at least 30 ft.

b. Concrete shall be encased in 2” – 5” of concrete.

c. Supplementary ground rods shall be placed apart a minimum of 6 ft on center.

M. Shielded Cable: Ground shielded cable at one end only, at the power source, unless manufacturer recommends otherwise. Terminate the shield drain wire on a dedicated terminal block.

3.3 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Measure resistance of grounding electrode system, in accordance with IEEE 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System. Submit results to Owner, add parallel connected ground rods at request of Owner.

B. Visual and Mechanical Inspection

1. Verify ground system is in compliance with ANSI/NFPA 70, National Electrical Code, Article 250.

2. Inspect physical and mechanical condition, and report damage or discrepancies in writing to owner prior to substantial completion.

3. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.

4. Inspect anchorage and report damage or discrepancies in writing to owner prior to substantial completion.

C. Test Values – Visual and Mechanical

1. Grounding system electrical and mechanical connections should be free of corrosion.

2. Bolt-torque levels should be in accordance with the manufacturer's published data.

END SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metallic Conduits
2. Nonmetallic Conduits
3. Conduit Bodies
4. Joint Compound
5. Pull Tape
6. Conduit Fittings and Accessories
7. Conduit Installation
8. Pull Boxes
9. Junction Boxes

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. Section 26 05 26 – Grounding and Bonding for Electrical Systems

1.2 REFERENCES

A. Reference Standards:

1. ANSI C801 American National Standards Institute: Electrical Rigid Steel Conduit.

B. Industry Codes and Standards

1. California Building Code (CBC)
2. National Fire Protection Association, National Electrical Code (70)

1.3 DEFINITIONS

A. Conduit bodies: A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of 2 or more conduit sections. Includes, but not limited to, Shapes C, E, LB, T, X, etc.

B. Conduit fitting: An accessory that primarily serves a mechanical purpose. Includes, but not limited to, bushings, locknuts, hubs, couplings, reducers, etc.

C. FLX: Flexible metallic conduit.

D. GRC: Galvanized rigid steel conduit.

E. PCS: Polyvinyl chloride (PVC) coated rigid steel conduit.

F. PVC: Polyvinyl chloride rigid nonmetallic conduit.

G. SLT: Liquid-tight flexible conduit.

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Provide conduits, conduit bodies, fittings, junction boxes, and all necessary components as indicated and as required, to install a complete electrical raceway system.

B. All above-grade conduit shall be either PVC coated Rigid Conduit (OCal), all below-grade conduits shall be PVC-40.

1. All underground 90's and stub ups transitioning to above ground conduit should be PVC Coated Rigid Conduit (Ocal). All other types should not be allowed.

2. Conduits suspended on bridge above sludge equalization basin shall be PVC coated rigid conduits.

3. Above ground Flexible Electrical conduit should be jacketed metallic flexible conduit with a stainless steel core.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Product Data:

1. Manufacturer's catalog sheets for every type and size of conduit, fitting, conduit body, and accessories to be used on the Project. Manufacturer's recommended special tools to be used for installation if required.

2. Certified test results for PCS—coated metallic conduit showing the adhesive bond is stronger than the tensile strength of the PVC.

C. Shop Drawings:

1. Scaled conduit routing plans for all conduits detailing intended routing, material, dimension, placement in concrete pads, conduit material transitions, and supporting methods shall be submitted before the installation of any conduit.

2. Number conduits in accordance with the Contract Documents, Section 26 05 53 (Identification for Electrical Systems).

3. Installation drawings: Including individual conduit numbers, routing, sizes, cable sizes, and circuit numbers for each conduit.

D. Record Documentation:

1. Record Documents: Incorporate all changes in conduit routing on electrical plan drawings and prepare scaled and dimensioned drawings showing underground and concealed conduits and detail offsets from utilities and structures.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Every installer of Ocal shall be certified by the manufacturer for installation of the conduit.

B. Regulatory Requirements:

1. Code Requirements: Unless otherwise specified all work specified herein and as shown on the drawings shall conform to the applicable requirements of the California Building Code (CBC), the State Standard Specifications, and the National Fire Protection Agency Electrical and Safety Codes as detailed in NEC 70.

C. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

2. Provide material certificates, shop fabrication and placement drawings, and schedule for all reinforcing steel, imbedded items, form release and curing compounds.

3. Installation shall comply with National Electrical Code and California Electrical Code requirements.

D. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

B. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed per manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities. Do not expose non—metallic conduit or PCS to direct sunlight. Do not store conduit in direct contact with the ground.

1.8 SEQUENCING

A. Substantial completion will not be issued until raceways and boxes are labelled and tagged. Before final completion…Coordinate placement of conduits with equipment placement, existing utilities, concrete pad reinforcement, and structure footprints, and any other work performed for the Project.

C. Coordinate utility conduit runs with appropriate utility. Include Owner's Representative in all communications.

1. Electric/Gas

2. Communications

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed below or approved equal.

1. PVC coated rigid conduit: Ocal, or approved equal.

2. Jacketed Metallic Flexible Conduit with a stainless steel core: Electri-flex, Robroy, or approved equal.

3. Stainless Steel Conduit: Calbrite, or approved equal.

4. Galvanized rigid steel (GRC) conduit and fittings: Western Tube and Conduit, Allied Tube and Conduit, Wheatland Tube Co.

5. Polyvinyl-coated rigid steel (OCAL) conduit and fitting: Robroy Ind., Ocal, Inc., Calbond.

6. Liquid-tight flexible conduit (SLT): Southwire, AFC Cable Systems, Anaconda.

7. Rigid nonmetallic polyvinyl chloride (PVC) conduit: Carlon, Cantex.

8. Conduit bodies, supports, and seals: Crouse-Hinds, Appleton, O—Z/Gedney, Ocal, Inc, Robroy Ind., Calbond, Carlon.

9. Joint compound: Thomas and Betts.

10. Pull Tape: Southwire, 3M.

11. Conduit through wall and floor seals: O-Z/Gedney.

12. Pull Boxes: Oldcastle, Christy, or approved equal.

    a. Pull box concrete collar concrete mix.

2.2 MATERIALS

A. Jacketed Metallic Flexible Conduit: All above ground Flexible Electrical conduit should be jacketed metallic flexible conduit with a stainless steel core.

1. Stainless steel, corrosion resistant, liquid tight jacketed conduits, non-magnetic.

B. Stainless Rigid Conduit

1. Type 316 stainless steel, UL 6A listed.

C. GRC (Galvanized rigid steel conduit)

1. Standard conduit threads with a 3/4-inch taper per foot. Running conduit threads are not acceptable. Hot dip galvanized inside and out. Electro—galvanizing is not acceptable. Manufactured per UL-6 and ANSI C801. Inside and out hot dip.

D. PCS (Polyvinyl-coated rigid steel conduit)

1. The steel conduit, before PVC coating, shall be new, unused, hot-dip galvanized material, conforming to the requirements for Type GRC. Manufactured per NEMA Standard RN-1. The exterior galvanized surfaces shall be coated with primer before PVC coating to ensure a bond between the zinc substrate and the PVC coating. Nominal thickness of the exterior PVC coating shall be 0.040 inch except where part configuration or application of the piece dictates otherwise.

2. PVC coating on conduits and associated fittings shall have no sags, blisters, lumps, or other surface defects and shall be free of holes and holidays.

E. PVC (Rigid nonmetallic polyvinyl chloride conduit)

1. PVC: Extruded from virgin PVC compound, Schedule 40 unless otherwise specified, Schedule 80 extra-heavy wall where specified on drawings. Rated for use in direct sunlight.

F. CRMC (Coated rigid steel conduit)

1. Conduit: Equivalent to RMC with a Polyvinyl chloride (PVC) coated (40 mil minimum) bonded to the galvanized outer surface of the conduit. The bonding between the PVC coating and conduit surface shall be ETL PVC-001 compliant.

   Fittings: Equivalent to RMC above with bonded coating same as conduit. The PVC sleeve over fittings shall extend beyond hub or coupling approximately one diameter of 1 ½", whichever is smaller.

G. IMC (Intermediate metallic conduit)

1. Mild steel pipe.

2. Fittings (couplings, elbows, bends, etc.) equivalent to RMC above.

H. OCAL (PVC-Coated Corrosion Resistant Conduit:

1. Conduit: Hot dipped galvanized with undisturbed zinc coating under the PVC coating, listed per UL6.

2. Fittings: Double coated fittings.

2.3 *MANUFACTURED UNITS*

A. Junction Boxes

1. Provide NEMA 3R junction boxes.

B. Pull and junction boxes

1. 16 gauge sheet metal, minimum.

C. In-Ground Pull Boxes

1. Comprised of reinforced concrete. Provide extensions, as detailed in plans.

2. H-20 traffic rating.

   a. Box shall be precast concrete with a steel frame and cover rated to handle 16,000 lbs., minimum.

   b. Provide a concrete collar with concrete mix that is 3,000 psi, minimum.

3. Stamped with "POWER", "SIGNAL", or "COMMUNICATIONS" on lid, depending on application.

2.4 ACCESSORIES

A. Connectors, unions, and fittings: Manufactured with compatible materials to the corresponding conduit.

1. FLX: Provide insulated die-cast connectors with ridges that thread into the inside of the conduit to force fit. Building screws are not acceptable.

2. SLT: Malleable iron, furnished with locknut and sealing ring, liquid tight, raintight, oiltight, Insulated throat.

3. Insulated grounding bushings: Malleable iron or steel, zinc-plated, with a positive metallic end stop. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 °C. Tin—plated copper grounding saddle for use with copper or aluminum conductors.

4. SLT fittings: PVC coated liquid tight fittings with a bonded 0.040—inch thick PVC coating on the metal connector to form a seal around the BLT conduit. Insulated throat and an integral sealing ring.

5. PVC fittings: All devices shall be made of PVC, using the same materials as used for Type PVC conduit. All metal hardware shall be stainless steel.

B. Expansion/ deflection couplings:

1. Use to compensate for movement in any direction between 2 conduit ends where they connect. Shall allow movement from the normal in all directions. Shall allow angular movement for a deflection of 30 degrees from normal in any direction. Constructed to maintain electrical continuity of the conduit system. Deflection parameters specified in plan set.

C. Pull Tape

1. Polyester material, 600 ft spool length, marked with footage marking, 1,000 lbs. capacity (minimum). Non-rotting, corrosion resistant material, rated for use in wet environments.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions

1. Before installing any conduit or locating any device box verify all dimensions, space requirements, and make any minor adjustments to the conduit system as required to avoid conflicts with the building structure, other equipment, or the Work of other trades.

3.2 INSTALLATION

1. General: Install conduits in a neat manner, concealed except as noted. Mount conduits directly to building structure with clamps or one-hole straps where possible. Secure straps with cadmium plated wood screws into wood, and machine screws into metal or inserts preset in concrete. Where impractical to secure directly to structure, suspend on conduit hangers. Wherever possible, group and rack multiple conduits runs.

a. Where possible, align conduit in parallel with other piping/systems to allow for neat installation.

2. Installation and Cleaning: Install free from dents, kinks, and bruises. Plug ends at time of installation to prevent entry of dirt or moisture. Thoroughly clean out conduits before installing conductors. Thoroughly clean all exposed conduit exteriors.

3. Conduits which stub-up through floor shall be installed so that none of the curved portions of the elbow are exposed. Conduit bends and risers terminating below-grade runs shall be 40 mil PVC coated galvanized rigid steel.

   a. Minimum conduit size shall be ¾" unless otherwise indicated.

   b. Minimum duct bank size: 2-inches, unless otherwise noted.

4. Conduit Routing: Route exposed conduits parallel or perpendicular to walls or floors and align the conduit with boxes/termination points. Install conduits in masonry walls at time of wall construction. No conduits will run under heavy equipment, footing or other structural elements. Where runs must cross footings, install in sleeves per structural details. Install conduits with total conduit bends between pull locations less than or equal to 270 degrees. Install conduit runs so that runs do not interfere with proper and safe operation of equipment and do not block or interfere with ingress or egress, including equipment-removal hatches. Route conduits to avoid drains or other gravity lines. Where conflicts occur, relocate the conduit as required.

   a. Plug conduits brought into pull boxes, manholes, handholes, and other openings until used to prevent entrance of moisture.

   b. Install complete conduit systems before conductors are installed.

   c. For existing and new 2-inch and larger conduit runs, snake conduits with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of the conduit, prior to conductor/cable installation. Ensure conduit has full diameter prior to conductor/cable installation.

5. Conduits placed in or adjacent to reinforced concrete slabs shall not impact reinforcement. Reinforcement shall not be cut or altered when conduit is installed.

6. Confirm placement of conduit with Owner, prior to completing conduit installation.

7. The following conduit systems shall use large-radius sweep elbows:

   a. Underground conduits.

   b. Conduits containing medium-voltage cables.

c. Conduits containing shielded cables.

d. Conduits containing fiber optic cables.

8. Separations: Coordinate with all other Work and existing appurtenances/equipment to allow minimum of 12 inches running and 6 inches crossing clearance.

9. Provide minimum clearances listed below, from high-temperature surfaces for all conduit runs. Where it is necessary (or at the request of the Owner) to route conduits close to high-temperature surfaces, provide a high-reflectance thermal barrier between the conduit and the surface.

a. Clearance of 6 inches from surfaces 110 °F to 150 °F.

b. Clearance of 12 inches from surfaces greater than 150 °F.

10. Conduit joints and bends:

a. Threaded conduit: Cut threads on rigid metallic conduit with a standard conduit—cutting die that provides a 3/4-inch per foot taper and to a length such that all bare metal exposed by the threading operation is completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that all joints become secure and wrench-tight just preceding the point where the conduit ends would butt together in couplings or where conduit ends would butt into the ends or shoulders of other fittings. Thoroughly ream conduit after threads have been cut to remove burrs.

b. Use bushings or conduit fittings at conduit terminations.

c. On exposed conduits, repair scratches and other defects with galvanizing repair stick.

d. Penetration Sealing

1) Seal penetrations with non-flammable insulating material and match the fire rating of surrounding material.

2) Waterproofing sealing

a) Provide watertight conduit seals for all underground, concrete encased, and roof penetration installations.

B. Conduit Supports

1. Provide appropriate and UL listed hangers, supports, fasteners, and seismic restraints to suit application. Support conduit at the intervals required by the NEC, and as indicated on drawings.

2. Conduit on metal decking: Use 1-hole malleable iron straps with 1-inch-long cadmium-plated Type A panhead sheet-metal screws. Fully or partially hammer-driven screws are not acceptable.

3. Suspended conduit: Use malleable-iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter). For grouped conduits, construct racks with threaded rods and tiered angle iron or preformed channel cross members. Clamp each conduit individually to a cross member. Where rods are more than 2-feet long, provide rigid sway bracing.

4. Supports structural steel members: Use beam clamps. Drilling or welding may be used only as specified or with approval of the Owner.

5. PVC conduit supports: Mount all conduits with hangers specifically designed for use with PVC to minimize the problems of bowing resulting from the expansion and contraction of conduits caused by varying temperatures.

6. PVC-coated rigid metal systems: Provide right-angle beam clamps and" U" bolts specially formed and sized to snugly fit the outside diameter of the coated conduit. Provide "U" bolts with PVC-encapsulated nuts that cover the exposed portions of the threads. Securely fasten exposed conduits with Type 316 stainless steel clamps or straps.

C. Expansion/Deflection Fittings

1. Provide expansion/deflection fittings across concrete expansion joints and at locations that have a temperature range greater than 40 °F to compensate for thermal or mechanical expansion and contraction. Furnish fittings of the same material as the conduit system. Furnish fittings of the same material as the conduit system. Install expansion fittings a minimum of every 200-ft of straight conduit runs and where length change due to temperature exceeds 2 inches.

D. Boxes

1. Install boxes flush and level.

3.3 CONSTRUCTION

A. Special Techniques

1. Junction Boxes

a. Junction Boxes: Provide junction boxes and pull boxes to facilitate wire pulling as required to meet cable manufacturer's pulling tension requirements, to limit total conduit bends between pull locations. The electrical drawings do not indicate all required junction boxes and pull boxes.

2. Pull Boxes

a. Prepare the excavation approximately 6" deeper than the overall height of the enclosure.

b. The length and width of the excavation should be determined by adding 12” to the overall length and width of the box.

c. Place at least 6” of compacted clean crushed rock, coarse gravel, or angular stone material because of its drainage characteristics.

d. The compacted material should be leveled so the top of the box is flush to grade.

e. Place select backfill into the excavation in 4” to 6” lifts and compact.

f. The final 6” to 8” of the excavation should be finished with concrete collar. This may be accomplished by providing a form around the enclosure that would produce a six-inch minimum wide concrete collar.

B. Spare Conduits and Pull Tapes

1. Provide one continuous pull tape in each empty/spare conduit. Provide five feet of pull tape slack at the beginning and end of each conduit section, slack shall be neatly looped. Knots/joints/tangles in pull tape is not acceptable.

2. Immediately after installation, seal the ends of conduit with approved, manufactured conduit deals, caps, or plugs. Keep ends sealed until conductors are pulled.

C. Penetrations, Drains, and Seals

1. Seal roof and wall penetrations for raceways and other items that penetrate the roof or wall in accordance with manufacturer’s instructions and as indicated in plans. Provide conduit seals with drains in areas of high humidity and temperatures that vary more than 10 °F. Install seals with drains at any location along conduit runs where moisture may condense or accumulate. This requirement includes, but is not limited to, the following locations—control panels, junction boxes, pull boxes, or low points of the conduit.

2. Seal conduits that enter into/exit hazardous locations, with EYS-seal, or approved equal.

END SECTION

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wire Labels
2. Conduit and Raceway Markers and Cable Ties
3. Equipment Nameplates
4. Signs

1.2 REFERENCES

A. Industry Codes and Standards

1. NEC 70: National Electrical Code
2. NFPA: National Fire Protection Association

1.3 DEFINITIONS

A. OSHA: Occupational Safety and Health Administration

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Work required under this section consists of including identification of electrical equipment, devices, and components.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

1. Nameplates: Color, dimensions, lettering, material, mounting
2. Nameplate schedule and scaled proposed mounting scheme.
3. Wire Labels: Labelling scheme, color, size, application style, material, attachment method.
4. Conduit and Raceway markers: Material, color, lettering, dimensions.

B. Record Documentation: Update the conduit and cable schedule to reflect the unique identifier of each cable and conduit, termination points, and total quantity of wires per conduit.

1.6 QUALITY ASSURANCE

A. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

B. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed per manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

1.8 SEQUENCING

A. Coordinate wire and conduit labeling and nameplate design with Owner prior to placing labels and nameplates, to ensure labelling requirements are met.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady, Seton, Raychem, Thomas & Betts, Kroy, Cable Ties Unlimited, Masterbond, Simpson, or approved equal.

2.2 MATERIALS

A. Nameplates: 3/32" thick material, chamfered edges, 2-ply, block engraved and legible, UV resistant, listed for outdoor use. Characters shall face the open panel and shall read from left to right or top to bottom. Marker shall start within 1/32 inch of the end of the stripped insulation point.

1. Character Text Height:

a. Electrical Gear Enclosure Identification: 1", minimum.

b. Electrical Gear Compartment Identification: 7/16", minimum

c. Electrical Gear Component Identification and General Equipment: 1/8", minimum.

B. Warning Nameplates: Red face with white text.

C. General Nameplates: Black face with white text.

D. Motor Control Center/Switchgear/Switchboard Nameplates:

1. Provide stamped metal nameplates on exterior of enclosure that details the motor control center's manufacturer name, date of manufacture, serial number, NEMA rating, voltage rating, current rating, and frequency. Stamped metal nameplate shall be visible and placed on exterior of enclosure.

a. Fix stamped metal nameplate to exterior of enclosure with stainless steel screws.

b. If environment is corrosive, provide a corrosion resistant metal nameplate.

E. Conductor and Cable Markers: Heat shrink tubing, white background with machine printed black characters (10-point font or larger). Listed for Industrial use, UV Resistant, operating temperature of -50 °F to 150 °F.

1. Conductor and Cable Markers: Provide the following wiring numbering schemes throughout the project for all field wires, including but not limited to power, controls, instrumentation, field instrumentation, field starters.

2. Conductor and cable markers shall denote the origin and destination and shall have a hyphen in between the two callouts.

3. Terminal designations at motor leads shall be the motor manufacturer's standard terminal designation (e.g., T1, T2, T3, etc.).

4. Marker shall include the following information, unless noted otherwise on plans:

	CONDUCTOR/CABLE MARKER				
INFORMATION	**CONDUCTOR ID (FROM PANEL SCHEDULE IN SHEET SET)**	**VOLTAGE**	**CIRCUIT NO.**	**LOCATION "FROM"**	**LOCATION "TO"**
EXAMPLE	P-001	240VAC	2,4	PANEL "L"	MCC
	P001-240VAC-2,4-PNLL-MCC				

F. Conduit and raceway markers: Stainless steel (Type 304 or 316), characters 1/2" (minimum) height, .036" thick (minimum), attached to conduits/raceway with cable ties.

1. Identification shall be stamped into the marker.

2. Marker shall include the following information, unless noted otherwise on plans:

CONDUIT AND RACEWAY MARKER				
INFORMATION	**CONDUIT ID (FROM PANEL SCHEDULE IN SHEET SET)**	**VOLTAGE**	**LOCATION "FROM"**	**LOCATION "TO"**
EXAMPLE	P-001	120VAC	PANEL "L"	MCC
	P001-120VAC-PNLL-MCC			

G. Cable ties: Stainless steel (316) cable ties, corrosion resistant, smooth round edges.

H. Signs: Listed for use outdoors, OSHA compliant. See plans for details.

2.3 COMPONENTS

A. Arc-Flash Hazard Labels:

1. Dimensions:

a. Minimum 5 inches by 3.5 inches.

2. Materials:

a. Polyester with polyvinyl polymer over-laminate.

b. Self-adhesive.

c. Resistant to:

1) UV
2) Chemicals and common cleaning solvent resistant.
3) Scuffing.
4) Wide temperature changes.

3. Contents:

a. Short-circuit bus identification

b. Calculated incident energy (calories/square centimeter) range

c. Hazard/risk, personnel protective equipment category number.

d. Arc-flash protection boundary.

e. Shock Hazard Boundary:

1) The CONTRACTOR may provide separate labels for indication of the shock hazard boundary.

f. Description of the combined level of personnel protective equipment.

4. Color scheme:

a. For locations above 40 calories/square centimeter:

1) White label with red “DANGER” strip across the top.

2) Black lettering.

b. For locations below 40 calories/square centimeter:

1) White label with orange “WARNING” strip across the top.

2) Black lettering.

PART 3 EXECUTION

3.1 INSTALLATION

A. Nameplates: Provide a nameplate for each piece of electrical equipment and device, control panel and control panel components. Provide all nameplates of identical style, color, and material throughout the facility.

1. Motor Control Centers/Switchgears/Switchboards: Provide nameplates on the front of each section and cubicle, for all devices within electrical gear. Provide nameplates on exterior enclosure doors to label each section, per the plans and Contract Documents.

B. Conductor and Cable Markers: Coordinate the wire numbering system with all vendors of equipment so that every field wire has a unique number associated with it for the entire system. Wire numbers shall correspond to the wire numbers on the control drawings or the panel and circuit numbers for receptacles and lighting. Wire numbers shall correspond to the terminal block number to which they are attached in the control panel. Internal panel wires on a common terminal shall have the same wire number. Multi-conductor cables shall be assigned a cable number that shall be attached to the cable at intermediate pull boxes and stub-up locations beneath freestanding equipment. All multi-conductor and instrumentation cables shall be identified at all pull points.

C. Conduit and Raceway Markers: Provide a unique marker for each conduit, at each end of the conduit.

D. Cable Ties: Provide cable ties to attach conduit and raceway markers to each end and transition point for all conduits and raceways.

E. Nameplates: Secured to equipment face with permanent adhesive and two (2) stainless steel self-tapping screws. Nameplates shall be aligned and level or plumb to within 1/64 inch over the entire length. Misaligned or crooked nameplates shall be remounted, or provide new enclosures at the discretion of the Owner. Provide all nameplates for control panel operator devices (e.g., pushbuttons, selector switches, pilot lights, etc.).

1. For NEMA Type 4, NEMA Type 4X, or NEMA Type 7 enclosures, use epoxy-based cement to attach nameplates.

F. Conductor and Cable Markers: Apply all conductor and cable markers before cable/conductor termination. Tubing shall be shrunk using a heat gun that produces low temperature heated air. Tubing shall be tight on the wire after it has been heated.

G. Conduit and raceway markers: Provide conduit/raceway markers for every conduit/raceway in the electrical system that is identified in the conduit schedule or part of the process system. Markings shall match the provided conduit and cable schedule and raceway schedule. Markers shall be placed at each end of each conduit/raceway, and where conduit/raceway penetrates a structure or emerges from a different elevation (below grade, slab). Markers shall be placed after the conduits/raceways have been fully painted (where applicable) and shall be placed in a location where they are easy to read.

1. Attach markers with stainless steel cable ties.

H. Signs and labeling: Provide signs and labeling that meet NEC 70 and OSHA requirements. Provide warning signs on equipment that has one or more one source of power. Provide warning signs to identify every panel and circuit number of the disconnecting means of all external power sources. Identify panel and circuit number or conductor tag for control voltage source disconnecting means.

1. Provide permanent warning signs at mechanical equipment that may be started automatically or from remote locations. Fasten warning signs with round head stainless steel screws or bolts. Locate and mount in a manner to be clearly legible to operations personnel.

2. Provide permanent and conspicuous warning signs on equipment (front and back), doorways to equipment rooms, pull boxes, manholes, etc. where the voltage exceeds 600 volts.

3.2 ADJUSTING

A. Replace any nameplates, signs, conductor markers, cable markers or raceway labels that in the sole opinion of the Owner do not meet the Owner's aesthetic requirements.

END SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commissioning, energization, start-up, and testing of the equipment at this facility, as detailed in the plans.

1.2 REFERENCES

A. NAME

1. NETA: National Electric Testing Association

2. NFPA: National Fire Protection Agency

1.3 DEFINITIONS

A. ATS: Automatic Transfer Switch

B. CT: Current Transformer

C. HMI: Human Machine Interface

D. I/O: Inputs and Outputs

E. PLC: Programmable Logic Controller

F. PT: Potential Transformer (Voltage)

G. SAT: Site Acceptance Test

H. SCADA: Supervisory Control and Data Acquisition

1.4 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Bill of Materials and Device List

1. Include any modifications made during construction.

C. Start-up and Commissioning Plan

1. Develop a detailed test plan document and schedule and submit for review and Owner approval at least four (4) weeks prior to start of commissioning.

2. Obtain and incorporate the equipment manufacturers' startup and commissioning procedures into the Startup and Commissioning Plan.

3. Account for the schedule of activities of manufacturer's service representative.

4. Manufacturer's Recommended Installation Details:

   a. Recommended torque value for terminations.

   b. Recommended minimum insulation resistance for low-voltage (less than 600V) non-shielded cables.

D. Test Reports

1. Provide a test report for each test required in this specification.

2. Provide photos of the terminations, showing white marking verifying equipment has been torqued.

E. Construction Turnover Package: Develop and submit to Owner for review before submittal completion. Turnover package shall include the items listed below. Before final completion, add in the following items to the Construction Turnover Package—the equipment Operation and Maintenance Manuals, and a list of spare parts.

1. Punchlist Items

2. Updated plans showing any changes made during construction

3. Equipment List

4. Cable List

5. Relay Settings

6. Wire Logs with Terminal Labels

7. Megger Test Data Sheets

8. Continuity Tests (If required by Contract)

9. Factory Test Data Sheets (If required by Contract)

10. Wiring Validation Checklist

11. Equipment Calibration Results

12. As-Built Bill of Materials

1.5 SEQUENCING

A. Before substantial completion submit the Construction Turnover Package.

B. Before final completion resubmit the Construction Turnover Package with the equipment Operation and Maintenance Manuals, and a list of spare parts.

C. Before final completion, coordinate with Owner to remove existing power and control panels after new equipment is commissioned.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 INSTALLERS

A. Contractor shall provide labor and material commissioning of the unit. Services shall consist of commissioning, energization, start-up and testing of the equipment included in the Contract Documents.

B. Adjustments to all equipment supplied and modified under this Contract necessary before long term operation of equipment may begin.

C. All new equipment and any existing equipment onsite which has been affected by the work shall be commissioned.

D. Redline Drawings: Contractor shall maintain as-built drawings throughout the construction period in the form of a redlined set of the drawings. A single set of redlined drawings shall be updated daily and available for Owner review. Redlined copies shall be furnished to Owner in the System Turnover Package.

E. Utility Power tests and test reports shall meet the requirements of the applicable Utility.

F. These requirements are not intended to be an all-inclusive list. Contractor shall expand on and complete the Plan and submit to Owner for review and approval.

G. Contractor shall retain equipment manufacturer's representatives to inspect and adjust equipment prior to operational testing, if required by Contract.

H. Coordinate all tests with Owner, 5-working days prior to proposed test date. Tests shall be performed in the presence of Owner.

3.2 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Low-Voltage non-shielded cables (less than 600V)

a. Perform continuity and insulation resistance testing of wiring.

b. Verify tightness of screws by calibrated torque limiting screwdriver or similar device. List manufacturer recommended torque for termination, ensure equipment is torqued to the manufacturer's recommended value.

1) Use an oil-based white metal marking pen to mark the termination and show manufacturer's toque has been met. This will allow operators to easily visually evaluate terminals that need to be tightened.

c. Visually inspect compression connections for cable size match, correct insulation strip length and crimp indentation.

d. Perform dielectric insulation test using DC Megger method with respect to ground and adjacent conductors.

1) Submit manufacturer's minimum insulation resistance prior to testing, ensure cable meets manufacturers insulation resistance.

2. Overcurrent Protective Device

a. Test Utility Main Overcurrent Protective Device, and Generator (ATS) Overcurrent protective device.

1) Voltage for breaker closed (A-G, B-G, C-G, A-B, B-C, C-A)

2) Voltage for breaker open (A-G, B-G, C-G, A-B, B-C, C-A)

3) Minimum to trip at 70% or less DC control voltage

B. Power & Control Panel

1. The control panel and I/O panels shall be factory tested prior to shipment.

2. Site Acceptance Test: Site Acceptance Test (SAT) shall be performed by Contractor on the PLC, excitation, and instrumentation. The SAT shall demonstrate complete operability and performance requirements including interfaces with existing hardware.

3. The function of the Power & Control Panel and Level elements shall be tested in presence of Owner, to confirm operation of the facility. The following instruments shall be integrated into the control scheme, to control pump operation:

a. Level switches

b. Level transducers

4. The Contractor shall submit SAT procedures (10) ten weeks prior to the time testing will commence for the Owner's review and approval. The test procedures shall include the following:

a. Purpose of each test

b. Function(s) to be tested and not to be tested.

c. Exact procedures to be followed.

d. Setup and conditions for testing

e. Listing of test inputs and outputs

f. Test software descriptions and listings

g. Expected results.

h. Pass/fail criteria.

5. During the SAT, the Contractor shall demonstrate completion of the following pre-commissioning and commissioning tasks:

6. Field verification of the installation prior to checkout.

7. Point to point verification of interconnection wiring including checking that each conductor is labelled and terminated correctly at both ends. This test shall be with all disconnectable terminal blocks open and de-terminating the field end of wire to ensure against crossed wires.

8. Contractor shall energize circuits and close disconnectable terminal blocks sequentially and shall demonstrate proper voltage at each connected device.

9. Contractor shall validate correct wiring and operability of each PLC IO point, and shall demonstrate proper operability from the connected device to the PLC.

10. Wherever practical, test I/O by manipulation of instrument source, e.g., pressure, level, position, etc. Otherwise, test from wiring, as close to the instrument as possible.

11. Discrete inputs shall be verified by actuation from the initiating device.

12. Analog inputs shall be calibrated at 0%, 25%, 50%, 75%, and 100% of input scaling range.

13. Discrete outputs shall be verified by forcing. Proper actuation of the receiving device shall also be verified.

14. Verify internal I/O mapping, scaling, and engineering units, ranges and offsets, communication between devices, logical functions, timers and setpoints, and proper annotation of functionality.

15. Provide calibration of new field and panel analog instruments. Validate analog inputs to PLC by manipulation of the instrument source (pressure, level, etc.).

16. Contractor shall verify each input point type to ensure the data is correctly transmitted to the PLC and HMI.

17. The Contractor shall adjust, troubleshoot, and fully commission equipment as necessary to achieve proper operation and functionality of PLC, excitation,

and protection equipment as shown on the Control System Description document.

18. Communication Tests

a. Verify all equipment connected with a networking or communications cable for proper network discovery and IP addressing.

b. Verify local and remote HMI interface is operating with the PLC as designed. If the SCADA network is not available, local testing of the remote HMI is acceptable.

3.3 ADJUSTING

A. Any equipment/materials that do not meet manufacturer recommendations or Owner's requirements shall be replaced, at the cost of Contractor.

3.4 DEMONSTRATION

A. Demonstrate all equipment and materials operate as Owner intended, and per Contract documents.

3.5 SCHEDULES

A. Test Sequence: The following tests shall be completed in the following sequence:

B. Pre-Startup Testing and Checks

C. Facility Energization

D. Phase Rotation Verification – Utility Service, Automatic Transfer Switch, Generator

END SECTION

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SECTION 26 27 00

LOW-VOLTAGE DISTRIBUTION EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles

2. Switches

3. Finish Plates

1.2 REFERENCES

A. UL 498 Standard for Safety Attachment Plugs and Receptacles

1.3 DEFINITIONS

A. GFCI: Ground Fault Circuit Interrupter

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Provide Low-Voltage Distribution Equipment, as indicated in drawings.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Submittals shall be in accordance with the Standard General Conditions and the Supplementary conditions.

C. Shop Drawings detailing dimensions, mounting details, construction materials, grader, and termination details.

D. Electrical ratings.

1.6 QUALITY ASSURANCE

A. Qualifications:

B. Regulatory Requirements:

C. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

D. DELIVERY, STORAGE, AND HANDLING

1. Packing, Shipping, Handling, and Unloading:

2. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

E. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed per manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

1.7 PROJECT/SITE CONDITIONS

A. Project/Site Environmental Requirements

1. Provide weatherproof enclosures for all equipment in outdoor or damp environment.

2. Provide equipment that is rated to perform in site environmental conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Leviton

B. Westinghouse

C. Hubbell

D. Or approved equal.

2.2 MANUFACTURERED UNITS

A. Equipment detailed below shall be rated to operate as indicated in plans.

B. Duplex Receptacles

1. Receptacles shall be grounded, rated for use in industrial environments, with brass plated contacts, crews, and clamps, and shall be UL498 listed.

2. Provide outdoor receptacles with weatherproof cover for outdoor locations.

a. Provide a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to

the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

3. Unless otherwise noted, all receptacles shall be rated to match the voltage and current of the line side circuit protector.

C. GFCI Receptacles

1. Shall be an integral unit suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring. GFCI receptacles shall be self-test receptacles in accordance with UL 943.

2. Ground fault interrupter shall consist of a differential current transformer, self-test, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device.

3. End-of-life indicator light shall be a persistent flashing or blinking light to indicate that the GFCI receptacle is no longer in service.

D. Switches

1. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be white in color unless otherwise specified or shown on the drawings.

2. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.

3. Shall be single unit toggle, butt contact, quiet AC type, heavy duty general-purpose use with an integral self-grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.

4. Unless otherwise noted, all receptacles shall be rated to match the voltage and current of the line side circuit protector.

E. Finish Plates

1. Wall plates for switches and receptacles shall be 302 stainless steel and shall be sized to fit the switch.

2. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown on the drawings.

B. Install wiring devices after wall construction and painting is complete.

C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and connected to the branch circuit equipment grounding conductor.

D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.

E. Provide barriers in multi-gang outlet boxes to comply with the NEC.

F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material.

G. Install wall switches 48 inches above floor, with the toggle OFF position down.

H. Install pole mounted switches per plans.

I. Install wall dimmers 48 inches above floor.

J. Install receptacles 18 inches above floor, and 6 inches above counter backsplash or workbenches, unless otherwise noted.

3.2 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Perform manufacturer’s required field checks in accordance with the manufacturer's recommendations.

2. Inspect physical and electrical conditions.

3. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.

4. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

5. Test GFCI receptacles in presence of Owner.

END SECTION

SECTION 26 28 11

OVERCURRENT PROTECTION DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to overcurrent protection devices.

a. Circuit Breakers

b. Fuses

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

2. The requirements of this Section apply to all Division 26 work as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR – California Code of Regulations, Title 24

a. Part 3 – California Electrical Code (CEC); NFPA 70 National Electrical Code (NEC) with California amendments

2. Federal Specification

a. W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service

3. NEMA – National Electrical Manufacturer's Association

a. AB 1; Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures

b. PB 2.2; Application Guide for Ground Fault Protective Devices for Equipment

4. UL – Underwriters Laboratories, Inc.

a. 248; Low Voltage Fuses

b. 468; Wire Connectors

c. 508E; IEC Type "2" Coordination Short Circuit Tests

d. 489; Molded-Case Circuit Breakers and Circuit Breaker Enclosures

e. 943; Standard for Ground-Fault Circuit-Interrupters

1.3 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance with Section 26 05 00.

B. Submittal shall show the following information: circuit breaker numbering, circuit breaker type and short circuit rating.

C. Time-Current Curve for all devices.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. The manufacturing facility shall be registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9002 Series Standards for quality.

1.5 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

PART 2 PRODUCTS

2.1 FUSES

A. All power distribution fuses shall be time-delay, high interrupting (200kAIC minimum) and current limiting type, unless otherwise indicated. All fuses shall be of the same manufacturer and model.

1. Motor branch circuit fuses (0 – 600A): UL Class RK5 dual element, time delay type shall be size for UL 508E "Type 2" coordination for the motor controller. Coordinate fuse selection with motor starter overload relay heaters as required.

2. General purpose fuses (0 – 600A): UL Class RK1 dual element, time delay type shall be size per Drawings.

B. Control and instrumentation fuses shall of type and rating as recommended by equipment manufacturer, suitable for fuse blocks type installation.

2.2 MOLDED CASE CIRCUIT BREAKERS

A. General

1. Bolt-on construction method.

2. Current carrying components shall be isolated from the handle and the accessory mounting area.

3. Circuit breakers shall have a toggle mechanism to provide quick-make, quick-break contact action. All poles shall trip in unison.

4. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication.

5. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker after installation.

6. Circuit breakers shall have an interrupting capacity not less than shown on Drawings, or if not shown shall not be less than:

   a. 25kA for 480V systems

   b. 22kA for 240V (or less) systems

7. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.

8. Circuit breakers shall be equipped with UL Listed electrical accessories as noted on Drawing. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position.

9. Circuit breakers shall be constructed with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs. Lug body shall be bolted in place; snap in design not acceptable.

10. Provide breakers with integrated GFCI protection, where indicated in plans.

11. Provide equipment ground fault protection where shown on Drawing with the following features.

    a. A means of testing the ground fault system shall be provided.

    b. Local visual ground fault trip indication shall be provided.

B. Thermal-Magnetic Circuit Breakers

1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true RMS sensing and thermally responsive to protect circuit conductor(s) in a 40°C ambient temperature.

3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.

C. Electronic Trip Circuit Breakers

1. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on plans.

2. The integral trip system shall be independent of any external power source and shall be rated for industrial use.

3. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

   a. Instantaneous Pickup

   b. Long Time Pickup

   c. Long Time Delay

   d. Short Time Pickup

   e. Short Time Delay

   f. Ground Fault Pickup (when specified with ground fault protection)

   g. Ground Fault Delay (when specified with ground fault protection)

4. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment and their accessories to manufacturer's instructions, pertinent Codes, and with recognized industry practices to ensure device operates properly.

B. Tighten electrical connectors and terminals in accordance with manufacturer's requirements. Where the manufacturer does not have published torque tightening values, comply with the requirements of UL 468.

3.2 FIELD QUALITY CONTROL

A. Check tightness of circuit breaker connections using a calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

B. Obtain the services of an independent testing company who shall provide quality control and adjustments as well as tests for

1. Check each circuit breaker above 100A on a 225A frame for long-time and short- time delay pickup and instantaneous pickup.

   a. Instantaneous pickup current shall be determined by 4 cycles or less.

   b. Perform timing test with 300% of breaker trip unit rated current.

   c. Adjust unit if required, so that the tripping characteristics are within the limits of the published time-current characteristic curves for that particular trip unit.

2. Test and calibrate ground fault protection trip and pickup time on 225A frame breakers and larger.

C. Physically test key interlock systems to check for proper functionality.

D. Check and set where required all protective device settings in accordance with approved coordination study settings and conduct ground fault acceptance tests.

3.3 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Adjust circuit breaker trip and time delay settings to values indicated as instructed by Owner.

1. Check each circuit breaker above 100A, long-time and short-time delay pickup and instantaneous pickup. Instantaneous pickup current shall be determined by 3 cycles or less. Perform timing test with 3 times the breaker trip unit rated current.

2. Main circuit breaker ground fault setting shall be per the California Electrical Code, of Owner.

3.4 CLEANING

A. Remove marks, dirt and debris from equipment.

END SECTION

SECTION 26 29 13

REDUCED VOLTAGE MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reduced-Voltage Motor Controllers

1.2 REFERENCES

A. NFPA 70® – National Electric Code® (NEC®)

B. UL 50 – UL Standard for Safety for Enclosures for Electrical Equipment

C. UL 508C – UL Standard for Safety for Power Conversion Equipment

D. UL 508A – UL Standard for Safety for Industrial Control Panels

E. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

1.3 DEFINITIONS

A. RVSS – Reduced Voltage Soft Starter

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Provide a reduced voltage motor controller to operate system.

1.5 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedures.

B. Manufacturer Drawings

1. Elevation drawings showing dimensional information, inside of Power & Control Panel.

2. Structure descriptions showing:

a. Enclosure ratings

b. Fault ratings

3. Other information as required for approval Conduit locations

4. Unit descriptions including amperage ratings, frame sizes, trip settings, pilot devices, etc.

5. Nameplate Information

C. Equipment Ratings: Voltage, horsepower, current rating, weight, and standard and optional features and accessories.

D. Wiring Diagrams (Power and Control)

E. Cut Sheets

F. Scaled and Dimensioned Drawings – Plan and Profile

1. Conduit entry/exit location and sizes

G. Factory Testing Results

H. Operation, Maintenance, and Installation Manuals

1. Installation manuals detailing grounding requirements, initial installation, and testing/commissioning requirements.

I. Testing and Test Reports

1. Testing shall be per manufacturer's standard.

2. A copy of the test reports, if available, shall be provided as part of the final documentation.

J. Parameter details, listing As-Left values.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. To ensure all quality and corrective action procedures and documented and implemented all manufacturing locations shall be certified to the ISO-9001 Series of Quality Standards.

2. Third party manufacturers and brand labeling shall not be allowed.

B. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

B. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed per manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

2. Store, protect and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

3. Inspect and report concealed damage to carrier within 48 hours, in writing.

4. Store equipment in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris and traffic. Heat enclosures to prevent condensation.

5. Handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices and finish.

1.8 WARRANTY

A. Special Warranty: The manufacturer warrants the materials and workmanship of the drive to be free from defects for a period of twenty-four months from the date of shipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Allen Bradley (Rockwell)

B. GE

C. Yaskawa

D. Or Approved Equal

2.2 MANUFACTURED UNITS

A. Reduced Voltage Soft Starter

1. The solid-state reduced voltage controller shall accept an input voltage as detailed in the single line diagram, plus 10 percent or minus 15 percent.

2. The solid-state reduced voltage controller shall have a minimum short-circuit current rating of 65 kA when protected with Type CC/J/L fuses (up to 600V).

3. The open-type controller device shall be modular, consisting of a power structure and a logic component.

4. Power Structure

   a. The power structure shall include built-in 3-phase current monitoring and overload protection.

   b. The power structure shall consist of three power poles with integral heatsinks.

   c. Use of an External bypass to alternate starter must be an option.

5. Logic Component

   a. The logic component shall be a self-contained control module.

   b. The control module shall provide digital microprocessor control and supervision of all controller operation, including pulse firing of the SCRs.

   c. The control module shall consist of the following:

      1) Self-tuning power supply accepting control power input that is integrated with the RVSS.

      2) Input/output circuitry.

      3) Digital programming keypad.

      4) HMI display with multi-lingual capabilities.

      5) Communication port.

   d. The control module shall be easily removed from the power structure, without the need to disassemble the assemblies.

B. Performance Requirements:

1. The soft starter shall be suitable for use at temperatures from -10 ºC to 40 ºC without derating, and up to 60 ºC with derating.

2. The soft starter shall be suitable for operation at altitudes up to 1500 ft above sea level without derating.

3. The soft starter shall be correctly selected for the application and rated for a minimum of 3 starts per hour.

4. Starting Modes

a. Soft start with Selectable Kickstart

1) Programmable initial torque value of 0…90 percent of locked rotor torque.

2) Programmable acceleration ramp time from 0…30 seconds.

3) A selectable kickstart, or boost, shall provide a current pulse of 550 percent of the full load current. The kickstart time shall be adjustable from 0…2 seconds.

4) Current limit start.

5) Provide means of limiting the maximum starting current.

6) Adjustable from 50…600 percent of motor full load current.

b. Full-voltage start

1) Provides across the line starting.

2) Ramp time shall be less than 0.25 seconds.

c. Dual ramp start

1) Provides two (2) separate start profiles with separately adjustable ramp times and initial torque settings.

2) Programmable acceleration times from 0…30 seconds.

3) Current limit level programmable from 50…600 percent full load current.

4) Programmable initial torque values from 0…90 percent of locked rotor torque.

5. Stopping Modes

a. Soft stop

1) The soft stop option shall provide a voltage ramp-down for an extended motor stopping time.

2) Soft stop shall be initiated by a dedicated Soft Stop input. A coast-to-rest stop shall still be possible with a separate stop input.

3) Programmable voltage ramp down time from 0…60 seconds, minimum.

4) The load shall stop when the motor voltage drops to a point where the load torque is greater than the motor torque.

2.3 EQUIPMENT

A. All controls are shown deenergized.

2.4 COMPONENTS

A. Communications Protocols:

1. The drive shall include ModBus TCP protocols.

B. The soft starter shall permit the operator through the means of standard USB memory stick to:

a. save the current configuration to an external file

b. reload a previously saved configuration or default set from an external file

c. save log contents and diagnostic data to an external file for further analysis

C. Communication Ports:

1. The drive shall contain (1) RJ45 ethernet port (minimum).

D. Overload Protection

1. Shall meet applicable standards as a motor thermal protective device.

2. Shall utilize three-phase current sensing. The use of two current transformers shall be unacceptable.

E. The soft starter shall provide the following protections as standard:

a. Motor electronic thermal model

b. Excess start time

c. Motor overtemperature

d. Motor thermistor circuit

e. Current imbalance

f. Frequency out of range

g. Phase sequence

h. Undercurrent

i. Overcurrent

j. Undervoltage

k. Overvoltage

l. Underpower

m. Overpower

n. Power loss

o. Input A trip

p. Input B trip

q. Starter communications

r. Bypass contactor failure (where internal bypass is used)

s. L1, L2, L3 phase loss

t. L1, L2, L3 shorted SCR

u. Motor connection

v. Heatsink overtemperature

w. Battery / clock failure

F. Digital I/O

1. Digital and Analog I/O shall be provided, as detailed below:

a. 2 Analog Inputs, user programmable.

b. 2 Analog outputs, user programmable.

c. 2 digital inputs, user programmable.

d. 2 digital outputs, user programmable.

e. 4 digital inputs

1) Start
2) Motor Stop
3) Spare Input
4) Spare Inpit

f. 4 digital outputs

1) Motor On/Off
2) Motor Ready
3) Motor Faulted
4) Spare

2. Contact configuration shall be programmable and contain the following configuration:

    a. Normal Operation (N.O. or N.C.)

    b. Up-to-Speed indication (N.O. or N.C.)

    c. External bypass

    d. Fault indication (N.O. or N.C.)

    e. Alarm indication (N.O. or N.C.)

    f. Network controlled output (N.O. or N.C.)

3. Monitoring – the controller shall provide the following motor and/or power system monitoring functions indicated through the HMI display.

    a. Three-phase current

    b. Three-phase voltage

    c. Power in kW

    d. Power usage in kWh or MWh

    e. Power factor

    f. Motor thermal capacity usage

    g. Elapsed time

4. Protection and Diagnostics

    a. Pre-start line fault advising or missing load connection with phase indication.

    b. Running line fault advising power loss or missing load connection.

    c. The following programmable protection shall be provided as the standard with the controller.

        1) Overload
        2) Underload
        3) Undervoltage
        4) Overvoltage
        5) Voltage unbalance
        6) Phase reversal
        7) Stall

8) Jam

9) Excessive starts per hour

d. Fault diagnostics shall be indicated in descriptive text on the HMI display.

e. An auxiliary contact that is user programmable for fault indication shall be provided for customer use.

f. The soft starter shall provide real-time feedback of operating conditions, including:

1) starter status
2) average current
3) L1 current
4) L2 current
5) L3 current
6) mains frequency
7) motor voltage (Average rms across all three phases)
8) motor voltage (phase voltages A-B, B-C, C-A)
9) motor power factor
10) motor temperature (as a % of total thermal capacity)
11) heatsink temperature
12) bypass model
13) SCR temperature
14) rating capacity
15) number of starts
16) hours run
17) current graph

g. The soft starter shall record all changes to its configuration for storage in an event log. The soft starter's event log shall store no fewer than 300 events.

2.5 ACCESSORIES

A. Enclosure

1. Located in Power & Control Panel.

B. Input Circuit Breaker

1. Provide a door interlocked circuit breaker disconnect, the type of breaker shall be as detailed in the contract documents.

2. Operator Handles

   a. Provide flange mounted operator handles for free standing units.

   b. Through the door operating handles are acceptable for wall mounted units.

   c. Handles shall be padlockable.

C. Control Power Transformer

1. Provide a control power transformer mounted and wired inside of the system enclosure, as-needed.

2. The transformer shall be provided with fused primary and secondary protection.

D. Hand-Off-Auto Selector Switch, Start/Stop push buttons, and Pilot lights

1. Provide a “Hand/Off/Auto” selector switch for start-stop control.

2. Provide pilot lights for indication of the “Hand” and “Auto”, modes.

3. Provide pilot lights, mounted on the enclosure door, for indication of On, Off and Fault.

4. Pilot light shall be transformer type.

5. Provide Start-Stop and Pump Stop push buttons. Stop push buttons shall always be active.

6. The devices shall be pilot devices rated NEMA Type 4X and shall be mounted on the enclosure door.

E. Human Machine Interface (HMI)

1. Provide a door mounted Human Interface Module with integral display and programmable keys.

2. The display shall show operating conditions, adjustments and fault indications.

3. The display shall be backlit.

4. The built-in user interface shall comprise as minimum:

   a. status LEDs indicating

   b. motor state

c. starter control state

d. trip status

e. local pushbuttons to control:

f. menu access

g. parameter configuration

h. motor start

i. motor stop

j. current and voltage startup and shutdown limitations

k. startup and shutdown durations

l. starter reset

m. menu access

n. parameter configuration

PART 3 EXECUTION

3.1 INSTALLERS

A. Make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.

B. At a minimum, the start-up service shall include:

1. Pre-power check

a. Megger motor resistance: phase-to-phase and phase-to-ground

b. Verify system grounding per manufacturer' specifications

c. Verify power and signal grounds

d. Check connections

e. Check environment

2. Poer-up and commissioning

a. Measure incoming power phase-to-phase and phase-to-ground

b. Measure DC bus voltage

c. Measure AC current unloaded and loaded

d. Measure output voltage phase-to-phase and phase-to-ground

3. Check motor rotation and ensure rotation is correct.

4. Recording of all measurements

5. Tuning for system operation

6. Providing a parameter list, as-left settings.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Examine installation area to assure there is enough clearance to install panel.

2. Check mounting surfaces for uniformity and level surface.

3. Inspect for any physical damage.

4. Verify that equipment is ready to install.

5. Verify Owner has taken no exceptions to the field measurements.

6. Verify that required utilities are available, in proper location and ready for use.

3.3 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Inspect physical and mechanical, anchorage, alignment, and grounding. Inform Owner of any discrepancies/damage in writing, prior to substantial completion.

2. Inspect contactors.

3. Verify mechanical operation.

4. Inspect and adjust contact gap, wipe, alignment, and pressure in accordance with manufacturer's published data.

5. Motor-Running Protection

a. Compare overload element rating with motor full-load current rating to verify correct sizing.

1) If motor-running protection is provided by fuses, verify correct fuse rating considering motor characteristics and power-factor correction capacitors.

b. Test the motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.

1) Overload test trip times at 300 percent of overload element rating should be in accordance with manufacturer's published time-current curve.

c. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use of a low-resistance ohmmeter.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data. I

6. Calibration Tests: Test for the following parameters.

a. Input phase loss protection

b. Input overvoltage protection

c. Output phase rotation

d. Overtemperature protection

e. DC overvoltage protection

f. Over frequency protection

g. Drive overload protection

h. Fault alarm outputs

7. Perform operational tests by initiating control devices.

a. Verify operation of drive from remote start/stop and speed control signals.

8. Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

9. Clean the unit after tests are completed.

10. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to ground with starter closed, and across each open pole. Test voltage shall be in accordance with manufacturer's published data.

11. Test motor protection devices in accordance with manufacturer's published data, including but not limited to:

12. RTDs, thermostats, vibration monitors, motor heaters.

13. Perform operational tests by initiating control devices.

14. Motor protection parameters and devices shall perform in accordance with manufacturer's published data and system design requirements.

3.4 TRAINING

A. The instruction shall include the operational and maintenance requirements of the controller.

B. The basis of the training shall be the installed controller, the engineered drawings, and the user manual. At a minimum, the training shall do the following:

1. Review the engineered drawings identifying the components shown on the drawings.

2. Review starting/stopping options for the controller.

3. Review operation and the Human Interface for programming and monitoring of the controller.

4. Review maintenance requirements of the controller.

5. Review safety concerns with operating the controller.

C. Provide training for Owner and prepare materials including operation and maintenance manuals for the equipment listed below. Submit schedule for training and all training materials 10-business days prior to proposed training day.

Training Topic and Duration	
Reduced-Voltage Motor Controller	2-hours

END SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaires
2. Lighting Equipment
3. Ballasts
4. Dimming Controls
5. Lighting Accessories
6. Light fuses and fuse block holders

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Interconnect new circuit with existing pole mounted light.

1.3 SUBMITTALS

A. Wiring Diagram.

B. Scaled and dimensioned plan and profile drawing showing installation details.

1. Detailing terminal location and transition of new circuit into existing light.

1.4 QUALITY ASSURANCE

A. Certifications:

1. UL: All material and equipment within the scope of the UL re-examination service shall be listed and approved by the Underwriters' Laboratories for the purpose for which they are used and shall bear their label.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Equipment and materials shall be packed, shipped, and handled per manufacturer recommendations. Attach equipment specific instructions for handling, storage, and installation to each piece of equipment before packing and shipping.

B. Storage and Protection:

1. Equipment and materials shall be stored per manufacturer recommendations, in a clean, dry, and protected location. Equipment and materials shall be stored and installed according to the manufacturer's recommendations. All material and equipment shall be stored in a manner to prevent damage or corrosion. Equipment with components which can be damaged due to moisture shall be placed in special heated storage facilities.

1.6 SEQUENCING

A. Confirm any installation challenges with Owner, prior to mobilization.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

3.1 INSTALLATION

A. Ensure all lights and equipment enclosures are grounded and bonded per NEC requirements.

B. Fixture installation shall conform to all applicable standards for installation, mounting, wiring, and quality.

C. All fixtures shall be grounded and bonded in accordance with applicable codes and manufacturer recommendations. Where fixtures are installed in rows, a bonding screw shall be used to maintain bonding integrity from fixture to fixture.

D. All fixtures, lenses, and other trim shall be aligned, cleaned, free of paint and blemishes before final acceptance.

E. Fixtures weighing more than two pounds shall be supported by means other than the outlet box.

1. All outlet boxes shall be able to support a minimum of eight pounds.

F. For fixtures weighing more than two pounds, support shall be provided at all four corners, plus the outlet box. Each support shall be able to carry a minimum of four times its intended load.

G. When fixtures are stem mounted, the variation in distance from the finished floor shall vary no more than 1/2" from the heights as specified on the plans.

H. All fixtures shall be supported by the building structural members or from bridging attached to the structural members. Provide all necessary blocking and hardware so that fixtures hang true, square, plumb, and in proper alignment. Recessed fluorescent fixtures in T-bar ceilings shall have minimum of two #12 steel hanger wires from each 4-foot fixture, one at either end.

I. All lamps shall be operating, and all fixtures shall be clean at the time of final inspection.

3.2 APPLICATION

A. Unless otherwise shown on the plans, fixture type designation for an individual fixture shall be typical for similarly indicated fixtures within the entire room or defined area.

B. Provide fixtures complete with all component parts to make a complete installation. Fixtures shall have a suitable interior means of grounding the enclosure.

C. All fixtures shall bear the UL label and shall be suitable for installation location.

D. All attaching devices for fixtures mounted at the ceiling shall be of formed or rolled steel and of sufficient strength to prevent movement of fixture after installation.

E. Provide gasketing, stops, and barriers to form light traps and prevent light leaks.

3.3 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Upon completion of installation apply electrical energy to demonstrate capability and compliance with requirements.

2. Test operation of light and associated photocell/motion detection accessories, in presence of Owner.

3.4 CLEANING

A. Clean interior lighting fixtures of dirt and debris. Clean and remove smudges from lenses and refractors.

B. Clean all glass and plastic and polish all visible metal parts before submitting job to Owner's representative for final acceptance. Remove all fingerprints and dirt from exposed surfaces. Replace scratched or damaged components at the Contractor's expense.

END SECTION

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SECTION 31 23 17

TRENCHING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. This section includes material, testing, and installation for trench excavation, backfilling and compacting.

1.2 RELATED WORK

A. Section 32 11 23 – Aggregate Base

1.3 REFERENCES

A. ANSI/ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557 – Moisture-Density Relations of Soils and Sol-Aggregate Mixture Using 10 lb (4.54 kg) Hammer and 18-inch (457 mm) Drop.

C. ANSI/ASTM D1556 – Density of Soil and base rock in Place by Sand-Cone Method.

D. ASTM D6938 – Density of soil and base rock in place by Nuclear method.

E. ASTM D2937 – Density of soil and in place by Tube method.

F. Section 26 – Aggregate Bases, State Standard Specifications.

1.4 SUBMITTALS

A. Submit plans as required for worker protection against caving ground in excavations.

B. Submittals shall be in accordance with the General and Special Provisions.

1.5 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

1. Trenches shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926, Subpart P—Excavations, CAL/OSHA requirements, and the Contract Documents.

B. Notify Engineer of unexpected subsurface conditions.

C. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

D. When the pipe laying is not in progress, including the noon hours, close the open ends of pipe. Do not allow trench water, animals or foreign material to enter the pipe.

1.6 CONTROL AND DIVERSION OF WATER

A. General – The Contractor shall furnish or procure all materials and labor required for constructing and maintaining all temporary diversion and protective works and shall furnish, install, maintain, and operate all necessary pumping and other equipment for removal of water from the various parts of the work and for maintaining the foundations and other parts of the work free from water. See section 31 23 19 Structure Excavation and Backfilling.

B. Plan – Prior to beginning any work on the removal of water from trenches, the Contractor shall submit for the Engineer's approval a water control plan showing his proposed method for the removal of water from trenches and other parts of the work.

C. Dispose of the water in a manner that will prevent damage to the adjacent property and in accordance with regulatory requirements.

D. Do not drain trench water through the pipeline under construction.

1.7 PROJECT CONDITIONS

A. Underground utilities may exist at this site. Contractor shall take all necessary precautions to protect said utilities. Notify Engineer of any deviation in utility location from that which is shown on the drawings.

B. Obtain all required permits and licenses before installing utilities and follow the rules and requirements of the authority having jurisdiction.

C. Arrange construction sequences to provide the shortest practical time that the trenches will be open to avoid hazard to the public, and to minimize the possibility of trench collapse.

PART 2 MATERIALS

2.1 NATIVE EARTH BACKFILL

A. Native earth backfill used above the pipe zone shall be fine-grained materials free from roots, debris, and rocks larger than 3 inches.

2.2 SELECT AND IMPORT MATERIAL IN PIPE AND BEDDING ZONE

A. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; 1/4-inch minimum to 5/8-inch maximum size.

B. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter, graded in accordance with Section 19-3.02F(2), State Standard Specifications, within the following limits.

Sieve Size	Percent Passing By Weight
No. 4	75 – 100
No. 200	0 - 10

C. Imported sand shall have a sand equivalent of 30 per ASTM D2419.

2.3 WATER FOR COMPACTION

A. Water shall be free of organic materials injurious to the pipe coatings, have a pH of 7.0 to 9.3, maximum chloride concentration of 500 mg/l, and a maximum sulfate concentration of 500 mg/l.

PART 3 EXECUTION

3.1 GENERAL

A. Excavation, grading and compaction shall conform to State Standard Specifications, Section 19, Earthwork.

3.2 INSPECTIONS

A. The City of Los Banos inspector is to approve stockpiled material for reuse.

B. Verify areas to be backfilled are free of debris, snow, ice, or water, and surfaces are not frozen.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.4 AC PAVEMENT AND CONCRETE REMOVAL

A. Cut bituminous and concrete pavements, regardless of the thickness, curbs, gutters and sidewalks prior to excavation of trenches.

1. Width of material removed shall be at least equal to the required width of the trench at ground surface.

2. Width of material removed shall be as shown on the Plans.

3. AC pavement and concrete rubble shall not be used for trench backfill.

3.5 TRENCH EXCAVATION

A. Excavate the trench to the lines and grades shown on the Drawings and details with allowance for pipe thickness, sheeting and shoring if used, and for special bedding.

B. Paved Areas: Cut existing pavement to full depth to a true line before excavation and maintain the edge suitable for repaving. Pavement removed shall not be used as backfill.

C. Trenching Guidelines: Excavate the trench to the approximate level of the grade of the utility line to be installed, using adequate trench width and side slopes to safely accommodate worker access.

1. Unstable Trench Bottom: Secure approval of depth of over-excavation and stabilization method. For wet trench construction, use approved method of dewatering through diversion, damming and pumping, well points, or underdrain systems. Dispose of removed fluidized materials as approved. Use bedding material to build a suitable foundation to within 6 inches of finished utility grade, prior to bedding with the specified material. Compact layers to 95 percent of maximum density in not greater than 6-inch layers. Do not proceed with utility installation until wet trench and unstable conditions are corrected to the satisfaction of the Engineer.

D. Remove areas of sub-grade not readily capable of it-situ compaction.

1. Backfill with Bedding or Select Backfill material and compact to density equal to requirements for subsequent backfill.

E. Unauthorized excavations shall be at no cost to Owner.

1. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade.

2. Place the refilling material over the full width of trench in compacted layers not exceeding eight inches deep to the established grade with allowance for special bedding.

F. Trench widths in the pipe zone shall be as shown on the drawings. If no details are shown, maximum width shall be 24 inches greater than the pipe outside diameter.

1. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least two feet between the top edge of the trench and the structure or footing.

G. Remove lumped soil, boulders and rock.

H. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

I. During trench excavation, place the excavated material only within the working area. Do not obstruct roadways or streets. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

3.6 LENGTH OF OPEN TRENCH

A. Limit the length of open trench to amount of pipe installed in one working day.

B. Complete backfilling, temporary or first layer paving, not more than 400 feet in the rear of pipe laying operation.

3.7 TRENCH EXCAVATION IN EMBANKMENT AREAS

A. Construct and compact the embankment to an elevation one foot, minimum, over the top of the largest pipe or conduit to be installed prior to trench excavation.

3.8 UNSUITABLE MATERIAL

A. Unsuitable material shall be excavated and disposed of in a lawful manner off the project site, all disposal shall be approved by the Engineer prior to initiating the work.

3.9 DEWATERING

A. See Section 31 23 19 Structure Excavation & Backfilling

3.10 TRENCH BACKFILLING

A. Support pipe during placement and compaction of bedding fill.

B. Backfilling and cleanup work shall be accomplished as sections of pipe or conduit are tested and approved. Vehicular travel through the work site shall be impeded or obstructed as little as possible.

C. Compaction: Use vibratory compactors for sands and gravels (non-cohesive soils). Use mechanical tampers for sand and gravel containing a significant portion of fine-grained materials, such as silt and clay (cohesive soils). Hand tamp around pipe or cable to protect the lines until adequate cushion is attained. Puddling or water flooding for consolidation of backfill or compaction by wheel rolling will not be permitted.

D. Employ a placement method that will not disturb or damage pipe or utilities.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction or hand tamping. Do not use high impact hammer type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

G. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

1. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe.

2. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

H. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe, in maximum 8-inch lifts, keeping the level of backfill the same on each side.

I. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of building walls, foundations, and other structures.

J. Do not permit free fall of the material until at least two feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe. Do not operate heavy equipment over the pipe until at least 3 feet of backfill has been placed and compacted over the pipe.

K. Remove surplus backfill materials from site.

L. Leave stockpile areas completely free of excess fill materials.

3.11 COMPACTION REQUIREMENTS

A. Relative compaction requirements shall be as shown on the Plans.

END SECTION

SECTION 31 23 19

STRUCTURE EXCAVATION & BACKFILLING

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work of this section consists of excavation and backfill for concrete structures, and preparation of subgrade for concrete flatwork.

B. Haul, place, rough grade, compact, and finish grade excavated material as engineered fill on those portions of the project site where it is necessary in order to construct the facilities indicated on the Plans.

C. Dispose of unsuitable material off-site or in designated areas, as directed by the Engineer.

1.2 RELATED WORK

A. Section 03 41 00 – Precast Concrete Structures

B. Section 31 23 17 – Trenching, Backfilling and Compacting

1.3 REFERENCES

A. ANSI/ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557 – Moisture-Density Relations of Soils and Sol-Aggregate Mixture Using 10 lb (4.54 kg) Hammer and 18-inch (457 mm) Drop. (Curve).

C. ANSI/ASTM D1556 – Density of Soil and base rock in Place by Sand-Cone Method.

D. ASTM D2937 – Density of soil and in place by Tube method.

1.4 SUBMITTALS

A. Submit plans as required for worker protection against caving ground in excavations.

B. Submittals shall be in accordance with the General and Special Provisions.

1.5 SAMPLES

A. Submit samples in accordance with the General and Special Provisions.

1.6 DEFINITION

A. Unsuitable Material: Unsuitable material is material determined to be

1. Incapable of being compacted to specified density using ordinary methods at optimum moisture content.

2. Too wet to be properly compacted if circumstances prevent satisfactory in-place drying prior to incorporation into the work.

3. Otherwise unsuitable for the planned use.

1.7 PROTECTION

A. Notify Engineer of unexpected subsurface conditions.

B. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

C. Grade excavation top perimeter to prevent surface water run-off into excavation.

1.8 SHORING AND SHEETING

A. Construct and maintain all shoring, sheeting, and slope layback necessary to protect the excavation and surrounding infrastructure, as needed, for the safety of the employees and as required by applicable State and Federal laws. Provide suitable barricades for public safety, regardless of excavation depth.

B. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

1. Trenches shall have sloping, sheeting, shoring, and bracing conforming with Subpart P, CAL/OSHA requirements, and the Contract Documents.

1.9 CONTROL AND DIVERSION OF WATER

A. General – The Contractor shall furnish or procure all materials and labor required for constructing and maintaining all necessary cofferdams, channels, flumes, drains, sumps, and/or other temporary diversion and protective works and shall furnish, install, maintain, and operate all necessary pumping and other equipment for removal of water from the various parts of the work and for maintaining the foundations and other parts of the work free from water.

1.10 SITE CONDITIONS

A. Underground utilities may exist at this site. Contractor shall take all necessary precautions to protect said utilities. Notify Engineer of any deviation in utility location from that which is shown on the drawings. The site has been previously excavated to install the existing lift station and associated underground utilities as such, it is expected that most excavation will take place within a previously backfilled area. No geotechnical investigation or soils exploration has been performed for this project.

PART 2 PRODUCTS

2.1 SELECT BED AND FILL MATERIALS

A. Conform to Section 31 23 17 – Trenching, Backfilling and Compacting.

2.2 SELECT MATERIAL

A. Gravel: Pit run, natural stone; free of shale, clay, friable materials and debris; graded in accordance with 1½" x ¾" aggregate grading in Section 90-1.02C, State Standard Specifications.

B. Pea Gravel: natural stone; washed, free of clay, shale, organic matter; ¼ inch minimum to ⅝ inch maximum size.

C. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter, graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Percent Passing
No. 4	75-100
No. 200	0-10

D. Class 2 Aggregate Base: material as specified for ¾" maximum grading in the State Standard Specifications, Section 26.

2.3 ENGINEERED FILL MATERIAL

A. Native granular soil materials may be used as engineered fill. Particles larger than three inches shall be removed from trench backfill, particles larger than six inches shall be removed from engineered fill.

B. All imported fill material placed in structural areas shall consist of predominantly granular soil that is non-expansive, and shall be approved by the Engineer prior to use.

1. The R-value of the imported fill material shall be at least 50.

2.4 GRANULAR BACKFILL/AGGREGATE BASE COURSE

A. Granular backfill and aggregate base course shall meet the requirements of State Standard Specifications, Section 26, Class 2 aggregate base, ¾ inch maximum.

B. Material from concrete crushing operations may be used as granular backfill provided it meets the above requirements.

PART 3 EXECUTION

3.1 GENERAL

A. Provide required shoring, sheeting, and slope layback necessary to protect the excavation, as needed, for the safety of the employees and as required by applicable State and Federal laws. Provide suitable barricades for public safety, regardless of trench depth.

B. Upon completion of excavation and before placing forms or structures, notify the Engineer who will inspect the excavation and may take tests to determine soil-bearing values.

C. Identify required lines, levels, contours, and datum.

1. Stake and identify the extent of all earthwork operations prior to starting work.

D. Use suitable material removed from excavation before importing backfill.

E. Verify that stockpiled fill to be reused is approved by the Engineer.

F. Verify areas to be backfilled are free of debris, snow, ice, or water, and surfaces are not frozen.

3.2 DEWATERING

A. Dewatering is not anticipated at the site. On the California Department of Water Resources website, there are two wells approximately 2 miles from the project site with depth to groundwater results ranging from 19.10' to 27.90' depth for 2024 readings. See table below.

Well Number/Site Code	Type	Date	Depth to Water (ft)
370916N1208427W001	Residential	3/12/24 10/10/24	19.10 27.90
370993N1208571W001	Irrigation	10/09/24	20.90

The deepest excavation for project improvements will be the bypass manhole with approximately 14' of excavation required.

B. If dewatering is required, Additive Alternate Bid item 21 Temporary Dewatering Operation will be added to the contract and the following should be applied:

1. The Contractor shall keep all excavation free from water. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering of excavations. The Contractor shall at all times have on the project sufficient pumping equipment for immediate use, including stand-by pumps for use in case other pumps become in-operable.

2. The dewatering operation shall be continuous, so that the excavated areas are kept free from water during the construction, until backfill has been placed to a sufficient height to anchor the work against possible floatation.

3. Dewatering devices shall be adequately filtered to prevent the removal of fines from the soil.

4. Repair any damage caused by the failure of any part of the protective works. Remove temporary protective works when they are no longer needed for dewatering purposes.

5. Any drain rock required in the trench bottom to convey water or stabilize wet soil shall be included at no extra cost to the Owner.

3.3 EXCAVATION

A. Carefully excavate to the established lines and grades shown on the drawings, or as revised and approved by the engineer, to provide a firm, uniform, and unyielding foundation for the proposed structures.

B. Excavations for all footings, piers, finished walls and grade beams shall be sufficiently large so that forms for concrete may be properly placed, removed, and inspected.

1. Excavation for footings may be made to the net footing size plus two inches if the earth banks are sufficiently stable to remain in position until the concrete is in place and if approved by the Engineer.

C. The bottoms of footings, piers, slabs, walls, and grade beams to receive concrete shall be level before placing concrete. All foundations shall rest on firm bearing in undisturbed soil, or on controlled compacted fill.

1. The exposed subgrade surface shall be scarified to a depth of 8 inches, conditioned to optimum moisture content and compacted to at least 95 percent of the maximum dry density.

D. If any existing foundations, roots, stumps, debris, waste materials, pipes, or similar items have been removed, the Contractor shall excavate below these portions to solid undisturbed earth and foundations in these areas shall be built to necessary levels.

3.4 SURPLUS MATERIAL

A. Unless otherwise specified, surplus excavated material shall be used to widen embankments uniformly or to flatten slopes, or it shall be disposed of in a uniform manner along the adjacent roadway around the site or otherwise as approved.

B. Unless otherwise specified, surplus excavated material shall be used as fill for other areas requiring fill as shown on the Plans. Excess material that is not needed for engineered fill may be disposed of at an off-site spoil area. The location of the off-site spoil area, the limits of the fill area, the depths of fill, and the manner of work shall be as directed by the Engineer.

C. Stockpile surplus material as shown on the plans and/or as directed by the Engineer.

D. Leave stockpile areas completely free of excess fill materials.

3.5 UNSUITABLE MATERIAL

A. Unsuitable material shall be excavated and disposed of in a uniform manner off the project site, within the Owner's property as approved, however all disposal shall be approved by the Engineer prior to initiating the work.

3.6 BACKFILLING

A. Unless otherwise shown in the Plans, all backfill shall conform to Section 19-3 of the State Standard Specifications.

B. Do not place backfill against concrete until concrete has cured sufficiently to accept the load as determined by Section 19-3.03E of the State Standard Specifications.

C. Place and compact common fill material in continuous layers not exceeding eight inches loose depth.

D. Employ a placement method so not to disturb or damage pipes or utilities.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Remove surplus materials from site.

3.7 TOLERANCES

A. Top Surface of Backfilling: ±0.1 foot from design grade.

END SECTION

SECTION 32 11 23

AGGREGATE BASE

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish, spread, and compact aggregate base in roadways, driveways and other paved areas as shown on the Plans.

B. The work of this section consists of furnishing and placing aggregate base material and/or lean concrete base materials, and filler if required, on the prepared subgrade.

1.2 RELATED WORK

A. Section 31 23 17 – Trenching, Backfilling and Compacting

B. Section 32 12 16 – Asphalt Concrete Paving

1.3 REFERENCES

A. Section 26 – Aggregate Bases, State Standard Specifications.

B. Section 28-2 - Lean Concrete Base, State Standard Specifications.

C. ANSI/ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.

D. ANSI/ASTM D1557 – Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10 lb (4.54 kg) Hammer and 18-inch (457 mm) Drop.

E. ANSI/ASTM D1556 – Density of Soil and Base Rock in Place by Sand-Cone Method.

F. ASTM D6938 – Density of Soil and Base Rock in Place by Nuclear Method.

1.4 SUBMITTALS

A. Submittals shall be in accordance with the General and Special Provisions.

B. If materials are obtained from a commercial source, submit certification from the supplier certifying that aggregate base course meets the requirements of this section.

C. Copies of certified weight tickets for each load of aggregate delivered to the project site.

1.5 QUALITY ASSURANCE

A. Tests for compaction shall conform to references listed in Part 1.3 of this section.

B. Sample backfill materials per ASTM D75.

C. Compaction testing will be performed in accordance with Section 19-5 of the State Standard Specifications.

D. The percentage composition by weight shall conform to Class 2 aggregate base determined by Test Method No. Calif. 202, modified by Test Method No. Calif. 905 if there is a difference in specific gravity of 0.2 or more between the coarse and fine portion of the aggregate or between blends of different aggregates.

E. Aggregate base shall also conform to the following quality requirements:

Tests	Test Method Calif. No
R-Value	301
Sand Equivalent	217
Durability Index	229

F. Quality Control shall be under the provisions of Section 01 43 00 – Quality Control.

PART 2 PRODUCTS

2.1 MATERIALS

A. AGGREGATE BASE

1. Class 2 Aggregate Base, ¾-inch maximum; as per Section 26-1.02B, State Standard Specifications.

2. Aggregate for Class 2 aggregate base shall be free from organic material and other deleterious substances.

B. LEAN CONCRETE BASE

1. Lean Concrete Base shall conform to the State Standard Specifications, Section 28-4, Lean Concrete Base Rapid Setting.

C. WATER

1. As specified in State Standard Specifications.

2. At the time aggregate base is spread, it shall have a moisture content sufficient to obtain the required compaction. Such moisture shall be uniformly distributed throughout the materials.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. As specified in State Standard Specifications.

3.2 SPREADING

A. The aggregate base course material shall be deposited and spread to the required compacted thickness by means that will maintain the uniformity of the mixture. The aggregate base course shall be free from pockets of coarse or fine material.

B. Deliver aggregate base to the area to be paved as a uniform mixture and spread each layer in one operation.

C. Aggregate base placed at locations which are inaccessible to the spreading equipment shall be spread in two layers by any means to obtain the specified results.

D. The aggregate shall not be treated with lime, cement or other chemical materials before the Durability Index test has been performed.

E. The surface of the finished aggregate base at any point shall not vary more than ±0.05-foot from matching the existing surface.

3.3 PLACING

A. If the required compacted depth of the aggregate base course exceeds 6 inches, place course in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

3.4 MIXING

A. Mixing shall be in accordance with one of the methods set forth in State Standard Specifications, Section 28-4.03B.

B. When commercial binders or fillers are used with aggregate, mix with a central mixing plant of the twin-pugmill type. Other methods that ensure a thorough and homogenous mixture may be used on written approval from the Engineer.

3.5 MOISTURE CONTROL

A. When spread, aggregate base shall have a moisture content sufficient to obtain the specified compaction.

3.6 SURFACE FINISHING

A. Use a smooth steel wheel roller for the final rolling of top surface base course. Water surface and evenly spread loose stones before final rolling. Make minimum of two complete passes over area to embed stones. Correct soft spots developed during rolling.

B. Compacted aggregate base course surface shall be smooth and free from waves and other irregularities. Unsatisfactory portions of base course shall be corrected, at no additional expense to the Owner.

3.7 MATERIAL ACCEPTANCE REQUIREMENTS

A. Acceptance will be based on periodic samples and tests taken following mixing and before placing.

3.8 TOLERANCES

A. Surface: The finished surface of the base course will be tested with a 10-foot straightedge or other device. The variation between any two contacts with the surface shall not exceed ±0.05 feet.

B. Thickness: existing section plus 2 additional inches, ±0.05 feet.

C. Any areas not complying with these tolerances shall be reworked to obtain conformity, at no additional expense to the Owner.

3.9 MAINTENANCE

A. Maintain base course in a satisfactory condition until surfaced or until final acceptance.

END SECTION

SECTION 32 12 16

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work of this section consists of constructing one or more surface courses composed of a mixture of aggregate, filler if required, asphalt material and placed on a prepared base to lines, grades and details, as shown on the plans and covered within these specifications. This section includes asphalt patching for areas where utility lines cross existing paved surfaces, trench resurfacing, saw cutting and resurfacing additional paving widths as required in the contract or under permit requirements.

B. Mix aggregate and asphalt binder at a central mixing plant. Haul, spread, and compact the mixture for paved areas as shown and as specified.

C. Upon completion of all paving, finish the entire roadway. Trim and shape cut and fill slopes to produce smooth surfaces and uniform cross sections. Clean the finished pavement of all dirt and foreign material.

D. Cross sections of paving shall be as indicated in the Plans.

1.2 RELATED WORK

A. Section 31 23 17 – Trenching, Backfilling and Compacting

B. Section 32 11 23 – Aggregate Base

1.3 REFERENCES

A. Section 22 – Finishing Roadway, State Standard Specifications

B. Section 39 – Asphalt Concrete, State Standard Specifications

C. Section 92 – Asphalt Binders, State Standard Specifications

1.4 SUBMITTALS

A. Submittals shall be in accordance with the General and Special Provisions.

B. Certificates:

1. Certification from the supplier that the asphalt concrete is of correct type and meets requirements of this section.

2. Job mix formula shall be submitted with certification that the mix formula meets the requirements of Standard Specification Specifications Section 39, Asphalt Concrete. The job mix formula shall include definite single values for:

a. The percent of aggregate passing the specified sieve, based on dry weight of aggregate.

b. The percent of bituminous material to be added, based on the total weight of the mix.

c. Kind and amount of chemical additives (anti-stripping, hydrated lime, etc.) as established by the design procedure.

d. Maximum theoretical density.

e. Temperature ranges for the bituminous material at the point of mixing with the aggregates and bituminous mixture at the paving machine.

1.5 QUALITY ASSURANCE

A. Asphalt concrete supplier to prepare a mix design; to recommend adjustments to the proportions of the mix, as necessary, to conform to the mix design; and to consult with the Contractor and the Engineer during paving as required.

B. Density: Acceptable density of the in-place asphalt concrete pavement shall be 95 percent of the optimum values as determined from the mix design formula. Field sampling and density determination shall be made in accordance with with AASHTO T230-68, or an accepted nuclear procedure.

PART 2 PRODUCTS

2.1 ASPHALTS

A. Asphalt binder to be mixed with aggregate shall be liquid asphalt PG 64-16, conforming to State Standard Specifications Section 92, Asphalt Binders.

2.2 AGGREGATE

A. The combined aggregate grading of the asphalt concrete shall be Type A, 3/4-inch maximum grading, per Section 39-2.02B(4)(b), of the State Standard Specifications.

2.3 TACK COAT

A. Tack coat shall conform with Section 39, of the State Standard Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. The pavement section shall comply with City of Los Banos Standards and as shown on the Plans.

B. Prior to any paving and surfacing operations, all pipes and conduits shall be installed and properly backfilled as shown.

3.2 STORAGE

A. Storage of materials shall comply with the requirements of Section 39, State Standard Specifications.

3.3 MIXING

A. Mixing shall conform to the approved mix design.

B. The weight of asphalt binder to be mixed with aggregate shall be between 3 percent and 7 percent of the weight of the dry aggregate.

3.4 SUBGRADE

A. Subgrade shall conform to Section 39-2.01C(3)(b), State Standard Specifications.

B. Unless otherwise specified, the upper six inches of subgrade beneath the structural section shall be scarified, moisture conditioned as necessary and compacted to at least 95 percent relative density.

3.5 EQUIPMENT

A. Spreading and compacting equipment shall conform to State Standard Specifications Section 39-2.01C(2), Spreading and Compacting Equipment.

3.6 SPREADING AND COMPACTING

A. Spreading and compacting shall conform to State Standard Specifications Section 39-2.01C(2), Spreading and Compacting Equipment.

B. Apply mixture only during hours of daylight; when air temperature is 50 degrees F or higher; when surfaces to be paved are dry and free of frost, snow or ice; and when precipitation is not imminent.

3.7 PLACING TACK COAT

A. Apply tack coat on surfaces to receive finish pavement per Section 39 of the State Standard Specifications. Apply tack coat to metal or concrete surfaces that will be in contact with the asphalt concrete paving.

3.8 MISCELLANEOUS AREAS

A. Paving miscellaneous areas shall conform to State Standard Specifications Section 39-2.01C(9), Miscellaneous Areas and Dikes.

3.9 FINISHING PAVED AREAS

A. Finishing roadway and parking areas shall conform to the provisions of State Standard Specifications Section 22, Finishing Roadways.

3.10 TRENCH RESURFACING

A. At areas where asphalt concrete had been removed due to pipeline construction, trench shall be resurfaced with asphalt concrete. Unless otherwise noted, asphalt concrete resurfacing shall match the existing thickness of the asphalt and base course removed (plus 2 additional inches of base).

1. Base course shall be as specified in Section 32 11 23, Aggregate Base, and in this Section.

B. If an edge of a trench resurfacing occurs within three feet of an existing edge of pavement, lip of gutter or the face of curb, or if no gutter is present, the Contractor shall remove all existing paving to the lip of gutter or curb face and or, edge of existing pavement and resurface with the applicable trench resurfacing section. The limits of removal are minimum requirements and there may be additional width requirements by governing agencies.

C. If during the Contractor's operations pavement is disturbed outside the limits of removal, Contractor shall make the necessary repairs at no additional cost to the Owner.

D. Edge of existing asphalt along the trench line shall be tack coated prior to placing new asphalt concrete.

3.11 ACCEPTANCE REQUIREMENTS

A. Surface Tolerance: The variation between any two contacts with the surface shall not exceed ±0.015 foot in 10 feet. Correct all humps or depressions exceeding the specified tolerance by removing defective work and replacing it with new material at no additional expense to the Owner.

B. A uniform compacted thickness shall be obtained for each course equal to or greater than the thickness shown. Individual tests shall not vary by more than ±0.02 foot.

C. Width: Plan dimension, ±0.02 foot.

D. Thickness: Match existing, ±0.02 foot.

END SECTION

SECTION 32 31 00

FENCING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials and equipment and perform all operations necessary to complete to install wrought iron gates as specified, shown on the Drawings, or as directed.

1.2 RELATED WORK

A. Section 03 33 00 – Cast-in-Place Concrete

B. Section 31 05 00 – Common Work Results for Earthwork

1.3 SUBMITTALS

A. Submit shop drawings in accordance with the General and Special Provisions.

B. Shop Drawings: Show dimensions, attachments, inserts and relationship of work to adjoining construction.

1.4 MATERIALS

A. All materials in contact with potable water shall be certified to ANSI/NSF Standard 61.

PART 2 PRODUCTS

A. Richter Fence Gates (Job reference number Q563170) or engineer approved equivalent.

B. Gates shall be furnished without privacy sheet metal (Option 1).

PART 3 EXECUTION

3.1 FENCES AND GATES

A. Installation shall be in accordance with State Standard Specifications, Section 80, and with State Standard Plans Drawing A85, A85A and as indicated on the Plans.

B. Gate installation shall be in accordance with standard construction practices.

3.2 GATES

A. Existing gates shall be disposed of as indicated on the Plans.

END SECTION

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SECTION 33 01 31

SEWER BYPASS

PART 1 GENERAL

1.1 SUMMARY

A. The work of this section consists of bypass pumping and spill prevention.

1.2 SUBMITTALS

A. As specified in the General and Special Provisions.

B. Submit the following:

1. List of equipment for bypass pumping.

2. Bypass pumping plan.

3. Spill Prevention and Response Plan (SPRP)

1.3 SPILL PREVENTION AND RESPONSE PLAN IMPLEMENTATION

A. Contractor shall assess the pipeline segment for spill potential and analyze spill flow paths. The spill potential assessment shall also include the potential spillage of flushed materials and water that are present in the bypass pipe during removal. A site-specific SPRP shall be developed and mitigation measures installed to include sand bags and liners, plugging culverts, mobilizing bypass equipment, and other spill prevention and response measures, equipment, and materials, as required, prior to proceeding with the work. The site-specific SPRP development and implementation shall be approved by the City prior to proceeding with the work. The SPRP will be submitted in accordance with the General and Special Provisions.

B. The primary purpose of the SPRP is to prevent sewage spills from occurring by proper planning and protection of the project area, and then to respond to any sewage spills that may occur during the course of this project including appropriate notification of staff. The SPRP (prepared and implemented by the Contractor) will be general in nature and typical to all phases of the work with site specific plans required for areas involving trenching or any work with the possibility of accessing the existing system. The Contractor shall exercise diligence and care in work near any sewer facilitates. Any fines incurred by the City due to the acts of the Contractor shall be paid by the Contractor.

C. The SPRP shall be structured in two parts – first a Spill Prevention Plan and then a Spill Response Plan. The Spill Prevention Plan (SPP) shall include evaluation of specific conditions, setup of containment for actual construction work as well as for bypass pumping. Sewer bypass must be constructed to tie existing gravity sewer lines into the existing force main. The Spill Response Plan (SRP) shall include the

initial response to stop and contain a spill, notification of staff, clean-up, and follow-up documentation. The SPP and the SRP together comprise the entire SPRP. A template of a SPRP follows in Appendix A at the end of this Section. An electronic version of this template will be provided to the successful bidder.

D. All Contractor employees are required to be trained in the Spill Prevention Control in accordance with this SPRP.

E. Equipment and materials shall be available as identified in the site-specific SPRP. Equipment and material shall be standing by and ready immediately in the event of a spill.

PART 2 PRODUCTS

2.1 BYPASS PUMP ASSEMBLY

A. Contractor shall maintain a minimum of two bypass pump assemblies at the site in sound operating condition. Bypass pumps and equipment shall be mobilized to the work location and ready to operate prior to commencement of work.

B. Each bypass pump assembly shall include, but is not limited to, the pump, engine drive, starters, battery starter, valving, suction hose and appurtenances, such that the equipment is fully functional and equipped for use as a bypass pump station. Muffler shall be hospital grade with regard to noise suppression. Equipment shall meet air quality exhaust criteria of the local Air Pollution Control District as applicable.

C. The Contractor shall assess the work and develop a list of bypass equipment required for approval by the City. The Contractor shall assume that all pipes flow at capacity for development of the equipment list. The Contractor shall also assume that sewer service shall not be interrupted and that continuous monitoring of all bypass operation and equipment is required. A peak sanitary sewer flow rate of approximately 800 gallons per minute is expected at the site.

D. A sample list of minimum materials and equipment to be provided are listed below. This sample list is provided as an example only, actual materials and equipment must be determined by the contractor.

(1 ea) Pumps, trailer-mounted, with built-in 30-gallon gas tank.

(1 ea) Backup/Redundant Pumps, trailer-mounted, with built-in gas tank.

(5 ea) Four-inch cam lock male x 4-inch cam lock female, 20-foot all-weather semiflexible suction hoses.

(2 ea) Portable Spill Guards, 12’ x 15’ x 0.5’ for trailer-mounted pumps to sit while in operation.

(100 ft) Hard tubing for use in running across roadways with blocking and sandbags to secure against traffic loads.

PART 3 EXECUTION

3.1 FLOW CONTROL

A. Divert sewage flows around the lift station reconstruction area. Furnish, install, and operate pumps, plugs, conduits, and other equipment to divert the flow of sewage around the lift station rehabilitation area in which work is to be performed. Plugs shall be designed so that all or any portion of the sewage can be released. The plug shall be provided with a tag line. The pumping system shall be of sufficient capacity to handle existing flow, plus additional flow that may occur during a rainstorm. Pumping will be required on a 24-hour basis and engines shall be equipped in a manner to keep noise to a minimum. Contractor shall have personnel available 24 hours a day on an on-call basis, with a response time of 30 minutes, to make repairs to bypass equipment if needed while the bypass is in service.

B. Standby pumps shall be provided. Pumping shall be done in such a manner as will not damage property or create a nuisance or health menace. After the work has been completed, flow shall be restored to normal.

APPENDIX A

SPILL PREVENTION ANALYSIS FORM

SPILL PREVENTION ANALYSIS – For Sewer Bypass

Superintendent: _____ Date: _____

Foreman_____ Page _____of_____

Location of Pipe Segment (attach appropriate map):

Need for Spill Containment System (Y/N): If No, briefly explain why _____
_____

STEP BY STEP PLAN TO IMPLEMENT OPERATION:

1. Install bypass pipeline and pumping if required	**5.**
2. Maintain pipeline and pumps	**6.**
3. Remove bypass and pumps	**7.**
4.	**8.**

POTENTIAL SPILL HAZARDS	
1. Leaks at points of connection	**6.**
2. Damage to bypass line	**7.**
3. Sabotage	**8.**
4. Drain and cleaning spills	**9.**
5. Pumping operations	**10.**

SAMPLE ONLY

Potential Spill Hazard #	**Precautionary Plan**
1. Leaks at points of connection	**Close valves each side of station, contain leak and repair or replace defects**
	Fix leak and/or replace system component
	Report to Superintendent
	Bypass outage cannot last longer than 2 hours during peak flows.

Potential Spill Hazard #	Precautionary Plan
2 Damage bypass line	Close valves each side of damaged pipe
	Contain leak and install repair coupling immediately.
	Keep an inventory of spare parts
	Report to Superintendent

Potential Spill Hazard #	Precautionary Plan
3. Sabotage	Close valves on each side of damaged pipe.
	Contain leak and install repair coupling immediately.
	Keep inventory of spare parts.
	Report to Superintendent.

SAMPLE ONLY

Potential Spill Hazard #	Precautionary Plan
4. Draining and Cleaning spills	Return flow to installed force main pipe
	Flush, sanitize and drain bypass pipe
	Use containment when removing drain and ARV stations
	Use containment when cutting pipe for removal

Potential Spill Hazard #	Precautionary Plan
5. Pumping Operation	Provide backup power (emergency generator or redundant gas or diesel engine driven pumps) and redundant pumping.

SECTION 33 01 36

SEWER RECONSTRUCTION

PART 1 GENERAL

1.1 WORK INCLUDED

A. Construct new sewer force main and appurtenances along or adjacent to existing pipeline alignments, as shown on the Plans.

B. Modify existing sewer manholes to allow changes in sewer grades and profiles.

C. Furnish temporary bypasses as required to maintain existing flows until after completion of sewer reconstruction.

1.2 ORDER OF WORK

A. Contractor shall maintain existing flows to the pump station until the new Pump Station has been completed and tested.

B. Contractor shall schedule sewer reconstruction to minimize the time during which pumped bypasses are required.

C. Contractor shall submit a schedule for the individual portions of sewer construction work.

1.3 RELATED WORK

A. Section 03 36 00 – Concrete Lining for Corrosion Protection

B. Section 03 41 00 – Precast Concrete Structures

C. Section 31 23 17 – Trenching, Backfilling and Compacting

D. Section 33 01 31 – Sewer Bypass

E. Section 40 05 00 – Pipe and Fittings

1.4 REFERENCES

A. Section 70, Miscellaneous Drainage Facilities, State Standard Specifications

PART 2 PRODUCTS

2.1 MATERIALS

A. Pipe shall conform to Section 40 05 00, Pipe and Fittings.

PART 3 EXECUTION

3.1 PREPARATION

A. Contractor shall submit a plan of work and schedule for each reach of sewer reconstruction prior to beginning work.

B. Contractor shall notify Owner prior to beginning construction or bypass operations.

3.2 WET WELL MODIFICATION

A. Wet well shall be modified in accordance with details shown on the Plans.

B. Before modification of the wet well, the new pumping bypass assembly and vault shall be completed and tested.

3.3 SEWER BYPASS

A. See Section 33 01 31 Sewer Bypass.

B. Contractor shall maintain a back-up engine driven pump for all bypasses which require pumping. Bypass shall be checked for adequate capacity during high flow periods prior to removing or blocking the existing sewer pipe.

3.4 REPLACEMENT FORCE MAIN

A. Replacement force main involves the removal or abandonment of existing force main and replacing with new force main, pumping bypass vault, valve assemblies and vault as indicated in the Plans.

END SECTION

SECTION 33 05 26

UTILITY LINE MARKING

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work of this section consists of furnishing and installing utility line marking tape in the trench above newly constructed utility lines.

1.2 SUBMITTALS

A. Submittals shall be in accordance with the General and Special Provisions.

B. Samples: 24-inch strips of tape and two markers.

C. Certification that the materials used in the tape fabrication meet the requirements of this section.

PART 2 PRODUCTS

2.1 MARKING TAPE

A. Capable of being inductively detected electronically.

B. Construction: Metallic foil laminated between two layers of impervious plastic film not less than 3 inches wide. Total thickness of tape shall not be less than 0.005 inch (5 mil), ±10 percent manufacturing tolerances.

1. Film: Inert plastic. Each film layer shall be not less than 0.001 inch (1.0 mil) thick.

2. Foil: Not less than 0.001 inch (1.0 mil) thick.

3. Adhesive: Compatible with foil and film.

C. Imprint: 3/4-inch or larger bold black letters.

D. Legend: Identify buried utility line tape with imprint such as "Caution: Sewer Line Below". Repeat identification at approximately 24-inch intervals.

E. Background Color: APWA color code and as specified in the following table.

Color	Utility
Safety Brown	Force Mains and Effluent Lines

F. Manufacturer: Lineguard, Inc., Wheaton, Illinois; Reef Industries, Inc., Houston, Texas; Thor Enterprises, Inc., Sun Prairie, Wisconsin; or Engineer-approved equivalent.

PART 3 EXECUTION

3.1 MARKING TAPE

A. Install tape in backfill directly over each buried utility line as shown on the detailed drawings.

B. Where utilities are buried in a common trench, identify each line by a separate warning tape. Bury tapes side by side directly over the applicable line.

3.2 TRACER WIRE

A. Wherever PVC or Polyethylene pipe is installed in the ground, a tracer wire shall be installed. Conductors shall be spliced in accordance with Division 26, Electrical.

1. Tracer wire shall be brought to the surface at all valves, air valves, blow-offs, Fire Hydrants, Water Services, and other pipeline appurtenances

B. Tracer Wire: Attachment of the wire to the pipe shall be made with plastic tie-wraps or other approved method.

C. Contractor shall conduct a satisfactory continuity test prior to Owner acceptance.

END SECTION

SECTION 40 05 00

PIPE AND FITTINGS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish, install, and test all sewer force main, utility, pipe, fittings, and appurtenances as indicated and as specified.

1.2 RELATED WORK

A. Section 03 41 00 – Precast Concrete Structures

B. Section 31 23 16 – Trenching, Backfilling, and Compacting

1.3 REFERENCES

A. California Plumbing Code

B. American Water Works Association Standards

1.4 SUBMITTAL REQUIREMENTS

A. Submit shop drawings in accordance with the General and Special Provisions.

B. Submit manufacturer's catalog data. Show manufacturer's model number.

C. Submit dimensions including wall thickness and materials by reference standard and grade. Submit information on interior and exterior coatings as applicable.

1.5 QUALITY ASSURANCE

A. All work performed under this section shall meet all recommendations and requirements of AWWA, Uniform Plumbing Code, NFPA 24, ASTM D2774, and all other applicable national, state, local, standards and regulations.

1.6 MATERIALS

A. All bolts, nuts, washers, and tie rods used to secure underground fittings shall be stainless steel per ASTM A320 unless noted otherwise.

1. Apply an anti-seize compound to all threads of stainless-steel bolts.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE

A. General: Ductile iron pipe shall conform to ANSI A21.51 (AWWA C151) and shall be Class 52 unless shown otherwise. Pipe for grooved or flanged joints shall be no less than Class 53.

B. Joints:

1. Buried pipe and pipe fittings shall have push-on joints or mechanical joints conforming to AWWA C111. Flanged joints, sleeve-type mechanical couplings, and grooved-type couplings shall be used when shown.

2. For push-on joints, shape of pipe ends shall conform to ANSI A21.11 (AWWA C111). Gaskets and lubricant for pipe and fittings shall conform to ANSI A21.11 (AWWA C111).

3. For mechanical joints, dimensional and material requirements for pipe ends, glands, bolts, nuts, and gaskets shall conform to ANSI A 21.11 (AWWA C111). Pipe smaller than 4 inches shall have screwed or grooved joints.

4. For flanged joints, ends of pipe and fittings shall be provided with flanges conforming to ANSI A21.15 (AWWA C115), and to ANSI B16.5 for 150 lb. class. Bolts, nuts, and gaskets for flanged connections shall conform to ANSI B18.2.1. For grooved joints, groove specifications shall conform to ANSI/AWWA C606.

C. Fittings: Fittings with push-on, mechanical joint, grooved joints and flanged ends shall conform to ANSI A21.53 (AWWA C153). Fittings shall have pressure rating of 350 psi for 3”-24” and 250 psi rating for 30”-48” pipe. Fittings shall have cement-mortar lining equivalent to that of the pipe lining.

D. Coating and Lining: Pipe shall be bituminous seal-coated and cement-mortar lined. The lining shall conform to AWWA C104.

E. All buried ductile iron pipe shall be encased in an 8-mil lining of polyethylene, installed per AWWA C105.

2.2 POLYVINYL CHLORIDE SCHEDULE PIPE

A. General: PVC schedule pipe up to 4 inches in diameter shall be ASTM D1785, Schedule 40 and 80 as specified or indicated in the Plans. Pipe material shall have cell classification 12454-B and have NSF seal.

B. Joints: Joints shall be solvent weld joints between pipes, and flanged or threaded at valves or fittings. Flange diameter and drilling shall conform to ANSI B16.5, class 150.

C. All joints shall be restrained joints including joints on straight/horizontal pipe runs.

D. Solvent cement for joints shall conform to ASTM D2564 and primer shall conform to ASTM F656. Fittings: PVC fittings shall conform to ASTM D2466, all classifications 12454-B, bearing NSF seal.

2.3 RESTRAINED JOINTS

A. Pipe restraint/harness shall be manufactured of ductile iron conforming to ASTM A536.

B. The combination of the restraint and fasteners shall have a pressure rating to the full pressure rating of the pipe.

C. The restraint/harness shall have a two to one safety factor.

D. Pipe restraint/harness hardware shall be 316 Stainless Steel.

E. EBAA Restraint Harness, Star Pipe Products Pipe Restraints Series 1100G2, or engineer approved equal.

2.4 GROOVED COUPLINGS

A. Groove dimensions shall conform to AWWA C606.

B. Grooved couplings for ductile iron shall be Victaulic Style 31;

C. Flexible grooved couplings for steel pipe shall be Victaulic Style 77 or equal; rigid grooved couplings for steel pipe shall be Victaulic Style 07 or equal. Couplings shall be rigid unless otherwise noted on the drawings.

D. Grooved - Flanged adapters shall be Victaulic Style 341 for ductile iron pipe and Style 741 for steel pipe or equal.

E. Grooved coupling for high density polyethylene pipe shall be Victaulic Style 995 or 997 or equal.

2.5 FLANGED JOINTS

A. Flange shall conform to ANSI B16.5, Class 150.

B. All steel hardware installed underground shall be coated with a rust preventative, wrapped with 4 mil polyethylene sheeting, and secured with PVC tape.

C. Gaskets shall meet the pressure requirements of the adjoining flanges and shall conform to AWWA C-207. Gaskets for flat faced flanges shall be 1/8-inch thick.

D. Gaskets for metallic pipe and non-potable 150 psi or less services shall be acrylic or aramid fiber bound with nitrile; Garlock Blue-Gard 3000 or equal. EPDM rubber gaskets, Garlock 98206 or equal, are also acceptable.

E. Gaskets for metallic pipe and potable water service shall be NSF/ANSI-61 certified EPDM rubber, Garlock 98206 or equal.

F. Gaskets for non-metallic flat faced flanges shall be constructed of a fluoroelastomeric material with a hardness of 70 durometer designed specifically for lower seating stress. Gaskets shall be certified to NSF/ANSI-61 for potable water service. Gaskets shall be Garlock Style XP or equal.

2.6 FLEXIBLE SLEEVE COUPLINGS

A. Flexible sleeve couplings shall be one of the following, or Engineer approved equivalent:

1. Dresser, Inc., Style 38 for Steel Pipe, and Style 253 Wide- Range for Steel, PVC, Copper, and Ductile Iron pipe.

2. Smith Blair, Inc., Series 411 or Wide-Range 461.

3. Romac Industries, Inc., Style 400 for 12” and larger pipe or XR501 Extended Range Coupling, 4” thru 12” pipe size.

B. Center sleeves shall comply with the following

Nominal Pipe Diameter	Minimum Sleeve Length
6 inch and smaller	Manufacturer’s Standard
8 through 14 inch	7 inch
14 inch and larger	10 inch

2.7 FLEXIBLE SPOOL-TYPE EXPANSION COUPLINGS

A. Flexible rubber coupling shall be flexible joints, which includes a tube, body cover and flanges. The tube shall be a leak proof liner and the body shall consist of fabric and rubber compound, reinforced with steel wire or rings for strength. Flexible rubber coupling shall be either a single arch or double arch construction as indicated in the Plans. Couplings shall have control rods to limit extension and flanges shall have backing rings. Couplings used for services with pressures greater than 75 psi shall have stainless steel flanges – rubber flanges with backing rings shall not be acceptable. Flexible couplings shall have minimum pressure ratings of 100 psi; couplings installed on suction of pumps shall have a minimum vacuum (pressure) rating of 30 inches Hg column.

B. Flexible coupling shall have Buna N liner and cover and shall be manufactured by Proco, Red Valve Company Inc., Metraflex Company or equal.

2.8 MARKER TAPE FOR BURIED PIPING

A. See Section 33 05 26 Utility Line Marking.

2.9 TRACER WIRE

A. See Section 33 05 26 Utility Line Marking.

2.10 FASTENERS

A. All fasteners shall include washers under both bolt head and nut unless the use of washers is incompatible with the fitting design.

B. Unless otherwise noted, all bolts, tie rods, and T-bolts used to secure flanges, fittings, and couplings located underground or submerged in liquid shall be Type 304 or 316 stainless steel per ASTM A320 or ASTM A193. Nuts shall be 304 or 316 stainless steel per ASTM A 194 and washers shall be ASTM F436 Type 3.

C. Unless otherwise noted, all bolts, tie rods, and T-bolts used to secure flanges, fittings, and couplings located indoors, above grade, and in vaults shall be carbon steel conforming to ASTM A307, Grade B with ASTM A563, Grade A nuts and ASTM

F436 washers. Bolts, nuts, and washers shall be hot dipped galvanized in accordance with ASTM F2329. Stainless steel meeting the requirements of Paragraph B shall also be acceptable.

PART 3 EXECUTION

3.1 HANDLING AND DISTRIBUTION OF MATERIALS

A. Delivery: Handle pipe carefully to ensure delivery at the project site in sound, undamaged condition. Contractor shall replace damaged pipe at no additional expense to the Owner.

B. Storage: Do not store materials directly on the ground. Support piping to prevent warping. Use protective covers where pipe may be damaged by sunlight.

C. No more than one week's supply of material shall be distributed in advance of pipe laying operations, unless otherwise approved or required.

D. Before laying, pipe shall be inspected for cracked, broken, or defective pieces. Such pieces shall be rejected. Pipe shall be carefully lowered into the trench to prevent damage. All dirt or other foreign matter shall be removed from inside the pipe before lowering into the trench.

3.2 INSTALLATION OF BURIED PRESSURE PIPING

A. General: Pipe, fittings, and appurtenances shall be installed in accordance with the manufacturer's instructions and in accordance with the following references:

1. Ductile Iron Pipe - AWWA C600

B. Handling: The pipe shall be protected to prevent entrance of foreign materials during laying operations. When laying is not in progress, open pipe ends shall be protected with a watertight plug or other approved means to exclude water or foreign material.

C. Alignment:

1. Mains shall be installed to the grades and elevations indicated and shall have a minimum cover of 30-inches from the top of the pipe to existing ground or paved surface unless otherwise indicated.

2. The allowable angle of deflection at any joint shall not exceed the amount recommended by the pipe manufacturer for the particular pipe size used. Deviation of any pipe section from the line and grade indicated shall not exceed 1/2-inch.

D. Joints:

1. Pipe shall be assembled and joined in accordance with the manufacturer's published instructions for the type of pipe and joint used. All portions of the joints shall be thoroughly cleaned before the sections of pipe are assembled. The ends of each pipe shall abut against the next pipe section in such a

manner that there shall be no unevenness of any kind along the bottom half of the interior of the pipe. Where mechanical joints are used, the pipe shall be marked in such a manner that it can be determined after installation that the pipe is properly seated.

2. Where flexible couplings are used as expansion joints, the ends of the pipes shall be separated 1-inch to allow for expansion. The welded seam at the end of each coupled steel pipe shall be ground smooth for approximately 12-inches. Couplings shall be centered on pipe ends. Runs of pipe containing flexible couplings shall be properly blocked, anchored or tied to the structure to prevent joints from separating.

3. Mechanical restrained joints shall be installed in accordance with joint manufacturer's instructions and recommendation.

E. Installation of Marker Tape: Install tape in backfill directly over each pipeline, 24 inches over top of pipe, unless shown otherwise on the Plans. Where utilities are buried in a common trench, identify each line by a separate marker tape. Place tapes directly over the applicable line.

3.3 INSTALLATION OF EXPOSED PIPING

A. General - Pipe shall be installed as specified, as indicated on the Plans or, in the absence of detail piping arrangement, in a manner acceptable to the Engineer.

B. Pipe shall be cut from measurements taken at the site and not from the Plans. All necessary provisions shall be taken in laying out piping to provide throughout for expansion and contraction. Piping shall not obstruct openings or passageways. Pipes shall be held free of contact with building construction so as not to transmit noise resulting from expansion.

C. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, dirt, and other foreign matter when erected. The interior of all lines shall be thoroughly cleaned, to the satisfaction of the Engineer, before being placed in service.

D. In all piping except air piping, insulated fittings shall be provided to prevent contact of dissimilar metals.

E. Pipe Joints - Pipe joints shall be carefully and neatly made in accordance with the requirements that follow.

1. Flanged - Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but not so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless-steel bolts during assembly. Connecting flanges shall have similar facings, i.e., flat or raised face.

3.4 ACCEPTANCE TESTS FOR BURIED PRESSURE PIPING

A. General

1. All testing and inspection shall be performed after final backfill and compaction operations are complete. If the Contractor so desires, he may pretest the lines at his own expense, but final testing must be performed after compaction requirements have been approved.

B. In general, tests shall be conducted in accordance with AWWA C600 and C651 except as otherwise herein specified.

C. All newly installed sections of buried pressure piping shall be pressure and leakage tested as described herein.

1. For buried pressure pipelines, tests shall be made on two or more valved sections not to exceed 2,500 feet in length. The Contractor shall furnish all necessary equipment, material and labor required.

2. Tests shall be made after the trench has been backfilled and compacted, but not until at least 5 days have elapsed since any thrust blocks in the section have been poured.

3. The pipe shall be filled with water and all air expelled from section being tested. A test pressure equal to 1.5 times the design pressure, of the pipe measured at the point of lowest elevation pressure, or 100 psi, whichever is greater, shall be applied.

4. The test pressure in the line shall be maintained for a period of 2 hours. Test pressure shall be maintained within 5 psi during the test period by adding water as required. The water required to maintain test pressure shall be measured by means of a graduated barrel, drum, or similar device at the pump suction or through a meter.

Allowable leakage at the specified test pressure shall not exceed the amounts allowed by AWWA C600, $L = \frac{SD\sqrt{P}}{148{,}000}$

Where:

L = Testing allowance in gallon per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of the pipe, in inches.
P = Average test pressure during the hydrostatic test, in pounds per square inch (psi).

Hydrostatic testing allowance per 1,000 ft. of pipeline in gph.

PSI	4”	6”	8”	10”	12”	14”	16”	18”	20”	24”

200	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29
175	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15
150	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99
125	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81
100	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62

5. Should testing disclose any visible leaks or leakage greater than that allowed, the defective joints or pipe shall be located, repaired, and re-tested until satisfactory. The cost of any retests, including time for the Engineer, shall be borne by the Contractor at no additional cost to the project.

3.5 ACCEPTANCE TEST FOR EXPOSED PIPING

A. Pipe to be Tested - All new installed piping sections shall be pressure and leakage tested as specified herein.

B. Pressure Testing - After the section of line to be tested has been filled with water or other test media, the test pressure shall be applied and maintained without interruption for 2 hours plus any additional time required for the Engineer to examine all piping undergoing the test and for the Contractor to locate all defective joints and materials.

1. Test medium shall be potable water for potable water piping; all other piping may be tested using plant water subject to Engineer's approval.

2. Pipe system shall be tested at 1-1/2 times the operating pressure, or 100 psi, whichever is greater, using the appropriate test fluid medium.

3. All piping shall be tight and free from leaks. All pipe, fittings, valves, pipe joints, and other materials that are found to be defective shall be removed and repaired or replaced with new and acceptable material, and the affected portion of the piping be retested until satisfactory. The cost of any retests, including time for the Engineer, shall be borne by the Contractor at no additional cost to the project.

Compressed air or gas under pressure shall not be used to test plastic piping unless specifically recommended by the pipe manufacturer.

Leakage may be determined by loss of pressure, soap solution, chemical indicator, or other positive and accurate method acceptable to the Engineer. All fixtures, devices, or other accessories which are to be connected to the lines and which would be damaged if subjected to the specified test pressure shall be disconnected and ends of the branch lines plugged or capped as required during the testing procedures.

END SECTION

SECTION 40 05 23

VALVES AND APPURTENANCES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish, install, and test all valves, fittings, and appurtenances as indicated and as specified and as shown on the plans.

1.2 RELATED WORK

A. Section 03 41 00 – Precast Concrete Structures

1.3 REFERENCES

A. California Plumbing Code.

B. American Water Works Association Standards.

C. Section 90, "Portland Cement Concrete", State Standard Specifications.

1.4 SUBMITTALS

A. Submittals shall be in accordance with the Standard General and Special Provisions.

B. Shop drawings, manufacturer's literature, and guarantees.

PART 2 PRODUCTS

2.1 VALVES

A. Gate valves shall be resilient wedge gate valves shall conform to AWWA C509 and be in compliance with the Improvement Standards of the City of Los Banos.

1. The valves shall be designed for a water working pressure of 250 psi. All working parts shall be constructed of brass, stainless steel, or other corrosion-resistant materials.

B. Butterfly Valves 4 Through 72 Inches, Class 150B:

1. Butterfly valves shall be short body, flanged type. Valves shall conform to AWWA C504. Minimum working differential pressure across the valve disc shall be 150 psi. Flanged ends shall be Class 125, ASME B16.1. Valve shafts shall be stub shaft or one-piece units extending completely through the valve disc. Materials of construction shall be as follows:

Component	Material	Specification
Body	Ductile iron	AWWA C504
Exposed body cap screws and bolts and nuts	Stainless steel	ASTM A276, Type 304 or 316
Discs	Ductile iron, Stainless steel	AWWA C504
Shafts, disc fasteners, seat retention segments, and seat fastening devices	Stainless steel	ASTM A276, Type 304 or 316
Seat material	Buna-N or approved equal	—

2. Where the rubber seat is applied to the disc, it shall be bonded to a stainless steel seat retaining ring which is clamped to the disc by Type 304 or 316 stainless steel screw fasteners or secured to a stainless steel seat by a combination of cap screws, a serrated disc retaining ring, and molded shoulders in the seat mating with machined registers in the disc valves shall be DeZurik Series BAW (250B for Ductile Iron Body), M&H, Val-Matic, or approved equivalent.

3. Actuator shall be manual gear with nut.

4. Mounting position shall be 90 degrees.

C. Eccentric Plug Valves:

1. Eccentric plug valves for sizes 4-inch and larger shall have stainless steel seats and ANSI 125 psi flanged ends. Eccentric plug valves shall have a pressure rating of not less than 150 psi.

Component	Material	Specification
Body	Ductile iron	AWWA C504
Body Bearing	Stainless steel	—
Plug	Ductile iron	AWWA C504
Bonnet Bearing and Screws	Stainless steel	—
Nut	Stainless Steel	—

1. Eccentric plug valves shall be DeZurick PEC Eccentric 12.00-1D, Victaulic Model 365 or Engineer approved equivalent.

2. Eccentric Plug valve for bypass vault shall be provided with one tee wrench for use on 2” square nut actuator and a nut extension. See plans to determine length of nut extension.

3. Plug valves in check valve vault shall be provided with manual gear actuators and extended nut. See plans to determine length of nut extension.

D. Swing Check Valves 3 Inches and Larger, Class 125:

1. Check valves for wastewater piping shall be of the unobstructed waterway, quick closing, lever and weight, swing type with ductile iron body and bronze trim. Hinge pins shall extend through bronze-bushed bearings and outside stuffing boxes with grease lubricated packing or O-ring seals. Provide check valves with outside lever. Swing check valves shall comply with AWWA C508 with the following materials of construction.

Description	Material	Specification
Disc or clapper seat ring and valve body seat ring	Bronze or brass	ASTM B62 or B584 (Alloy C84400 or C87600)
Body and cap (bonnet)	Ductile iron	ASTM A536
Disc	Ductile iron or bronze	ASTM A536; ASTM B62
Hinge pin	Stainless steel	Type 303, 304, or 410 stainless
Cover bolts and nuts	Stainless steel	ASTM A193, Grade B8M; ASTM A194, Grade 8M
Internal fasteners and accessories	Bronze or Type 304 or 316 stainless steel	

2. Flanges shall be flat faced ends, Class 125, ASME B16.1. Minimum valve working pressure shall be 150 psi.

3. The shop drawing submittal shall include a detail showing how the hinge pin extends through the valve body. Show packing gland, hinge pin gland, cap, and other pieces utilized.

4. Check valves shall be ASC Engineering Solutions “Series 22FCW”, APCO “CVS-250 Series” or Engineer approved equivalent.

2.2 VALVE ACTUATORS

A. Manual Nut Actuator - Nuts shall be provided on all buried valves and where indicated on the Plans. Unless otherwise directed by the Owner, all nuts shall comply with Section 3.16 of AWWA C500. Not less than one operating key shall be furnished for operation of nut operated valves.

B. Pull type manual actuators shall be designed to produce the specified torque of 80 pounds.

2.3 APPURTENENCES

A. Buried valves shall include extension stems extending to subgrade, terminating with 2-inch AWWA operating nut.

B. Valve box and cover shall be traffic rated assembly (minimum of AASHTO H-20 rating).

PART 3 EXECUTION

3.1 VALVES

A. Each valve assembly shall be installed complete with appurtenant piping and valves as specified or indicated on the Plans.

B. Valves shall be installed in accordance with the manufacturers' instructions and recommendations.

C. Unless otherwise necessary for proper operation or as permitted by the Engineer, all eccentric plug valves shall be installed with the shaft horizontal and the plug in the upper half of the valve body. Valves shall be installed with the seat on the upstream end.

3.2 VALVE BOX

A. Valve box shall be adjusted to final pavement grade and installed in accordance with Owner's Standard Specifications.

END OF SECTION

SECTION 40 61 00

COMMON WORK RESULTS FOR PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall procure the services of a single Process Control System Supplier (PCSS) to furnish and install all materials, equipment, labor and services, except for those services and materials specifically noted, required to achieve a fully integrated and operational system as specified herein and in other Specification Sections listed below.

B. Requirements specified in this Section apply to all equipment specified in the above sections, unless otherwise specified. The work shall include furnishing, installing and testing the equipment and materials detailed in the following Sections:

1. 40 67 00 CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.

D. Substitutions on functions or type of equipment specified shall not be acceptable unless specifically noted. In order to confirm compatibility between all equipment, coordinate all interface requirements with mechanical and electrical systems and furnish any signal isolation devices that might be required.

E. Equipment shall be fabricated, assembled, installed and placed in operating condition in full conformity with the project Specifications, Drawings, engineering data, instructions, and recommendations of the equipment manufacturer as approved by the Engineer.

F. To facilitate the Owner's future operation and maintenance, similar products (e.g., differential pressure transmitters, SCADA I/O cards) shall be supplied from the same manufacturer.

G. All equipment and installations shall satisfy applicable Federal, State and local codes.

H. Use the equipment, instrument, and loop numbering scheme that has been developed and shown on the Drawings and specifications in the development of the submittals. Do not deviate from or modify said numbering scheme without the Engineer's approval.

1.02 RELATED WORK

A. Process Flow Diagrams (PFD) are included in the Drawings.

B. Control System Architecture Block Diagram is included in the Drawings.

C. Specific control system and instrumentation materials and requirements are included in related Sections of Division 40.

D. Instrumentation and Controls conduit systems are specified in Section 26 05 33.

1.03 SUBMITTALS

A. General submittal requirements include:

1. Refer to General and Special Provisions for general submittal requirements.

2. Other Division 40 Sections may have additional submittal requirements.

3. Shop drawings shall be submitted as detailed herein. Shop drawings shall demonstrate that the equipment and services to be furnished comply with the provisions of these specifications and shall provide a complete record of the equipment as manufactured and delivered.

4. Submittals shall be complete; giving equipment specifications, details of connections, wiring, ranges, installation requirements, and specific dimensions. Submittals consisting of only general sales literature shall not be acceptable.

5. Submittals shall be bound in separate three-ring binders, with an index and sectional dividers, with all drawings reduced to a maximum size of 11-inch by 17-inch, then folded to 8.5 inch by 11 inch for inclusion within the binder. Maximum binder size shall be 3 inches.

6. The submittal drawings' title block shall include, as a minimum, the PCSS registered business name and address, Owner and project name, drawing name, revision level, and personnel responsible for the content of the drawing.

7. Incomplete or partial submittals not complying with the submittal arrangements outlined in this Section will be returned without review.

8. Separate submittals shall be made as follows:

a. Project Plan, Deviation List and Schedule Submittal

b. Application Development System Submittal

c. Coordination Meetings Agenda

d. I/O List Submittal

e. Field Instrument Submittal

f. Hardware Submittal and Software Packages Submittal

g. Panel Layout Drawings and Wiring Diagram Submittal

h. Testing Plans Submittal

i. Spares, Expendables, and Test Equipment Submittal

j. Final System Documentation

B. Project Plan, Deviation List, and Schedule Submittal

1. Submit a Project Plan within 21 calendar days from Notice to Proceed date. The Project Plan shall, as a minimum, contain the following:

a. Overview of the proposed control system in clear text format describing the PCSS understanding of the project work, preliminary system architecture drawing, interfaces to other systems, schedule, startup, and coordination.

b. Approach to work in clearly written format describing how the PCSS intends to execute the work. A discussion of switchover, startup, replacement of existing equipment with new, and other tasks as required by these specifications shall be included as applicable.

c. Preliminary HMI software, PLC software, and PLC hardware submittal information, including version numbers, solely to determine compliance with the requirements of the Contract Documents prior to development of system programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the PCSS of meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved is not allowed without Engineer approval.

d. Project personnel and organization including the PCSS project manager, project engineer, and lead project technicians. Include resumes of each key individual and specify in writing their commitment to this project.

e. Preliminary coordination meeting agendas as specified herein.

f. Preliminary testing plan

g. Preliminary training plan

h. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of panel fabrication drawings, loop, I/O wiring diagrams, and graphical display presentations.

2. Exceptions to the Specifications or Drawings shall be clearly defined in a separate Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the Engineer. The acceptability of any device or methodology submitted as an "or equal' or

"exception" to the specifications shall be at the sole discretion of the Engineer. If no exceptions are taken to the specifications or drawings the PCSS shall make a statement as such. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.

C. Input/Output (I/O) Address List Submittal

1. Submit a complete system Input/Output (I/O) address list for equipment connected to the control system under this Contract.

2. I/O list shall be based on the P&ID's, the Drawings, the design I/O list (if included within these specifications), and requirements outlined in the Specifications.

3. The I/O list shall be submitted in both a Microsoft Excel readable electronic file format on a CD-ROM and an 8-1/2 inch by 11-inch hard copy.

4. The I/O list shall reflect all active and spare I/O points. Add points to accommodate spare I/O.

5. The I/O list shall be arranged such that each control panel has a dedicated worksheet. At a minimum, I/O worksheet tables shall include the following information:

   a. TAG NUMBER(S): The identifier assigned to a device that performs a function in the control system. As part of this information, the loop number of the tag shall be broken out to allow for sorting by loop.

   b. DESCRIPTION: A description of the function of the device (text that includes signal source, control function, etc.) Include the text "Spare Points" for all I/O module points that are not connected to equipment.

   c. PHYSICAL LOCATION: The Control Panel designation of where the I/O point is wired to.

   d. PHYSICAL POINT ADDRESS: Rack, Slot, and Point (or Channel) assignment for each I/O point.

   e. LOGICAL POINT ADDRESS: If the PCSS is performing the PLC programming, I/O address of each point. If the PCSS is not performing the PLC programming, then leave this field blank for use by the PFSS.

   f. I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO – Pulse Output.

   g. RANGE/STATE: The range in engineering units corresponding to an analog 4-20 mA signal, or, the state at which the value of the discrete points are "1."

   h. ENGINEERING UNITS: The engineering units associated with the Analog I/O.

   i. ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.

6. The I/O list shall be sorted in order by:

    a. Physical location

    b. I/O Type

    c. Loop Number

    d. Device Tag

7. After the I/O list is approved, do not modify the PLC I/O addresses without approval by the Engineer.

8. Where multiple mechanical components are provided for process redundancy, their field connections to I/O modules shall be arranged such that the failure of a single I/O module will not disable all mechanical components of the redundant system. This applies to all I/O types.

D. Field Instruments Submittal

1. Submit complete documentation of all field instruments using ISA-S20 data sheet formats. Submit a complete Bill of Materials (BOM) or Index that lists all instrumentation equipment ordered by the loop numbering system as shown in the Contract Documents.

2. Submit separate data sheets for each instrument including:

    a. Plant Equipment Number and ISA tag number per the drawings

    b. Product (item) name used herein and on the Contract Drawings

    c. Manufacturer's complete model number

    d. Location of the device

    e. Input / output characteristics

    f. Range, size, and graduations in engineering units.

    g. Physical size with dimensions, enclosure NEMA classification and mounting details in sufficient detail to determine compliance with the requirements of the Contract Documents.

    h. Materials of construction for enclosure and wetted parts.

    i. Instrument or control device sizing calculations where applicable.

    j. Certified calibration data for all flow metering devices.

    k. Two-wire or four-wire device type as applicable.

3. Submit index and data sheets in electronic format as well as hard copies on 8-1/2 by 11 inches formats. Electronic format shall be in Microsoft Excel or Word. Submit electronic copy on CD-ROM or DVD disk.

E. Hardware Submittal and Software Packages Submittal

1. For each hardware component indicated below, submit a cover page that lists, at a minimum, date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.

2. Catalog cuts for supplied Programmable Logic Controller (PLC), process controller equipment, remote telemetry units (RTU), including central processing units, redundancy units, memory, input modules, output modules, modems, network interface modules, mounting racks, and power supplies. Submit descriptive literature for each hardware component that fully describes the units being provided. Any deviation of the hardware systems from the preliminary hardware submittal included in the Process Plan or Applications Development System submittal shall be described in detail.

3. Complete system architecture diagram showing in schematic form, the interconnections between major hardware components including control centers, panels, power supplies, consoles, computer and peripheral devices, networking equipment, processors, I/O modules, local operator interfaces, and like equipment. The system architecture shall be complete and shall depict all required cables, media type between components, network protocol used at each network level, details on connection requirements such as cable pin- outs, port numbers, and rack slot numbers. The intent of this specification requirement is for the PCSS to develop a diagram that is complete in every aspect to allow purchase of all required equipment by part number, and to allow a qualified technician to interconnect all equipment without having to refer to additional manuals or literature. Minimum sheet size shall be 11"x17" and using a larger sheet size or more than one sheet is acceptable.

4. Submit details of the controller development software package, the local operator graphic panel development software package, and the HMI software application packages to be used for each piece of equipment. Indicate all standard and optional features provided. Confirm in the submittal that the licenses will be assigned to the Owner at the time of purchase. Any deviation of the software platforms from the preliminary software submittal included in the Project Plan shall be described in detail.

F. Panel Layout Drawings and Wiring Diagrams Submittal

1. Where direct hardwired interfaces exist between the PCSS control panels and vendor provided control panels furnished under other Divisions, the Contractor shall provide to the PCSS the approved shop drawings and submittals in order for the PCSS to provide complete wiring diagrams showing all wiring connections in the I/O system. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names.

These drawings will be included in the Final Documentation submittal. Leaving this information blank on the Final Documentation drawings is not acceptable.

2. Panel Layout Drawings: Drawings shall be furnished for all panels, consoles, and equipment enclosures specified. Panel assembly and elevation drawings shall be drawn to scale and detail all equipment in or on the panel. Panel drawings shall be 11"x17" minimum in size. As a minimum, the panel drawings shall include the following:

    a. Interior and exterior panel elevation drawings to scale.

    b. Nameplate schedule.

    c. Conduit access locations.

    d. Panel construction details.

    e. Cabinet assembly and layout drawings to scale. The assembly drawing shall include a bill of material on the drawing with each panel component clearly defined. The bill of material shall be cross-referenced to the assembly drawing so that a non-technical person can readily identify any component of the assembly by manufacturer and model number.

    f. Fabrication and painting specifications including color (or color samples).

    g. Submit construction details, NEMA ratings, intrinsically safe barrier information, gas sealing recommendations, purging system details, etc. for panels located in hazardous locations or interfacing to equipment located in hazardous areas.

    h. Heating and cooling calculations for each panel supplied indicating conformance with cooling requirements of the supplied equipment and environmental conditions. Calculations shall include the recommended type of equipment required for both heating and cooling.

    i. Submit evidence that all control panels shall be constructed in conformance with UL 508 and bear the UL seal confirming the construction. Specify if UL compliance and seal application shall be accomplished at the fabrication location or by field inspection by UL inspectors. All costs associated with obtaining the UL seal and any inspections shall be borne by the Contractor and included in the Project Bid Price.

3. Panel Wiring Diagrams: Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. If ISA Loop Wiring Diagrams are specified below, equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams shall include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring shall include the device ISA-tag and a unique numeric identifier. The diagrams shall identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSS. Wiring labeling

used on the drawings shall match that shown on the Contract Documents or as developed by the PCSS and approved by the Engineer. I/O wiring shall be numbered with rack number, slot number, and point number. Two-wire and four-wire equipment shall be clearly identified and power sources noted. Submit final wire numbering scheme. Panel drawings shall be 11" x17" minimum in size.

4. ISA Loop Wiring Diagrams: Detailed ISA loop wiring diagrams showing requirements for each loop which is shown on the contract drawings. The Loop Drawings shall be prepared in accordance with ISA Standard S5.4 latest edition with the layout following Figures 5 and 6 (shown in the S5.4 Standard), titled Minimum Required Items Plus Optional items". Loop drawings shall be 11"x17" minimum in size. The information required on the Loop Drawings in order to satisfy the "minimum" and "optional" requirements is as follows:

    a. Minimum Required Items – The following information shall be provided on Loop Drawings in order to meet this requirement:

        1) Identification of the loop and loop components shown on the P&IDs. Other principal components of the loop to be shown and identified under ISA-5.1, "Instrumentation Symbols and Identification".

        2) Word description of loop functions within the title. If not adequate, use a supplemental note. Identify any special features or functions of shutdown and safety circuits.

        3) Indication of the interrelation to other instrumentation loops, including overrides, interlocks, cascaded set points, shutdowns and safety circuits.

        4) All point-to-point interconnections with identifying numbers or colors of electrical cables, conductors, pneumatic multitubes, and individual pneumatic and hydraulic tubing. This identification of interconnections includes junction boxes, terminals, bulkheads, ports, and grounding connections.

        5) General location of devices such as field, panel, auxiliary equipment, rack, termination cabinet, cable spreading room, I/O cabinet, etc.

        6) Energy sources of devices, such as electrical power, air supply, and hydraulic fluid supply. Identify voltage, pressure, and other applicable requirements. For electrical sources, identify circuit or disconnect numbers.

        7) Process lines and equipment sufficient to describe the process side of the loop and provide clarity of control action. Include what is being measured and what is being controlled.

        8) Actions or fail-safe positions (electronic, pneumatic, or both) of control devices such as controllers, switches, control valves, solenoid valves, and transmitters (if reverse- acting). These are to be identified in accordance with ISA-5.1, "Instrumentation Symbols and Identification".

b. Additional Required Items – The following information shall be provided on Loop Drawings (in a tabular format as shown in Figures 5 and 6 of ISA 5.4) in order to meet this requirement:

1) Process equipment, lines, and their identification numbers, source, designation, or flow direction.

2) Reference to supplementary records and drawings, such as installation details, P&IDs, location drawings, wiring diagrams or drawings, and instrument specifications.

3) Specific location of each device, such as elevation, area, panel subdivision, rack or cabinet number and location, I/O location.

4) Cross reference between loops that share a common discrete component, such as multipen recorders, dual indicators, etc.

5) References to equipment descriptions, manufacturers, model numbers, hardware types, specifications or data sheets, purchase order numbers.

6) Signal ranges and calibration information, including setpoint values for switches, and alarm and shutdown devices.

7) Software reference numbers, such as I/O addresses, control block types and names, network interfaces, point names.

8) Engraving or legend information that helps identify the instrument or accessory. Per ISA-5.4-1991 11.

9) Accessories, tagged or otherwise identified, such as regulators, filters, purge meters, manifold valves, root valves.

10) References to manufacturer's documentation such as schematics, connection details, operating instructions.

11) Color code identification for conductors or tubes that use numbers for differentiation.

G. Testing Plan Submittals

1. Test Procedure Submittals: Submit the procedures proposed to be followed for each test. Procedures shall include test descriptions, forms, and checklists to be used to control and document the required tests. Include sign-off forms for each testing phase or loop with sign-off areas for the PCSS, Engineer, and Owner.

2. Test Documentation: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures. Testing shall not be considered complete until the signed-off test procedures have been submitted and favorably reviewed. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

3. Each loop shall have a Loop Status signoff form to organize and track its inspection, adjustment and calibration. These forms shall include the following information and check-off items:

    a. Project Name.

    b. Loop Number.

    c. Detailed test procedure indicating exactly how the loop will be tested including all required test equipment, necessary terminal block numbers, and simulation techniques required.

    d. Tag Number for each component.

    e. Check-offs/signoffs for each component.

        1) Tag/identification

        2) Installation

        3) Termination - wiring

        4) Termination - tubing

        5) Calibration/adjustment

    f. Check-offs/signoffs for the loop.

        1) Panel interface terminations

        2) I/O interface terminations

        3) I/O signal operation

        4) Inputs/outputs operational: received/sent, processed, adjusted

        5) Total loop operation

        6) Space for comments.

        7) Sign off and date fields for the Contractor, the Engineer, and the PCSS.

4. Each active analog subsystem element shall have a Component Calibration form. These forms shall have the following information including space for data entry:

    a. Project Name.

    b. Loop Number.

    c. ISA Tag Number and I/O Module Address.

    d. Manufacturer.

e. Model Number/Serial Number.

f. Summary of Functional Requirements. For example:

1) For Indicators: Scale ranges

2) For Transmitters/Converters: Scale and chart ranges

3) For Computing Elements: Function

4) For Controllers: Action (direct/reverse) control modes (PID)

5) For Switching Elements: Unit range, differential (FIXED/ADJUSTABLE), reset (AUTO/MANUAL)

6) For I/O Modules: Input or output

g. Calibrations; for example:

1) For Analog Devices: Required and actual inputs and outputs at 0, 50 and 100 percent of span.

2) For Discrete Devices: Required and actual trip points and reset points.

3) For Controllers: Mode settings (PID).

4) For I/O Modules: Required and actual inputs or outputs for 0, 50 and 100 percent of span.

h. Space for comments.

i. Sign off and date fields for the Contractor, the Engineer, and the PCSS.

H. Spares, Expendables, and Test Equipment Lists Submittal

1. This submittal shall include for each Subsystem:

a. A list of, and descriptive literature for, spares, expendables, and test equipment as specified in Division 40.

b. A list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer.

c. Unit and total costs for the additional spare items specified or recommended for each subsystem.

I. Final System Documentation

1. The Final System Documentation shall consist of operations and maintenance manuals as specified herein. The manuals shall be bound in three-ring binders, maximum size of three inches, with Drawings reduced to 11 inch by 17 inch, then folded to 8.5 inch by 11 inch for inclusion. Each section shall have a uniquely

numbered tab divider, and each component within each section shall have a separate binder tab divider.

2. The operations and maintenance manuals shall, at a minimum, contain the following information:

   a. Table of Contents

      1) A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.

   b. Instrument and Equipment Lists

      1) The following lists shall be developed in Excel and provided not only as a hardcopy in O&M but also electronically on a CD.

      2) An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

      3) An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

   c. Data Sheets with Vendor Operations and Maintenance Information

      1) ISA S20 data sheets shall be provided for all field instruments.

      2) Cover page for each device, piece of equipment, and OEM software that lists, at a minimum, date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA S20, general data sheet; however, other formats will be acceptable provided they contain all required information.

      3) Final vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project, or modified standard vendor documentation. All standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages that do not apply at all to the specific model supplied shall be removed.

      4) For any component requiring dip switch settings or custom software configuration, that information shall be included along with the corresponding data sheets and O&M information.

   d. As-Built Drawings

1) Complete as-built drawings, including all drawings and diagram specified in this section under the "Submittals" section. These drawings shall include all termination points on all equipment the system in connected to, including terminal points of equipment not supplied by the PCSS.

2) As built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.

e. Original Licensed Software

1) Submit original software diskettes or CD-ROMs of all software provided under this Contract. Submit original paper based and electronic documentation for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers and related information. All software provided under this Contract shall be licensed to the Owner at the time of purchase. Provide media in software sleeves within O&M manual.

f. Electronic O&M Information

1) In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals CDROM or DVD. Electronic documents shall be supplied in Adobe Acrobat format.

2) Provide electronic files for all custom-developed manuals. Text shall be supplied in both Microsoft Office format and Adobe Acrobat format.

3) Provide electronic files for all drawings produced. Drawings shall be in AutoCAD ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, and fonts into individual zip files along with the drawing file.

4) Each computer system hardware device shall be backed up onto CDROM or DVD after Substantial Completion and shall be turned over to the Owner.

3. The cover and edge of each volume shall contain the following information:

a. Project Name (refer to Contract Documents)

b. Contract Number (refer to Contract Documents)

c. Instrumentation and Control System Hardware[or Applications Engineering] Operations and Maintenance Manual

d. Specification Sections [List appropriate section]

e. Subcontractor Name

f. Date

g. Volume X of Y [Where X is the volume number and Y is the number of volumes]

1.04 REFERENCE STANDARDS

A. Publications are referred to in the text by basic designation only. Where a date is given for reference standards, that edition shall be used. Where no date is given for reference standards, the latest edition in effect at the time of bid opening shall apply.

B. International Society of Automation (formerly the Instrumentation, Systems and Automation Society) (ISA)

1. ISA S5.2 Binary Logic Diagrams for Process Operations

2. ISA S5.3 Graphic Symbols for Distributed Control/Shared Display Instrumentation Logic and Computer Systems.

3. ISA S5.4, Instrument Loop Diagrams

4. ISA S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

5. ISA RP60.3, Human Engineering for Control Centers

6. ISA RP60.6, Nameplates, Labels, and Tags for Control Centers

C. National Electrical Manufacturers Association (NEMA)

D. National Fire Protection Agency (NFPA)

1. NFPA 70, National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL)

1. UL 508 – Industrial Control Equipment

F. American Society for Testing and Materials (ASTM)

1. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.05 QUALITY ASSURANCE

A. The Process Control System Supplier (PCSS) shall be a "systems integrator" regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems integrator" shall be interpreted to mean an organization that complies with all of the following criteria:

B. PCSS shall hold a valid UL-508 certification for their panel fabrication facility.

C. Actual installation of the instrumentation system need not be performed by the PCSS's employees; however, the PCSS as a minimum shall be responsible for the technical supervision of the installation by providing on site supervision to the installers of the various components.

D. Only approved suppliers will be accepted. The Contractor must name the proposed system supplier per General and Special Provisions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling shall be in accordance with General and Special Provisions.

B. Shipping Precautions

1. After completion of shop assembly, factory test and approval of all equipment, cabinets, panels and consoles shall be packed in protective crates and enclosed in heavy duty (5 mil) polyethylene envelopes or secured sheeting to provide protection from damage, dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.

2. Manufacturer's special instructions for field handling, storage and installation required for protection, shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other means of protection.

3. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the owner.

1.07 NOMENCLATURE AND IDENTIFICATION

A. Field Instrument Tags

1. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as indicated in the Drawings, shall be provided on each piece of equipment supplied under this Section. Equipment shall be tagged before shipping to the site.

2. Provide 1/8-in by 3/8-in, Type 316 stainless steel button head machine screws.

3. All supplied field instrument transmitters and field instrument transmitter elements shall have a stainless steel identification tag attached to each transmitter and element prior to shipment. Tag shall be attached via stainless steel chain or stainless steel wire (24 gauge inches. Tag shall include the ISA alphanumeric instrument number as indicated in the P&ID, loop, and detail drawings. The alphanumeric instrument number shall be stamped into the tag and shall have a minimum of 3/16-in high alphanumeric characters.

B. Panel Nameplates

1. See Section 40 51 50.

1.08 WARRANTY

A. Provide warranty per General and Special Provisions and as specified herein.

1.09 PROJECT/SITE REQUIREMENTS

A. Environmental Requirements. Refer to Section 26 05 00 and the Electrical Drawings for specific environmental and hazardous area classifications.

B. Elevation: Equipment shall be designed to operate at the project ground elevation.

C. Temperature:

1. Outdoor areas' equipment shall operate [between - 30 to 50 C degrees ambient].

2. Equipment located in indoor locations shall operate between [10 to 35 C] degrees ambient minimum.

3. Storage temperatures shall range from [0 to 50 C] degrees ambient minimum.

4. Additional cooling or heating shall be furnished if required by the equipment as specified herein.

D. Relative Humidity: Air conditioned area equipment shall operate between 20 to 95 percent relative, non-condensing humidity. All other equipment shall operate between 0 to 100 percent relative, condensing humidity.

PART 2 - PRODUCTS

2.01 PRODUCTS GENERAL

A. All instrumentation and electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture and fungus. The field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.

B. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks unless otherwise noted. Fasteners for securing control panels and enclosures to walls and floors shall be either hot-dipped galvanized after fabrication or stainless steel. Provide stainless steel fasteners only in corrosive areas rated NEMA 4X on the Drawings or as defined under Division 26. Provide and size anchors in accordance with CBC per seismic calculations. Provide minimum size anchor of 3/8-inch.

C. All indicators shall be linear in process units, unless otherwise noted. All transmitters shall be provided with indicators in process units, accurate to two percent or better.

D. All equipment, cabinets and devices furnished shall be heavy-duty type, designed for continuous industrial service. The system shall contain similar products of a single manufacturer, and shall consist of equipment models, which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

E. All electronic/digital equipment shall be provided with radio frequency interference protection.

F. Electrical

1. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

2. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.

4. All switches shall have double-pole double-throw contacts rated at a minimum of 600 VA, unless noted otherwise.

5. Switches and/or signals indicating an alarm, failure or upset condition shall be wired fail- safe to the SCADA/Dialer system. A fail-safe condition is an open circuit when in an alarm state.

6. Materials and equipment shall be UL approved. Where components are not available with UL approval, integrate the device with ground fault protective devices, isolation transformers, fuses, or other protective equipment necessary to achieve compliance with UL 508 requirements.

7. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified herein shall go through an orderly shutdown with no loss of memory, and shall resume normal operation without manual resetting when power is restored, unless otherwise noted.

8. All transmitter output signals shall include signal and power source isolation.

2.02 ELECTRICAL SURGE PROTECTION

A. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be

such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20µs impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground in accordance with Section 26 05 00.

B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in a separate enclosure, unless conduit mounted, and shall be Phoenix Contact PT Series, MTL Surge Technologies (Telematic) TP48, Citel TSP-10 series, or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable. Protection devices in control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel BP1-24, or equal.

C. Provide protection of all 120 VAC power feeds into control panels, instruments, and control room equipment. Surge arresters shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, or equal.

D. Inductive Loads – At a minimum, provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.

2.03 TUBING AND FITTINGS

A. All instrument air header takeoffs and branch connections less than 2-in shall be 316 stainless steel.

B. All instrument shut-off valves and associated fittings shall be supplied in accordance with the piping specifications and all instrument installation details. The materials for fittings and valves shall be compatible with process fluids. Where metallic fittings and valves are compatible, wetted materials shall be Type 316 stainless steel.

C. The materials for instrument tubing shall be compatible with process fluids. Where metallic tubing is compatible, tubing shall be fully annealed ASTM A269 Seamless 316 grade free of OD scratches having the following dimensional characteristics as required to fit the specific installation:

1. 1/4-in to 1/2-in O.D. by 0.035 wall thickness

2. 5/8-in to 1-in O.D. by 0.049 wall thickness

3. 1-in O.D. by 0.065 wall thickness

4. 1-1/4-in O.D. by 0.065 wall thickness

5. 1-1/2-in O.D. by 0.083 wall thickness

6. 2-in O.D. by 0.095 wall thickness

D. All process connections to instruments shall be annealed 1/2-inches O.D. stainless steel tubing, Type 316.

E. All tube tracks shall be supported by stainless steel and installed as per manufacturer's installation instructions.

2.04 SPARE PARTS

A. Spare parts of the type and quantity as recommended by the manufacturer shall be furnished for all devices furnished under these sections.

B. All spare parts shall be wrapped in bubble wrap, sealed in a polyethylene bag complete with dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's part number, part ordering information including manufacturer, part number, part name, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts. The spare parts shall be delivered and stored in a location directed by the Engineer.

C. As a minimum, furnish the following spare parts for control panels:

1. Timers - Five of each type installed

2. Relays - Five of each type installed

3. Fuses and circuit breakers - 10% (minimum of 10 fuses and 2 circuit breakers) of each type and size installed

4. Light bulbs - 10% (minimum of 10) of each type installed

5. Power supplies - one of each type installed.

6. Manufacturer's cables - one of each type installed.

7. Selector switches/pushbuttons - Two of each type installed including 5 contact blocks.

8. Surge protection devices - One of each type installed.

9. Provide one quart of touch-up paint, for each type and color used for all RTU cabinets, panels, and consoles supplied.

D. The following field Instrument related Spare Parts shall be furnished:

1. Miscellaneous: One year supply of items recommended by the manufacturer of the equipment including all reagents, dissolved oxygen probes, batteries, and calibration standards as needed to operate and maintain the furnished equipment.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices indicated are approximate only. Exact locations of all devices shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control equipment and in case of any interference with other work, proceed as directed by the Contractor and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the Owner.

B. All equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required for the locations as shown on the Drawings and specified in Division 26. All work shall be in strict accordance with codes and local rulings.

C. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

D. All piping and tubing to and from field instrumentation shall be provided with necessary unions, calibrations and test tees, couplings, adaptors, and shut-off valves. Process tubing shall be installed to slope from the instrument toward process for gas measurement service and from the process toward the instrument for liquid measurement service. Provide drain/vent valves or fittings at any process tubing points where the required slopes cannot be maintained. Process tubing shall be installed rigidly with supports to prevent significant vibrations.

E. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed as shown and not interfere with any other equipment.

F. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.

G. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, ship material in sections sized to permit passing through restricted areas in the building. Provide on-site service to oversee the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the Engineer's approval. Certify that field wiring associated with his/her equipment is installed in accordance with best industry practice. Schedule and coordinate work under this section with that of the electrical work specified under applicable Sections of Division 26.

H. Installation of fiber optic cable within control panel and console assemblies. Refer to cable manufacturer's specifications for bend radius. Use cable breakout assembly as recommended by the cable manufacturer. Provide wire basket, strain relief as required to meet manufacturer's strain requirements.

I. Provide local electrical shutoffs and disconnects for all 4-wire field instruments requiring 120 VAC power. Electrical disconnects shall be suitably rated disconnect switches or manual motor starters as specified under Division 26.

J. Loop Tuning - All electronic control stations incorporating PID controllers shall be tuned following field installation and calibration of instrumentation and control system components, but prior to commencement of the specified field tests. Field testing will be immediately 'failed' if loop tuning for the entire installed system is not complete.

1. Optimal loop tuning shall be achieved either by auto-tuning software or manually by trial and error, Ziegler-Nichols step-response method, or other documented process tuning method. Assigning common PID factors for identical loops following field tuning of a single typical loop is acceptable. However, tuning documentation shall be submitted for each loop individually as specified in Part 1 of these Specifications.

2. Determine and configure optimal tuning parameters to assure stable, steady state operation of final control elements running under the control of field mounted, dedicated PID controllers or software based PID controllers residing as part of the programmable logic controller system. Each control loop that includes anti-reset windup features shall be adjusted to provide optimum response following startup from an integral action saturation condition.

3. Tune all PID control loops to eliminate excessive oscillating final control elements. Loop parameters shall be adjusted to achieve 1/4 amplitude damping or better. In addition, loop steady state shall be achieved at least as fast as the loop response time associated with critical damping.

4. Loop performance and stability shall be verified in the field following tuning by step changes to setpoint. Submit loop tuning methodology and verification as part of the final system documentation as specified in Part 1.

5. For cascade loops, tune both sets of controllers so that the cascade loop achieves the loop tuning characteristics specified herein.

END OF SECTION

SECTION 40 61 14

PROCESS CONTROL AND INSTRUMENTATION SYSTEM LOOP DESCRIPTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Description

1. The descriptions, together with the detail drawings, instrumentation diagrams, comprise the functional design criteria of the Process Instrumentation and Control System (PCIS). The process and instrumentation diagrams (P&IDs) represent the basic concept of the PCIS requirements, whereas the descriptions supplement the instrumentation diagrams.

2. The PCIS Supplier shall utilize the descriptions and P&IDs as the basic criteria for the design of the instrumentation schematics, control software, preparation of data sheets, wiring diagrams, piping layouts, assembly drawings, and other requirements set forth in these specifications.

3. The wastewater wet well pumping system consists of two main pumps (Pump 1 and Pump 2) controlled by level transmitters. A set of backup float switches provides redundancy in case of primary level transmitter failure. Each pump has an associated level transmitter and backup float switch. If the lead level transmitter fails, the system will default to the lag pump's level transmitter. If the lag transmitter also fails, the system will revert to using the lead pump's float switch. The control sequence operates in an alternating lag-lead configuration to balance pump runtime and prevent excessive wear on any single pump.

4. Provide high-high, high, low, low-low, rate of change and instrument fail alarms for all analog points in the system.

1.2 LOOP DESCRIPTIONS

A. NORMAL OPERATION

1. The control system monitors the liquid level in the wet well using primary level transmitters.

2. The pumps operate in an alternating lag-lead sequence. If Pump 1 was the lead pump in the previous cycle, Pump 2 will be the lead pump in the next cycle, and vice versa.

B. PUMP ACTIVATION

1. When the liquid level reaches Level Set Point 1, the designated lead pump (either Pump 1 or Pump 2) will start.

2. If the liquid level continues to rise and reaches Level Set Point 2, the lag pump (the other pump) will also start.

3. Both pumps will continue to operate until the liquid level drops below the Reset Level Set Point.

C. PUMP DEACTIVATION

1. Once the liquid level drops below the Reset Level Set Point, both pumps will turn off.

2. If both pumps were not called during the previous cycle, the lead and lag designation will alternate based on a timer controlled by an 8-pin relay.

3. The system will then alternate the lead and lag pumps for the next cycle.

D. LEVEL DEVICE FAILURE

1. If the primary level transmitters fail, the backup float switches will engage.

2. The system will first look to the lag pump's level transmitter. If both transmitters are unavailable, it will rely on the lead pump's float switch.

3. If the high-level backup float switch is activated, both pumps will turn on in emergency mode until the water level decreases to a safe range.

4. An alarm signal will be triggered to notify operators of a level transmitter failure.

E. FAILURE CONDITIONS AND ALARMS

1. If both pumps are running and the water level continues to rise, a High-High Level Alarm will be triggered.

2. If a pump fails to start when commanded, a Pump Failure Alarm will be triggered.

3. If the backup float switches engage, a Primary Level Sensor Failure Alarm will be logged.

END OF SECTION

SECTION 40 63 43

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Programmable logic controller (PLC) based control systems hardware.

2. Development software to be used with the specified PLC hardware.

1.2 REFERENCES

A. Abbreviations and Acronyms:

1. IEEE: Institute of Electrical and Electronics Engineers

B. Definitions:

1. As specified in Section 40 61 00 (Common Work Results for Process Control and Instrumentation Systems).

2. Specific definitions:

a. CPU: Central Processing Unit.

b. I/O: Input/Output.

c. PLC: Programmable Logic Controllers.

3. Specific definitions:

a. Development operating software: The software provided by the PLC manufacturer for use in programming the PLC.

b. Application software: The software that is programmed specifically for the Project.

1.3 SUBMITTALS

A. Product Data:

1. CPU:

a. Processor type.

b. Processor speed.

c. Memory.

d. Internal processor battery backup time.

2. I/O Modules:

a. Make/Model.

b. Type.

c. Standard wiring diagram.

3. Programming Languages.

4. Operating System Requirements.

B. Test and Evaluation Reports:

1. Calculations:

a. Submit calculations or documented estimate to verify that memory requirements of this Section are met, including spare requirements. If possible, use PLC manufacturer's calculation or estimating worksheet.

b. Submit calculations to verify that PLC power supply requirements are met.

C. Software:

1. Provide application software for the specific Project process requirements.

a. Fully annotated copy of programmed PLC logic in its native format.

b. Cross-referenced index of all PLC registers or points.

c. Provide all licenses and any passcode.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers:

a. Provide PLC hardware manufactured at facilities certified to the quality standards of ISO 9001.

b. Provide PLC system components by a single manufacturer:

1) Third-party communication modules may be used only for communication or network media functions not provided by the PLC manufacturer.

2) Use PLC manufacturer approved hardware, such as cable, mounting hardware, connectors, enclosures, racks, communication cable, splitters, terminators, and taps.

3) All PLC hardware, CPUs, I/O devices, and communication devices shall be new, free from defects, and produced by manufacturers regularly engaged in the manufacture of these products.

PART 2 PRODUCTS

2.1 HMI

A. Rated for use in industrial environments.

a. Power Supply: Industrial Grade GE SDN-C series, input 115 VAC, output 24 VDC, 120W (minimum)

b. I/O Cards Options: Same manufacturer as PLC

Analog Input/output (4-20 mA) cards to support inputs indicated on Network Diagram drawings.

Discreet Input (24 VDC) cards to support inputs indicated on Network Diagram drawings.

Discreet Output cards to support inputs indicated on Network Diagram drawings.

Interface and Special Purpose Modules: Ethernet Network Interface Unit Module, Pressure Transducer Module, Serial Communications Module with 2-ports (for future use with radio).

Serial Modbus: Modbus/RTU

Ethernet Protocols: Modbus TCP/IP

Accessories and additional cards, as required to complete the Project.

c. The PLC programming software system shall be manufactured by PLC hardware manufacturer.

2.2 PROGRAMMABLE LOGIC CONTROLLERS

A. Manufacturers:

1. Product Options:

a. PLC: Rockwell Automation CompactLogix

b. I/O Cards Options: Same manufacturer as PLC

c. The PLC programming software system shall be manufactured by PLC hardware manufacturer:

1) Rockwell Software

B. Description:

1. Provide all PLC hardware as specified in Contract Documents.

C. Performance / Design Criteria:

1. Programmable logic controller:

a. Construction:

1) Furnish plug-in modular system.

2) Provide PLCs capable of operating in a hostile industrial environment:

a) Temperature: 0 to 60 degrees Celsius.
b) RFI: 80 to 1,000 MHz.
c) Vibration: 10 to 500 hertz.
d) Humidity: 0 to 95 percent.

3) Provide power supplies designed to protect against overvoltage and frequency distortion characteristics.

4) Design the PLC system to function as a standalone unit that performs the control functions described in the Contract Documents completely independent from the functions of the HMI system PC-based operator interfaces:

a) Failure of the HMI system shall not impact data acquisition, control, scaling, alarm checking, or communication functions of the PLC.

b. CPU:

1) Configure each CPU so that it contains software relays, timers, counters, number storage registers, shift registers, sequencers, arithmetic capability, and components necessary to perform the specified control functions.

2) Capable of interfacing with all discrete inputs, analog inputs, discrete outputs, analog outputs, and communication cards to meet the specified requirements.

a) Capable of supporting and implementing closed-loop floating-point math and PID control that is directly integrated into the CPU control program.

3) Memory:

a) Non-volatile memory: 10 MB memory card.

2. PLC power supply:

a. Input: 120 VAC to 24VDC.

b. Mounted in the Control Panel.

c. Sized to power all modules mounted in housing including an average module load for any empty housing slots plus 50 percent above that total.

3. PLC input/output, I/O modules:

a. General: Compatible with the PLCs being furnished under the contract and by the same manufacturer as the PLCs.

b. Provide I/O modules that:

1) Isolate in accordance with IEEE Surge Withstand Standards and NEMA Noise Immunity Standards.

2) The use of common grounds between I/O points is not acceptable.

3) Provide modules that are removable without having to disconnect wiring terminals.

4) Designated future I/O points contained in the I/O Lists and/or shown on the P&IDs, control schematics, or described in the control strategies.

a) Installed spare capacity in accordance with the requirements of this Section.

b) Discrete input/output modules:

(a) Defined as contact closure inputs from devices external to the input module.

(b) Individually isolated inputs.

(c) With LEDs to indicate the status of each discrete input.

(d) Input voltage: 24VDC.

c) Analog input modules:

(a) Signal type: Provide 4-20 mA for most applications; other levels are acceptable to interface to vendor control panels.

d) Analog output modules:

(a) Signal type: Provide 4-20 mA for most applications; other levels are acceptable to interface to vendor control panels.

c. Communications modules:

1) Network communications modules:

a) General:

(a) Install communications modules in the PLC backplane.

b) Ethernet:

(a) Ports: (1) RJ-45.

c) Modbus:

(a) Ports: 1.

(b) Each port is individually configurable as Modbus Master or Slave.

d. PLC backplane housing:

a) Mount the PLC power supply, CPU, communications module, and I/O modules in a suitable standard PLC backplane or housing.

e. PLC programming software:

1) Furnish operating software capable of monitoring and/or controlling the PLC.

a) Display the PLC status information, such as faults and communication errors and amount of memory remaining.

2) The PLC programming software shall support the following programming languages:

a) Ladder Logic.

3) Generate a PLC program printout, which is fully documented, through the PLC programming software.

f. Shutdown:

1) Where possible, provide orderly shutdown capability for shutdowns resulting from equipment failure, including other PLC processor failures, primary power failure, or a manually entered shutdown command.

a) Alarms:

(a) Provide an alarm program to check all analog variables against high high, high, low, and low-low alarm limits.

(b) When an analog value exceeds a set limit, it must be reported as an alarm based on individually set priority level for each alarm point.

b) Averages:

(a) Provide a program to calculate and store hourly, daily, and monthly averages of analog variables.

(b) Continuously compute averages, e.g., the average for the current period to the present point in time must be stored in memory and available for use in displays, etc.

(c) Update hourly averages each minute or at the polling interval for the selected variable.

(d) Update daily averages at least once each hour and calculate using the results of the hourly averages.

(e) Update monthly averages at least once each day and calculate using the results of the daily averages.

(f) At the end of each averaging period, store the average values for the period on the hard disk for historical record-keeping and reset the present period average register to the present value of the variable.

(g) The active database must include the present period average and previous period average for each variable and averaging period.

c) Totals:

(a) Provide a program to calculate and store hourly, daily, and monthly totalization of analog variables.

(b) Assign a scaling factor to each variable to convert to the appropriate units based on a 1-minute totalizing interval.

(c) Assign a separate factor for each totalizing interval.

(d) Variables for which totalization is inappropriate must have scaling factors of zero.

(e) At the end of each totalizing period, store the totalized values for the period on the hard disk for historical record-keeping and reset the present period totalization register to zero.

(f) The active database must include the present period total and previous period total for each variable and totalizing period.

d) Engineering units:

(a) Provide software to allow the system and the operator to convert all the measured analog variables to any desired engineering units.

(b) The operator must be able to view displays and generate reports of any measured variable in one or more engineering units such as flow in gpm, mgd, cfs, and acre-feet per day.

(c) Pre-program the conversion of the engineering units, and, if not preprogrammed, the operator must be able to program new engineering unit conversions by using simple methods, e.g., multiplication of the database attributes by a constant.

2) Some of the above functions may be better accomplished in the data acquisition and graphic display software package; it is the responsibility of the ICSC to optimize the location of the various functions between all software packages.

4. Installed spare requirements:

a. I/O points:

1) Provide a total of 25 percent spare I/O capacity for each type of I/O at every PLC and remote inputs and outputs (RIO).

2) Wire all spare I/O points to field terminal blocks in the same enclosure the PLC resides in.

PART 3 EXECUTION

3.1 ERECTION, INSTALLATION, APPLICATION, AND CONSTRUCTION

A. Special Techniques:

1. Application Software:

a. Provide a digital copy of the following:

1) Application software:

a) Finalized fully annotated copy of programmed PLC logic in its native format.

b) Cross-referenced index of all PLC registers or points.

2. Installation:

a. General:

1) The control system logic program shall reside at the PLC level.

b. Use the tag and loop identifications found on the P&IDs for all tags used and/or assigned as part of the application software Work provided by the ICSC.

c. Program the PLC logic using the following language(s):

1) Ladder Logic.

3.2 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate PLC works as intended.

B. Training:

1. Tailor training specifically for this Project that reflects the entire control system installation and configuration.

2. Perform training by pre-approved and qualified representatives of the ICSC and/or manufacturer of the PLC hardware and programming software.

END SECTION

SECTION 40 67 16

FREE-STANDING PANELS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor, through the use of the System Supplier, shall provide control panels for the PCIS, complete and operable, in accordance with the Contract Documents.

B. The System Supplier shall be responsible for selecting, sizing, and providing the correct and necessary type and quantity of the panels for each process control application. The necessary hardware and responsibilities shall include but not limited to:

1. Mounting the panel

2. Locating and mounting interior and exterior instruments, hardware and equipment in the panel

3. Field interface terminal blocks

4. Terminating panel internal wiring and signals

5. Terminating communication and network cabling and wiring

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Section 40 61 00 – Common Work Results For Process Control and Instrumentation System

B. Applicable Sections in Division 40 – Instrumentation and Control for Process Systems

C. Division 26 – Electrical

D. The provisions of this Section apply to local panels provided in equipment systems specified in other sections unless indicated otherwise in those sections.

E. All panels shall conform to the specifications; codes and standards requirements specified Section 40 61 00 – Common Work Results For Process Control and Instrumentation System.

F. Each control panel, including panels for service entrance equipment, shall meet all UL listing and labeling requirements including UL Standard 508 and UL Standard 508A and shall be UL-labeled accordingly. The Contractor shall arrange components and wiring to meet UL requirements stated above.

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittals, and Section 40 61 00 – Common Work Results For Process Control and Instrumentation System.

B. Approval Data:

1. Product data for control panel assemblies.

C. Factory Test Report:

1. Certified or record copies of all shop measurements and test data.

D. Field Test Report:

1. Certified or record copies of all field measurements and test data.

1.4 QUALITY ASSURANCE

A. Factory and field tests shall be performed in accordance with Section 40 61 00 – Common Work Results For Process Control and Instrumentation System.

1.5 WARRANTY

A. Guarantee and Special corrections of defects and software upgrade requirements and warrantee shall be in accordance with Section 40 61 00 – Common Work Results For Process Control and Instrumentation System

PART 2 PRODUCTS

2.1 GENERAL

A. All PCIS control panel assemblies, such as new PLCs, remote I/Os, analyzer systems, communication systems, etc. shall be mounted inside a new outdoor or indoor NEMA-rated type enclosure, suitable and designed for the application for which it was intended, as specified or as shown on the drawings. If required, PCIS panel assemblies shall be mounted in existing enclosures. Control panels shall be either freestanding, pedestal-mounted or equipment skid-mounted.

B. The enclosure and back panel shall be sized to contain the equipment required to make the installation complete and suitable for its intended purpose. Field conditions and the guidelines provided in the specifications and/or the drawings shall be followed. Accessibility for ease of maintenance, future expansion and good installation and industry practices shall be considered when sizing an enclosure. Spare space shall be kept clear of wiring, etc., to give contiguous clear space for future additions.

C. In cases where existing panel is used, the Contractor shall review the available space in the field or in the existing panel to determine the proper size of back panel suitable to accommodate the required equipment for the facility. It should be noted that control panel layouts shown on the Drawings are diagrammatic. The control

panel submittal shop drawing shall reflect the accurate layout of the equipment in the panel.

D. Environmental Suitability and NEMA Rating

1. Indoor and outdoor control panels and instrument enclosures shall be suitable for operation in the ambient conditions associated with the locations designated in the Contract Documents. Heating, cooling, and dehumidifying devices shall be provided in order to maintain instrumentation devices 20 percent within the minimums and maximums of their rated environmental operating ranges. The CONTRACTOR shall provide power wiring for these devices. Enclosures shall be suitable for the environment in which they are installed. Panel instruments and equipment in hazardous areas shall be suitable for use in the particular hazardous or classified location in which it is to be installed.

2. Control panels shall be sized to adequately dissipate heat generated by equipment mounted in or on the panel.

3. NEMA Rating

a. All PCIS panel assemblies, such as PLCs, remote I/Os, analyzer systems, communication systems, etc. shall be mounted in a NEMA-rated type enclosure suitable for the environment in which it is located. Different NEMA-rated enclosures and suitable materials of construction (e.g. stainless steel, fiberglass, etc.) shall be used for specific applications, project requirements and for corrosive and/or hazardous environments.

b. In areas that are classified as general purpose, the minimum rating of all outdoor mounted panels shall be NEMA 4 (IP66) steel construction. The minimum rating of all indoor mounted enclosures in general purpose classified areas shall be NEMA 4 or NEMA 12 (IP52) steel construction, unless otherwise indicated.

c. Instrumentation and enclosures in hazardous areas shall be suitable and/or protected for use in the particular hazardous or classified location in which it is to be installed.

2.2 CONSTRUCTION

A. Material and Fabrication

1. Floor-mounted-type enclosure shall be constructed of a minimum of 16-gauge, 14-gauge or 12-gauge 316 stainless steel, depending on the size of the enclosure, application, environment, and the project requirements. Floor-mounted free-standing enclosures shall be made of 12-gauge 316 stainless steel, depending on the size of the enclosure, application, and the project requirements.

2. Seams shall be continuously welded and ground smooth. Corners shall be welded and ground smooth.

3. Each enclosure shall have a heavy gauge, continuous piano hinge pin which shall support each door.

4. Door and body stiffeners shall be provided where required. The stiffeners shall be welded to the inside of enclosures to prevent deformation due to the weight of face-mounted instruments.

5. Doors shall be sealed with a closed cell neoprene gasket.

6. The interior rear and sides of each enclosure shall have steel mounting channels for supporting mounting panels.

7. Enclosures shall be provided with external mounting feet as shown, as well as door clamps, hasp and staple for padlocking, data pocket, and closed-cell oil-resistant gasket. Removable lifting lugs to facilitate handling shall be provided on large enclosures.

B. Back and Side Panels: Each enclosure shall be provided with a removable back panel. Depending on the size of the enclosure more than one back panel may be required. Removable side panels shall be provided as required for additional mounting space.

C. Finish: Non-stainless steel enclosures shall have an ANSI 61 gray polyester urethane powder coating electrostatically applied to inside and outside surfaces. Enclosure interior, and back and side panels shall be white.

D. Ventilation, Louvers, Vents, and Filters: In enclosures where excessive internal heat or internal moisture is a problem, the enclosure shall be equipped with louvers with filters and a cooling fan. The perimeters of the louver plate shall be sealed with a gasket. Louver shall be of the same material and finish as the enclosure. The louver shall be sized for effective heat rejection.

E. Accessories: The Contractor shall provide additional panel accessories to meet the specifications, such as floor stand and mounting kits, door handle and lock kits (common key shall be provided for all doors), 3-point latch, etc.

F. Instruments Mounting

1. Equipment mounted at the rear of enclosure shall be installed to allow for commissioning adjustments, operation and servicing requirements. The Contractor shall arrange components and wiring to meet UL requirements.

2. Spare space shall be kept clear of wiring, etc., to give maximum space for future additions.

3. For front mounted hardware, cutouts and holes may be cut or drilled by any standard method that does not cause deformation. Burrs shall be ground smooth. Mounting the instruments shall not degrade the NEMA rating of the enclosure.

4. DIN rail mounted equipment shall be used as much as possible.

5. Each enclosure shall be provided with interior nameplates to identify equipment tags and functions.

G. Enclosures shall be Hoffman, Hubbel-Wiegmann, or equal.

2.3 ELECTRICAL REQUIREMENTS

A. The main power supply to the control panel controls shall be 120 VAC, 60 Hz. The Contractor shall provide the main power supply from an external source. The Contractor shall provide a step-down transformer as required to power the panel.

B. The Contractor shall provide wireways, wire, and electrical fittings and components for 120V and 24VDC circuits to instruments and other electrical devices in the panel for a complete and operable installation. Wiring methods and materials for all panels shall be in accordance with the NEC requirements.

C. The circuits for 24VDC shall run in separate wireways from the 120 VAC circuits.

D. Each source of foreign voltage shall be isolated by providing disconnecting or pullapart terminal blocks. Each control panel shall be provided with identified terminal strips for the connection of all external foreign voltage. A “CAUTION-Foreign Voltage” nameplate shall be attached to the outside of the enclosure door warning of foreign voltages inside the enclosure.

E. If required by the contract documents, the control panel shall be the source of power for any 120 VAC solenoid valves interconnected with the control panel.

F. Terminal Blocks

1. The control panel shall be provided with sufficient terminal blocks for the connection of external field conductors, signals, and power and for use inside the panel for power distribution and for future expansion. In order to facilitate easy and safe loop maintenance, each analog input loop shall have a disconnect with test plugs built into its field terminal block.

2. Spare Terminal Blocks for Signals: The Contractor shall provide sufficient spare terminal blocks to connect additional signals for future use (implemented and future spares). Implemented spare signals shall be wired to terminal blocks.

3. Spare Terminal Blocks for Power and Other Applications: In addition to the spare terminals for signals, The Contractor shall provide spare terminals for 3 additional power distribution and grounding applications circuits.

4. Terminal blocks for all wiring shall be modular terminals, DIN rail mounted type rated at 15 amperes at 600 VAC and have a minimum width of 8-mm suitable for No. 12 A.W.G. stranded wire. Terminals shall be the solderless box lug type with pressure plates in actual contact with the wire to minimize wire breakage. Each terminal shall have a light-colored strip for marking the

terminal number or circuit designation. Double high terminal blocks are not acceptable.

5. External connections to and from enclosures shall terminate on terminal blocks, except approved communication and data cables. Circuit isolating switches and fuse terminals shall include non-conducting pullers which can be removed with finger alone, without tools. Additionally, the panel shall be provided with identified terminal strips for the connection of external/field conductors.

6. Terminals shall be as manufactured by Square D Class 9080 Type M, Allen-Bradley Bulletin 1492 Type H or J, by Entrelec, or equal.

G. Electrical Hardware Accessories - The control panel shall be equipped with the following:

1. A duplex 15-amp, 120 VAC GFCI type receptacles for service and maintenance use. The receptacle shall be 2-pole, 3-wire grounding, and heavy-duty industrial grade by Hubbell, Leviton, or equal.

2. A duplex 15-amp 120 VAC GFCI type receptacle dedicated for a powering an uninterruptible power supply (UPS). The receptacle shall be color-coded, 2-pole, 3-wire grounding, heavy duty industrial grade by Hubbell, Leviton, or equal

3. A 24 VDC LED light strip lamp with guards and a toggle switch (IDEC LUMIFA LF1B Series, Schneider Electric, or equal) mounted on the top of the enclosure or on the part the side or back panel shall be provided for panel lighting. A separate fuse/circuit breaker shall be provided for the lamp mounted inside and in the top of the back-of-panel area. Control panels that are longer than 72-inches, two lamps shall be provided.

4. A ¼-inch by one (1)-inch copper grounding bus bar with multiple connecting terminals. The grounding bus shall be complete with solderless connector for one 4 AWG bare stranded copper cable and with tapped holes to accommodate ground connections from various devices in the enclosure. Provide ground connections for different AWG wires and shield connection clamps by Phoenix Contact, Entrelec, Weidmuller or equal. Provide separate ground buses for analog and discrete/digital signals. The copper cable shall be provided by the CONTRACTOR and be connected to a system ground loop.

5. 120 VAC Heater and thermostat. Heater by Pfannenberg, Hoffman and thermostat by Stego model KTO-011, Hoffmann or equal.

6. Ventilation fan and filter kit by Cooltron FA and FAA series, Hoffman, Rittal or equal.

H. Circuit Breakers, Fuses, and Disconnects

1. Circuit breakers, fuses and disconnects shall be installed in the control panel to protect against fault current the 120 VAC and 24 VDC branch circuits and the instruments and the electrical components that these circuits power. Circuit breakers shall be installed as disconnects of external power feeds for control circuits from outside the enclosure and branch circuits within the enclosure.

2. The circuit breakers, fuses and disconnects shall also allow disconnecting the power from these instruments in a safe manner. Individual plug and cord set power supply connections, such as for a UPS, may be used without switches. Each circuit breaker and fuse shall be identified by a service nametag.

3. The fuses shall be mounted in a DIN mounted fuse holder terminal block and shall have a blown fuse indicator light. The fuse holders for 120 VAC applications shall have a neon light indicator and shall Entrelec part number 0115-661.21, Phoenix Contact or equal. The holders for 24 VDC applications shall have an LED indicator light and shall be Entrelec part number 0115-663.23, Phoenic Contact or equal.

4. The number of power distribution circuits depends on the type of electrical devices they power. A 120 VAC, 60 Hz single pole circuit breakers or a fuse, as noted, with the following minimum rating shall be provided in each branch circuit as listed below. The circuit load shall not exceed 10-amp. The circuit breakers shall be DIN rail mounted type. The 120 VAC breakers shall by Square D model QUO- 120 and QUO-115, Eaton/Cutler Hammer model CHQ-120 and CHQ-115 depending on the amperage rating, or equal.

    a. 20-amp main circuit breaker for the 120 VAC control panel power supply and the distribution of the power.

    b. 15-amp circuit breaker for the duplex 15-amp, 120 VAC GFCI-type receptacle used for service and maintenance.

    c. 15-amp circuit breaker (or as required by the UPS manufacturer) for the dedicated duplex GFCI type receptacle used for the UPS.

    d. 15-amp circuit breaker for the heater and thermostat and ventilation fan.

    e. 15-amp circuit breaker for the protection of the PLC if it is powered by 120 VAC power.

    f. 5-amp fuse, 120 VAC for each of the 120 VAC power input circuits to the two (2) redundant 24 VDC power supplies

    g. A 1/8–amp fuse to protect the 24 VDC LED light

    h. A fuse, sized as required, shall be provided for the protection of each 24 VDC branch (including spares) and equipment that is powered by the 24 VDC power supply. Each analog and discrete input loop shall

also be protected by a fuse. A fuse shall be provided for each instrument regardless if it is equipped with integral replaceable fuse.

I. Uninterruptible Power Supply

1. The CONTRACTOR shall provide an uninterruptible AC power supply (UPS) system for each control panel to back up the power for the panel in case utility power fails. The UPS shall be a “smart” type, use on-line, high frequency, double conversion technology. The batteries shall be integral to the UPS enclosure

2. Capacity and Duration: The continuous output capacity of the UPS shall be at least 1,000 VA. It shall be sufficient to supply the interface and peripheral equipment (present and future) with regulated AC power for a minimum of four (4) hours from batteries only. Additional batteries or larger UPS size shall be provided to meet the specified backup time.

3. The CONTRACTOR shall submit load calculations and size each UPS to justify the selection of present and future load requirements, as well as overload and inrush capacity requirements.

4. Under normal conditions the AC power line shall feed the UPS to power the protected load. The UPS shall also maintain the batteries in fully charged “float” condition. Whenever normal AC power fails or dips below the normal range, the critical load shall be continuously supplied from the batteries and the double conversion system. The transfer from normal to AC line to backup power shall be bumpless and without a break in the output of the UPS (0 transfer time).

5. Features and Options

a. Input Power Range: 100 to 132 volts, 60 Hertz +/- 5 Hertz, auto-sensing.

b. Output Power Range: 110/120 (selectable), +/- 3 percent of nominal, 60 Hertz +/- 0.5 percent.

c. Overload Capacity: The UPS shall have the ability to supply 110 percent of system requirements for 10 seconds, without degradation of the service life.

d. Protection: The UPS output shall be protected (IEEE standards) from lightning, surges overload, and short circuit. The input shall be protected by a circuit breaker, sized in accordance with manufacturer’s recommendations.

e. Battery: Lead acid type, maintenance free, sealed suspended electrolyte, and leak-proof. Recharge Time (with half load): three (3) hours.

f. Alarms and Status: The UPS shall be provided with a relay output card to provide a common dry contact output that represents the health/status of the UPS and battery functions (i.e. low battery, UPS on batteries, UPS fault, batteries failed on battery self-test).

6. Manufacturer: Phoenix Contact UPS4 Quint series, Sola HD SDU, or equal – 1,000 VA.

J. Control Panel 24 VDC Power Supplies

1. Control panels shall be provided with redundant power supplies which shall be configured in a fault-tolerant manner to prevent interruption of service upon failure and interruption of service necessitated by the replacement of a power supply.

2. The CONTRACTOR shall size the power supplies to meet the control panel requirement and the instruments and loops they support. Power supplies shall have an excess rated capacity of 40 percent. The failure of a power supply shall be alarmed at the SCADA System.

3. Power Supplies – 24 VDC: The control and PLC panels shall be the source of power for any 24 VDC two-wire field device, devices in the panel requiring 24 VDC power, or where applicable, solenoid valves interconnected with the panel.

4. The failure of a power supply shall generate a dry relay contact output that can be used as an input to the PLC/ SCADA system.

5. Power supplies shall be Phoenix Contact 24 VDC Quint series, Sola SDN-24 VDC, Weidmuller PS-24VDC or equal.

K. Control Panel Signal, Control and Power Wiring

1. General: The signal, control and power wiring specified herein shall apply only to the wiring inside the control panel. Field wiring shall be in accordance with requirements specified in Division 26.

2. Wire type and sizes: Conductor shall be flexible, stranded, copper UL-approved type wires, and shall be rated 600 volts. The following wire sizes and insulation types and color shall be used inside the control panel for the listed applications:

a. 120 VAC power wires: Main 120 VAC power wiring for distribution in the control panel (line, neutral and ground) shall be a minimum of 12 AWG, or heavier as required by the panel load, with THHN/THWN insulation.

b. Power conductors in branch circuits such as for lighting, receptacle, heater and thermostat, etc. shall be a minimum of 14 AWG also with THHN/THWN insulation.

c. Wiring for 600-volt class power and lighting shall be as manufactured by Okonite, General Cable, Southwire, or equal.

d. The following insulation color code designation shall be used:

1) Line Power – Black

2) Neutral (grounded circuits) – White

3) Power Ground – Green

4) Ungrounded 120 VAC control circuit conductors (switched power) – Red

5) Wires energized by 120 VAC source external to the control panel (usually used for DO) shall have yellow insulation

e. 120 VAC Control Wires: For AC control wiring shall be No. 14 AWG machine tool grade type MTW, rated for 90 degrees C at dry locations and be as manufactured by American, General Cable, or equal.

f. 24 VDC power, status, alarm, and control wires shall be a minimum of 16 AWG or heavier as required, with TFFN/MTW insulation.

g. The following insulation color code designation shall be used:

1) Positive (+) – Blue

2) Common (-) – Blue/White

3) DC Ground – Green/Yellow

h. Signals and Instrumentation Wires and Cables

1) Analog and instrumentation signal wiring inside the panel shall be No. 18 AWG minimum twisted shielded pair of stranded tinned copper conductors rated at 600 volts. Insulation shall be color coded PVC/Nylon - black-white for 2 conductor cable and black-red-white for 3 conductor cable.

2) Multi-conductor cables where indicated shall consist of No. 18 AWG copper stranded tinned copper signal wires twisted in pairs, with 90-C, 600V fault insulation. Multi-conductor cables shall be sized to allow for 10 percent spare signal wire.

3) All analog and Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a No. 22 or larger AWG stranded tinned copper drain wire, and a PVC outer jacket with a minimum thickness of 0.047-inches.

4) Insulation color code designation for 2-conductor cable shall be as follows:

a) Positive (+) – Black
b) Negative (-) – White

5) Insulation color code designation for Triad cable shall be Black-Red- White.

6) Single pair, No. 18 AWG, twisted, shielded cable shall be Belden Part No. 3088AE, similar by General Cable, or equal.

7) Single triad, No. 18 AWG, twisted, shielded cable shall be Belden Part No. 3089A, similar by General Cable, or equal.

L. Wire Markings: Each conductor in the control panel connected to a given electrical point shall be designated by a single unique wire number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal connection using numbered wire marking sleeves or heat shrink plastics by Brady, Phoenix contact, Weidmuller or equal.

M. Surge Protection Devices: Surge protection devices (SPD) shall be provided to process control loops, instruments, and networks (e.g. Modbus, Profibus, Device Net, etc.) for protection against induced current surge and transient surge sources (e.g. lightning, power switching, static discharge, etc.). The SPD shall divert the resulting surges safely to earth and limit voltages to acceptable levels.

1. Each end of a loop shall be protected by an SPD - at the control panel side and at the instrument, device, or equipment on the field side.

2. For application and installation in hazardous area classification, the SPD shall be certified to meet all hazardous area classifications required for the environment to which it is to be installed.

3. Technical Data and Design:

a. The SPD shall be of the fast-acting type, capable of limiting the surge destructive high voltage transients, and shall feature accurate voltage control. It shall be maintenance-free and fully automatic self-resetting, once the over voltage has ceased.

b. The SPD shall be of a multistage hybrid circuit design, incorporating gasfilled discharge tubes (for high surge current diversion) with zener diodes for fast operation. It shall have the following features:

1) Withstand a minimum of 10kAmp at 8/20μs total surge current impulse per wire for all 24VDC discrete and analog control panels interfaces.

2) Withstand at least 1.4 Kamp lightning impulse current at 10/350μs total surge current impulse per wire for all 24VDC discrete and analog control panels interfaces.

3) Housing shall be modular, 7mm maximum width, and of the DIN rail mount type for all 24 VDC analog and discrete control panel interfaces. Field SPD shall have ½ NPT threaded connection and shall be housed in a NEMA 4 rated housing and NEMA 4X rated for corrosive environment.

4) Operating Ambient Temperature Range -40ºC to +80ºC

5) 120VAC discrete circuits shall be protected by 7mm maximum width DIN rail mount, metal oxide varistor (MOV) SPDs for control panel interfaces

6) Field instrument SPDs shall be of the threaded conduit entry type with 20kA maximum surge current per wire. 7mm maximum width DIN rail mount units may also be used for 120VAC field instruments as specified.

7) Range of voltage ratings to suit all process I/O applications

4. Applications (non-hazardous locations):

a. Each 4-20 MADC, 2-Wire, 24 VDC analog loop (including HART) and each 24 VDC digital (discrete) loop shall be protected by installing one (1) MTL series SDM model SD32M at the control panel side, and one (1) MTL model TP-48, Weidmuller SD32X or equal, on the instrument side in the field.

b. Each 4-20 MADC, 4-wire analog loop shall be protected by installing two (2) SPD on each end of the loop. The SPDs shall be the same as those used for a 2-wire analog loop.

c. Each 120 VAC digital (discrete) shall be protected by installing one (1) MTL series SD model SD150X at the control panel side, and one (1) MTL model TP-AC 420-N or SD150X or equal, on the instrument side in the field, depending on the mounting conditions.

d. Each CAT-5 or CAT-6 Ethernet network cable from the PLC in the control panel to the network node connection shall be protected by installing one (1) MTL model ZB24596 or equal on each side of the cable.

2.4 ELECTRICAL COMPONENTS

A. General Purpose Relays

1. General purpose relays in the control panel(s) shall be compact plug-in type with contacts rated 10 amperes at 120-volts ac; or 24 VDC. Quantity and form of contacts shall be as required by the application. However, the relay shall have a minimum of two (2)-form C contacts (double pole-double throw), except when used as interpose relay for the PLC's DO modules they shall have a minimum of one (1)-form C (single pole single throw) contacts. Each relay shall be provided with a neon light to indicate an energized state.

2. The relay socket and mounting shall be a standard DIN rail mount with pullover wire spring ("horseshoe clip").

3. Relays shall be IDEC compact relays type RHXB-UL with SHXB-05 sockets where X indicates the number of form C contact, or equal.

B. Slave and Interpose Relays: Additional slave relays shall be provided when the number or type of contacts required exceed the contact capacity and/or rating of the

specified relays and timers. Additional relays shall be provided when higher contact rating is required in order to interface with starter circuits or other equipment. The slave and interpose relays shall be as the general-purpose relays specified above.

C. Time Delay Relays - Electronic Type: Time delay relays shall be plug-in electronic type with on-delay or off-delay actuation as required. Output contacts shall be DPDT rated 10-amperes at 120-volts ac minimum. Each unit shall include an adjustable time delay with a time range scale. Operating temperature range of the units shall be -20°F to +120°F minimum and each device shall be rated for 10,000,000 mechanical operations and 500,000 electrical operations. Time delay relays shall be Idec RTE series, Schneider Electric, Agastat Series SCC, Omron, or equal.

D. Indicating Pilot Lights

1. Indicating lights shall be ultra-bright multiple LED cluster lamps, push-to-test transformer type and shall be heavy-duty, oil-tight construction. Operators shall be nickel or chrome plated. Each light shall have a screwed-on prismatic lens approximately 1-inch in diameter. Miniature style devices are not acceptable.

2. Lens colors shall be green for "run," "open," or "on"; red for "stopped," "closed," or "off"; and amber for alarm.

3. Indicating lights shall be Square D Company, Class 9001 Type K, General Electric Company Type CR104P, or equal. Each light shall have a factory-engraved legend plate, as shown on the Contract Documents.

E. Selector and Pushbutton Switches: Selector and pushbutton switches shall be rated 10-amperes at 600 volts; shall be heavy-duty, oil-tight construction; and shall have the number of positions and poles required. Miniature style devices are not acceptable. Operators shall be nickel or chrome plated. Switches shall be Square D Company, Class 9001 Type K, General Electric Company Type CR104P, or equal. Each switch shall have a factory-engraved legend plate as shown on the Contract Documents.

F. Signal Isolators, Conditioners and Converters

1. Signal isolators conditioners and converters shall be provided as required to resolve any signal level incompatibilities, to ensure adjacent component impedance match where feedback paths may be generated, or to maintain loop integrity during the removal of a loop component.

2. Signal isolators, integrators and converters shall be 24 VDC or 120 VAC powered as applicable, and shall be DIN rail-mounted. Isolators shall be by Phoenix Contact, Acromag, or equal.

G. Nameplates: Nameplates shall be provided for instruments, function titles for each group of instruments, and other components mounted on the front or the inside of the control panel. A nameplate shall be provided for each instrument and device. The nameplates shall be descriptive to define the function and system of such device in accordance with the CONTRACT DOCUMENTS or the approved shop

drawings. Adhesives shall be acceptable for attaching nameplates, but stainless steel nameplates shall be fastened with screws. Nameplates shall be fabricated from whiteface, black-center, laminated engraving plastic.

2.5 INSTRUMENT AIR

A. Dry, filtered control air at 30 psi nominal pressure shall be piped to field instruments and instrument panels requiring air. Each field instrument shall be provided with an integral, non-adjustable filter/regulator assembly to provide regulated air. Each instrument panel requiring air shall be provided with an adjustable filter/regulator assembly with gauge and an air manifold to provide air to pneumatic instruments. Air shall be filtered to 5-micron maximum particle size. Pressure reducers and regulators shall be furnished with additional instrumentation as required.

2.6 SPARE PARTS AND SPECIAL TOOLS

A. Control panel spare parts selected by the CONTRACTING OFFICER'S REPRESENTATIVE or the GOVERNMENT and special tools shall be furnished in accordance with Section 40 91 00 – Process Control and Instrumentation System.

PART 3 EXECUTION

3.1 EXAMINATION

A. Preparation for Shipment and Shipping

1. Control panels shall be crated for shipment using a heavy framework and skids as required and cushioned to protect the finish and the instruments during shipment. Shipments shall be by air-ride vehicle. Suitable cushioning material shall be used to protect interior hardware that could be damaged due to mechanical shock.

2. Depending on panel size, each separate panel unit shall be provided with removable lifting lugs to facilitate handling.

3. Control panels shall be installed in accordance with Section 40 91 00 – Process Control and Instrumentation System.

3.2 INSTALLATION

A. Control Panel Signal and Control Circuit Wiring

1. Wiring Installation

a. Wiring methods and materials for panels shall be in accordance with the NEC requirements and industry practices.

b. Wires shall be run in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, and (3) wiring from components on a swing out panel to components on a part of the fixed structure.

c. atly grouped using nylon tie straps, and shall be fanned out to terminals. Wiring run from components on a swing out panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties and shall be secured to panels at both sides of the hinge loop so that conductors are not strained at the terminals.

d. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and be secured to the inside face of the panel using adhesive mounts.

e. Splicing of shall be kept to a minimum and only if the wire cannot be replaced. Splicing shall be either soldered or pressure crimped type. Data and communication wires/cables shall not be spliced.

2. Wiring Termination

a. All field wiring shall terminate at a terminal block in the enclosure. Field wiring shall be terminated first at the field interface terminal block and then wired to the devices/instrument or PLC inside the panel. Except for antenna cable, Cat 5e cables and other specialty cables, such as thermocouples and data cables, field wiring shall not be wired directly to the panel mounted device.

b. Terminals and fuses for each conductor and shield drain wire of a twisted shielded pair or triad cable shall be mounted consecutively next to each other.

c. Terminal blocks shall be grouped based on their function and voltage. Each group of terminal blocks shall be located in the panel to provide easy access, safety, practicality, and minimization of internal wiring.

d. Terminal blocks for 24 VDC signals shall be grouped separate from the power and other 120 VAC terminals.

e. Terminal blocks for 24 VDC signals shall be grouped separate from the 24VDC power as well. Likewise, terminal blocks for 120 VAC power and distribution shall be grouped separate from the 120 VAC terminals for control signals.

f. Each terminal and wire connection shall be tagged in accordance with the approved shop drawings or GOVERNMENT's standard tagging/numbering, if available.

3.3 FIELD QUALITY CONTROL

A. General: Calibration, testing, and instruction shall be performed in accordance with Section 40 61 00 – Process Control and Instrumentation System.

3.4 ADJUSTING

A. As specified elsewhere in these specifications and as shown on the drawings, the Contractor is required to remove or disconnect some existing equipment as a result of their complete or partial replacement of their functionality, and in some cases to provide space for the new equipment. In all cases the Contractor shall disconnect the replaced equipment and functions and ensure that the remaining equipment and their remaining (not replaced) functionality shall continue to function/operate as originally intended. The Contractor shall also restore the condition of the modified operational control or monitoring circuits.

B. Analog Loops: Whenever an existing analog loop is modified, the Contractor shall ensure that the integrity and isolation of the loop is maintained and the shield is grounded correctly. In modifying the analog loop the Contractor shall also modify the 24 VDC to that loop so that the power supply source of that loop is part of the control panel and backed up by the UPS in it.

C. Field Connection Panels and Interface Terminal Blocks: In cases where field I/O wiring has to be extended to the control panel from enclosures that are removed or modified, the CONTRACTOR shall provide separate enclosures/field connection panel (FCP), as required, to which field I/Os are wired, and from which the signals shall be wired to the control panel.

END SECTION

SECTION 40 91 06

LEVEL MEASURING

PART 1 GENERAL

1.1 SUMMARY

A. General

1. The CONTRACTOR shall install level measuring systems complete and operable in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Section 40 61 00 – Common Work Results For Process Control and Instrumentation System

B. Applicable Sections in Division 40 – Instrumentation and Control for Process Systems.

C. Division 26 – Electrical.

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittals, and Section 40 61 00 – Common Work Results For Process Control and Instrumentation System.

B. Approval Data and Cutsheets:

1. Product data for level measuring systems.

PART 2 PRODUCTS

2.1 MILTI-SENSOR CONDUCTIVITY PROBE LEVEL MEASUREMENT

A. Manufacturers: Multi-sensor level measuring systems shall be MultiTrode MTIC MK III, no equal.

B. Level probe shall be Motor Protection Electronics, LLC part number LP-79-10-50 (Flygt part number 14-414005). Spacing between electrodes shall be 8 inches.

C. Description:

1. Furnish and install a liquid level detection system utilizing conductivity-based sensing technology. The system shall consist of a multi-point level probe with multiple stainless steel electrodes encapsulated in a corrosion-resistant, non-conductive housing. The probe shall be capable of detecting up to 10 discrete liquid levels and shall be designed for installation in water and wastewater environments, including applications where grease, foam, sludge, or other debris may be present. The level controller shall provide individual relay

outputs corresponding to each probe input and include an isolated 4–20 mA analog output proportional to liquid level. It shall be capable of operating multiple pumps based on configured setpoints and support power supply options of 24 VDC, 115 VAC, or 230 VAC as required. The system shall be panel-mountable, suitable for continuous operation, and comply with applicable electrical and safety standards.

D. Performance/Design Criteria:

1. The transmitter unit shall provide an isolated 4 - 20 mA-DC output signal, linearly proportional to level. In addition, the transmitter shall provide SPDT relay outputs, rated at 5 Amp.

2. The transmitter's accuracy shall be at least 0.25-percent of span. It shall have non-interacting zero and span controls. The unit shall have a local LCD display for configuration and monitoring scalable in the desired process variable. Measuring range shall be as indicated in the data sheet.

E. Materials / Components: Transducer shall have temperature compensation and a contact output upon transmitter failure (loss of echo). Input power shall be as indicated in the data sheet. The liquid level detection system shall be housed in an enclosure suitable for the required installation location.

PART 3 EXECUTION

3.1 CONTRACTOR FIELD QUALITY CONTROL

A. Level measuring systems shall be handled, installed, calibrated, loop-tested, precommissioned, and performance tested in accordance with Section 40 61 00 – Process Control and Instrumentation Systems by the Contractor.

B. Manufacturer's service, supervision, and training shall be in accordance with Section 40 61 00 – Process Control and Instrumentation Systems.

END SECTION

SECTION 43 21 63

SUBMERSIBLE PUMPS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work required under this section consists of related items necessary and required to complete the work. The Contractor shall provide all items, and operations, including all labor, materials, equipment, and incidentals necessary for completion of work.

B. Installation of two (2) submersible vertical centrifugal pumps for pumping wastewater from pump station to force main sanitary sewer line.

C. Install the complete pumping system as specified and indicated in the Plans, for a complete and functioning system.

D. Test completed system to check for proper operation of pumps and controls.

1.2 RELATED WORK

A. Section 01 11 01 – Owner-Furnished Contractor-Installed Items

B. Section 03 41 00 – Precast Concrete Structures

C. Section 08 30 01 – Lift Station Access Hatches

D. Section 40 05 00 – Pipe and Fittings

E. Division 26 – Electrical

F. Division 40 – Process Integration

1.3 QUALIFICATIONS

A. Pumps will be FLYGT NP 3069 MT 3 Adaptive 432, 3.2 HP. Pumps shall be provided by the owner for installation. See section 01 11 01 Owner

B. Pumps will be furnished as a complete unit, including mounting equipment and controls, by a single supplier.

1.4 PUMP INFORMATION

A. Performance and design requirements:

Unit Designation	FLYGT NP 3069 MT 3 Adaptive 432
Number of units	2
Rated total head, ft	15.1
Capacity @ rated head, gpm	409
Operating head range, ft	15.1’ to 16.8’
Max pump operating speed, RPM	1705
Min. discharge nozzle, inches	3
Max motor hp rating	3.2
Min. hydraulic efficiency at rated operating point, percent	72.6%

B. Materials:

Impeller Hard Iron

1.5 GUARANTEE

A. The Contractor shall guarantee the equipment installed will function satisfactorily for a period of two (2) years from the date of initial operation. Parts, mechanisms or equipment found to be defective due to unsatisfactory workmanship/installation during this period shall be resolved until the lift station is satisfactorily operational by the Contractor without cost to the Owner.

1.6 POWER SUPPLY

A. See Division 26 - Electrical

PART 2 PRODUCTS

2.1 SUBMERSIBLE PUMPS

A. The pump shall be capable of being serviced without disturbing the system piping.

2.2 PUMP CONTROL

A. Pump control is provided and covered in the electrical plans and under Division 26 Electrical and Division 40 Process Integration.

PART 3 EXECUTION

3.1 INSTALLATION

A. Each pump shall be aligned and connected to the discharge piping.

B. The pump shall be installed under the supervision of a pump manufacturer representative.

C. Coordination of the installation supervision of the pump manufacturer representative shall be conducted by the contractor.

3.2 FIELD TESTING AND INSTRUCTION

A. Upon completion of installation, field tests shall be performed on the pumping system to verify that the pump meets the pumping capacity and operate automatically at the sump level as specified in the electrical section. Testing shall be performed by the Contractor under the supervision of a manufacturer's representative in the presence of the Engineer.

B. After successful completion of the test, the manufacturer's representative shall submit to Owner, as specified in Section 01 77 00 Contract Closeout, testing reports and certification that the pumping system meets performance requirements.

C. The manufacturer's representative shall provide to Owner's personnel, a minimum of 4 hours field instruction on the operations and maintenance of the pumping equipment.

D. All cost of testing and instructions shall be at no cost to the Owner.

END SECTION

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