City of San Diego

CONTRACTOR'S NAME: Ahrens Mechanical
ADDRESS: 5959 Mission Gorge Rd., Suite 204, San Diego, CA 92120
TELEPHONE NO.: 619-487-9036 **FAX NO.:**
CITY CONTACT: Brittany Friedenreich, Senior Contract Specialist, Email: BFriedenreic@sandiego.gov
Phone No. (619) 533- 3104
G. Torres / A. Parra / K. Stewart

BIDDING DOCUMENTS

e - Bidding

FOR

METROPOLITAN BIOSOLIDS CENTER (MBC) STORM WATER DIVERSION PROJECT

BID NO.: **K-22-2096-DBB-3**
SAP NO. (WBS): **B-19197**
CLIENT DEPARTMENT: **2000**
COUNCIL DISTRICT: **6**
PROJECT TYPE: **BO**

THIS CONTRACT WILL BE SUBJECT TO THE FOLLOWING:

- PHASED-FUNDING
- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM
- PREVAILING WAGE RATES: STATE ☒ FEDERAL ☐
- APPRENTICESHIP

BID DUE DATE:

2:00 PM
JULY 20, 2022
CITY OF SAN DIEGO'S ELECTRONIC BIDDING SITE, PLANETBIDS

http://www.sandiego.gov/cip/bidopps/index.shtml

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

1) Registered Engineer	06/08/2022 Date	Seal: 
2) For City Engineer	06/08/2022 Date	Seal: 

TABLE OF CONTENTS

SECTION **PAGE**

REQUIRED DOCUMENTS SCHEDULE DURING BIDDING AND AWARDING

The Bidder's attention is directed to the City's Municipal Code §22.0807(e), (3)-(5) for important information regarding grounds for debarment for failure to submit required documentation.

The specified Equal Opportunity Contracting Program (EOCP) forms are available for download from the City's web site at:

http://www.sandiego.gov/eoc/forms/index.shtml

ITEM	DOCUMENT TO BE SUBMITTED	WHEN DUE	FROM
1.	Bid Bond (PDF via PlanetBids)	At Time of Bid	ALL BIDDERS
2.	Contractors Certification of Pending Actions	At Time of Bid	ALL BIDDERS
3.	Mandatory Disclosure of Business Interests	At Time of Bid	ALL BIDDERS
4.	Debarment and Suspension Certification for Prime Contractors	At Time of Bid	ALL BIDDERS
5.	Debarment and Suspension Certification for Subcontractors, Suppliers & Mfgrs	At Time of Bid	ALL BIDDERS
6.	Bid Bond (Original)	By 5PM 3 working days after bid opening	ALL BIDDERS
7.	SLBE Good Faith Effort Documentation	By 5 PM 3 working days after bid opening	ALL BIDDERS
8.	Form AA60 – List of Work Made Available	By 5 PM 3 working days after bid opening with Good Faith Effort (GFE) documentation	ALL BIDDERS
9.	Phased Funding Schedule Agreement (when required)	Within 10 working days of receipt by the bidder of the Notice of Intent to Award	AWARDED BIDDER
10.	If the Contractor is a Joint Venture: • Joint Venture Agreement • Joint Venture License	Within 10 working days of receipt by bidder of contract forms	AWARDED BIDDER

ITEM	DOCUMENT TO BE SUBMITTED	WHEN DUE	FROM
11.	Payment & Performance Bond: Certificates of Insurance & Endorsements	Within 10 working days of receipt by bidder of contract forms and NOI	AWARDED BIDDER
12.	Signed Contract Agreement Page	Within 3 working days of receipt by bidder of Contract Agreement	AWARDED BIDDER
13.	Listing of "Other Than First Tier" Subcontractors	Within 10 working days of receipt by bidder of contract forms	AWARDED BIDDER

NOTICE INVITING BIDS

1. **SUMMARY OF WORK:** This is the City of San Diego's (City) solicitation process to acquire Construction services for **Metropolitan Biosolids Center (MBC) Storm Water Diversion Project.** For additional information refer to Attachment A.

2. **FULL AND OPEN COMPETITION:** This solicitation is subject to full and open competition and may be bid by Contractors on the City's approved Prequalified Contractors List. For information regarding the Contractors Prequalified list visit the City's web site: http://www.sandiego.gov.

3. **ESTIMATED CONSTRUCTION COST:** The City's estimated construction cost for this project is **$6,900,000.**

4. **BID DUE DATE AND TIME ARE: JULY 20, 2022 AT 2:00 PM.**

5. **PREVAILING WAGE RATES APPLY TO THIS CONTRACT:** Refer to Attachment D.

6. **LICENSE REQUIREMENT**: To be eligible for award of this contract, Prime contractor must possess the following licensing classification: **A**

7. **SUBCONTRACTING PARTICIPATION PERCENTAGES**: Subcontracting participation percentages apply to this contract.

7.1. The City has incorporated **mandatory** SLBE-ELBE subcontractor participation percentages to enhance competition and maximize subcontracting opportunities. For the purpose of achieving the mandatory subcontractor participation percentages, a recommended breakdown of the SLBE and ELBE subcontractor participation percentages based upon certified SLBE and ELBE firms has also been provided to achieve the mandatory subcontractor participation percentages:

1. SLBE participation **8.1%**
2. ELBE participation **14.2%**
3. Total mandatory participation **22.3%**

7.2. The Bid may be declared non-responsive if the Bidder fails to meet the following requirements:

7.2.1. Include SLBE-ELBE certified subcontractors at the overall mandatory participation percentage identified in this document; OR

7.2.2. Submit Good Faith Effort (GFE) documentation, saved in searchable Portable Document Format (PDF), demonstrating the Bidder made a good faith effort to conduct outreach to and include SLBE-ELBE Subcontractors as required in this solicitation by 5 PM 3 Working Days after the Bid opening if the overall mandatory participation percentage is not met.

All submittals in searchable PDF shall be submitted electronically within the prescribed time identified in the contract documents via PlanetBids by invitation to the point of contact named in the bid provided by the Contract Specialist to all bidders.

8. AWARD PROCESS:

8.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions of Award as stated within these documents and within the Notice of Intent to Award.

8.2. Upon acceptance of bids and determination of the apparent low bidder, the City will prepare the contract documents for execution within approximately 21 days of the date of the bid opening. The City will then award the contract upon receipt of properly signed Contract, bonds, and insurance documents.

8.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form by the City Attorney's Office.

8.4. The low Bid will be determined by the Base Bid.

8.5. Once the low bid has been determined, the City may, at its sole discretion, award the contract for the Base Bid alone.

9. SUBMISSION OF QUESTIONS:

9.1. The Director (or Designee) of the Purchasing & Contracting Department is the officer responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. Any questions related to this solicitation shall be submitted to:

BFriedenreic@sandiego.gov

9.2. Questions received less than 14 days prior to the date for opening of Bids may not be considered.

9.3. Questions or clarifications deemed by the City to be material shall be answered via issuance of an addendum and posted to the City's online bidding service.

9.4. Only questions answered by formal written addenda shall be binding. Oral and other interpretations or clarifications shall be without legal effect. It is the Bidder's responsibility to be informed of any addenda that have been issued and to include all such information in its Bid.

10. PHASED FUNDING: For Phased Funding Conditions, see Attachment B.

1. PREQUALIFICATION OF CONTRACTORS:

1.1. Contractors submitting a Bid must be pre-qualified for the total amount proposed, including all alternate items, prior to the date of submittal. Bids from contractors who have not been pre-qualified as applicable and Bids that exceed the maximum dollar amount at which contractors are pre-qualified may be deemed **non-responsive** and ineligible for award.

1.2. The completed application must be submitted online no later than 2 weeks prior to the bid opening.

1.3. **Joint Venture Bidders Cumulative Maximum Bidding Capacity:** For projects with an engineer's estimate of $30,000,000 or greater, Joint Ventures submitting bids may be deemed responsive and eligible for award if the cumulative maximum bidding capacity of the individual Joint Venture entities is equal to or greater than the total amount proposed.

1.3.1. Each of the entities of the Joint Venture must have been previously prequalified at a minimum of $15,000,000.

1.3.2. Bids submitted with a total amount proposed of less than $30,000,000 are not eligible for Cumulative Maximum Bidding Capacity prequalification. To be eligible for award in this scenario, the Joint Venture itself or at least one of the Joint Venture entities must have been prequalified for the total amount proposed.

1.3.3. Bids submitted by Joint Ventures with a total amount proposed of $30,000,000 or greater on a project with an engineer's estimate of less than $30,000,000 are not eligible for Cumulative Maximum Bidding Capacity prequalification.

1.3.4. The Joint Venture designated as the Apparent Low Bidder shall provide evidence of its corporate existence and furnish good and approved bonds in the name of the Joint Venture within 14 Calendar Days of receipt by the Bidder of a form of contract for execution.

1.4. Complete information and links to the on-line prequalification application are available at:

http://www.sandiego.gov/cip/bidopps/prequalification

1.5. Due to the City's responsibility to protect the confidentiality of the contractors' information, City staff will not be able to provide information regarding contractors' prequalification status over the telephone. Contractors may access real-time information about their prequalification status via their vendor profile on PlanetBids™.

2. **ELECTRONIC FORMAT RECEIPT AND OPENING OF BIDS:** Bids will be received in electronic format (eBids) EXCLUSIVELY at the City of San Diego's electronic bidding (eBidding) site, at: http://www.sandiego.gov/cip/bidopps/index.shtml and are due by the date, and time shown on the cover of this solicitation.

2.1. **BIDDERS MUST BE PRE-REGISTERED** with the City's bidding system and possess a system-assigned Digital ID in order to submit and electronic bid.

2.2. The City's bidding system will automatically track information submitted to the site including IP addresses, browsers being used and the URLs from which information was submitted. In addition, the City's bidding system will keep a history of every login instance including the time of login, and other information about the user's computer configuration such as the operating system, browser type, version, and more. Because of these security features, Contractors who disable their browsers' cookies will not be able to log in and use the City's bidding system.

2.3. The City's electronic bidding system is responsible for bid tabulations. Upon the bidder's or proposer's entry of their bid, the system will ensure that all required fields are entered. **The system will not accept a bid for which any required information is missing.** This includes all necessary pricing, subcontractor listing(s) and any other essential documentation and supporting materials and forms requested or contained in these solicitation documents.

2.4. **BIDS REMAIN SEALED UNTIL BID DEADLINE.** eBids are transmitted into the City's bidding system via hypertext transfer protocol secure (https) mechanism using SSL 128-256 bit security certificates issued from Verisign/Thawte which encrypts data being transferred from client to server. Bids submitted prior to the "Bid Due Date and Time" are not available for review by anyone other than the submitter who has until the "Bid Due Date and Time" to change, rescind or retrieve its proposal should it desire to do so.

2.5. **BIDS MUST BE SUBMITTED BY BID DUE DATE AND TIME**. Once the bid deadline is reached, no further submissions are accepted into the system. Once the Bid Due Date and Time has lapsed, bidders, proposers, the general public, and City staff are able to immediately see the results on line. City staff may then begin reviewing the submissions for responsiveness, EOCP compliance and other issues. The City may require any Bidder to furnish statement of experience, financial responsibility, technical ability, equipment, and references.

2.6. **RECAPITULATION OF THE WORK**. Bids shall not contain any recapitulation of the Work. Conditional Bids may be rejected as being non-responsive. Alternative proposals will not be considered unless called for.

2.7. **BIDS MAY BE WITHDRAWN** by the Bidder only up to the bid due date and time.

2.7.1. Important Note: Submission of the electronic bid into the system may not be instantaneous. Due to the speed and capabilities of the user's internet service provider (ISP), bandwidth, computer hardware and other variables, it may take time for the bidder's submission to upload and be received by the City's eBidding system. It is the bidder's sole responsibility to ensure their bids are received on time by the City's eBidding system. The City of San Diego is not responsible for bids that do not arrive by the required date and time.

2.8. **ACCESSIBILITY AND AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE:** To request a copy of this solicitation in an alternative format, contact the Purchasing & Contracting Department, Public Works Division Contract Specialist listed on the cover of this solicitation at least five (5) working days prior to the Bid/Proposal due date to ensure availability.

3. ELECTRONIC BID SUBMISSIONS CARRY FULL FORCE AND EFFECT:

3.1. The bidder, by submitting its electronic bid, acknowledges that doing so carries the same force and full legal effect as a paper submission with a longhand (wet) signature.

3.2. By submitting an electronic bid, the bidder certifies that the bidder has thoroughly examined and understands the entire Contract Documents (which consist of the plans and specifications, drawings, forms, affidavits and the solicitation documents), and that by submitting the eBid as its bid proposal, the bidder acknowledges, agrees to and is bound by the entire Contract Documents, including any addenda issued thereto, and incorporated by reference in the Contract Documents.

3.3. The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certification, forms and affidavits submitted as part of this bid are true and correct.

3.4. The Bidder agrees to the construction of the project as described in Attachment "A– Scope of Work" for the City of San Diego, in accordance with the requirements set forth herein for the electronically submitted prices. The Bidder guarantees the Contract Price for a period of 120 days from the date of Bid opening. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent.

4. BIDS ARE PUBLIC RECORDS: Upon receipt by the City, Bids shall become public records subject to public disclosure. It is the responsibility of the respondent to clearly identify any confidential, proprietary, trade secret or otherwise legally privileged information contained within the Bid. General references to sections of the California Public Records Act (PRA) will not suffice. If the Contractor does not provide applicable case law that clearly establishes that the requested information is exempt from the disclosure requirements of the PRA, the City

shall be free to release the information when required in accordance with the PRA, pursuant to any other applicable law, or by order of any court or government agency, and the Contractor will hold the City harmless for release of this information.

5. CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM:

5.1. **Prior** to the Award of the Contract or Task Order, you and your Subcontractors and Suppliers must register with the City's web-based vendor registration and bid management system. For additional information go to:

http://www.sandiego.gov/purchasing/bids-contracts/vendorreg

5.2. The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.

6. JOINT VENTURE CONTRACTORS: Provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 14 Calendar Days after receiving the Contract forms.

7. INSURANCE REQUIREMENTS:

7.1. All certificates of insurance and endorsements required by the contract are to be provided upon issuance of the City's Notice of Intent to Award letter.

7.2. Refer to sections 5-4, "INSURANCE" of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.

8. REFERENCE STANDARDS: Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

Title	Edition	Document Number
Standard Specifications for Public Works Construction ("The GREENBOOK") http://www.greenbookspecs.org/	2021	ECPI010122-01
City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK")* https://www.sandiego.gov/ecp/edocref/greenbook	2021	ECPI010122-02
City of San Diego Standard Drawings* https://www.sandiego.gov/ecp/edocref/standarddraw	2021	ECPI010122-03
Citywide Computer Aided Design and Drafting (CADD) Standards https://www.sandiego.gov/ecp/edocref/drawings	2018	PWPI010119-04
California Department of Transportation (CALTRANS) Standard Specifications https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications	2018	PWPI030119-05

Title	Edition	Document Number
CALTRANS Standard Plans https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications	2018	PWPI030119-06
California Manual on Uniform Traffic Control Devices Revision 6 (CA MUTCD Rev 6) https://dot.ca.gov/programs/safety-programs/camutcd/camutcd-files	2014	PWPI060121-10
NOTE: *Available online under Engineering Documents and References at: https://www.sandiego.gov/ecp/edocref/ ***Electronic updates to the Standard Drawings may also be found in the link above		

9. **CITY'S RESPONSES AND ADDENDA:** The City, at its discretion, may respond to any or all questions submitted in writing via the City's eBidding web site in the **form of an addendum**. No other responses to questions, oral or written shall be of any force or effect with respect to this solicitation. The changes to the Contract Documents through addenda are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda at the time of bid submission.

10. **CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Notice Inviting Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Notice Inviting Bids shall be the sole responsibility of each bidder. The Notice Inviting Bids creates or imposes no obligation upon the City to enter a contract.

11. **CONTRACT PRICING:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth herein. The Bidder agrees to perform construction services for the City of San Diego in accordance with these contract documents for the prices listed below. The Bidder further agrees to guarantee the Contract Price for a period of 120 days from the date of Bid opening. The duration of the Contract Price guarantee may be extended, by mutual consent of the parties, by the number of days required for the City to obtain all items necessary to fulfill all contractual conditions.

12. **SUBCONTRACTOR INFORMATION:**

12.1. **LISTING OF SUBCONTRACTORS**. In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act" of the California Public Contract Code, the Bidder shall provide the **NAME** and **ADDRESS** of each Subcontractor who will perform work, labor, render services or who specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also state within the description, whether the subcontractor is a **CONSTRUCTOR**, **CONSULTANT** or **SUPPLIER**. The Bidder shall state the **DIR REGISTRATION NUMBER** for all subcontractors and shall further state within the description, the **PORTION** of the work which will be performed by each subcontractor under this Contract. The Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement

may result in the Bid being rejected as **non-responsive** and ineligible for award. The Bidder's attention is directed to the Special Provisions – Section 3-2, "Self-Performance", which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which Bidders are seeking recognition towards achieving any mandatory, voluntary (or both) subcontracting participation goals.

Additionally, pursuant to California Senate Bill 96 and in accordance with the requirements of Labor Code sections 1771.1 and 1725.5, by submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the California Department of Industrial Relations (DIR). **The Bidder shall provide the name, address, license number, DIR registration number of any Subcontractor – regardless of tier** - who will perform work, labor, render services or specially fabricate and install a portion [type] of the work or improvement pursuant to the contract.

12.2. LISTING OF SUPPLIERS. Any Bidder seeking the recognition of Suppliers of equipment, materials, or supplies obtained from third party Suppliers towards achieving any mandatory or voluntary (or both) subcontracting participation goals shall provide, at a minimum, the **NAME**, **LOCATION (CITY), DIR REGISTRATION NUMBER** and the **DOLLAR VALUE** of each supplier. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for materials and supplies unless vendor manufactures or substantially alters materials and supplies, in which case, 100% will be credited. The Bidder is to indicate within the description whether the listed firm is a supplier or manufacturer. If no indication is provided, the listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage.

12.3. LISTING OF SUBCONTRACTORS OR SUPPLIERS FOR ALTERNATES. For subcontractors or suppliers to be used on additive or deductive alternate items, in addition to the above requirements, bidder shall further note "ALTERNATE" and alternate item number within the description.

13. SUBMITTAL OF "OR EQUAL" ITEMS: See Section 4-6, "Trade Names" in The WHITEBOOK and as amended in the SSP.

14. AWARD:

14.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award.

14.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening and award the Contract approximately within 7 days of receipt of properly executed Contract, bonds, and insurance documents.

14.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.

15. **SUBCONTRACT LIMITATIONS**: The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 3-2, "SELF-PERFORMANCE" in The GREENBOOK and as amended in the SSP which requires the Contractor to self-perform not less than the specified amount. Failure to comply with this requirement shall render the bid **non-responsive** and ineligible for award.

16. **AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: http://www.sandiego.gov/cip/. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Purchasing & Contracting Department, Public Works Division.

17. **ONLY ONE BID PER CONTRACTOR SHALL BE ACCCEPTED:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than one (1) Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub-proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf. Any Bidder who submits more than one bid will result in the rejection of all bids submitted.

18. **SAN DIEGO BUSINESS TAX CERTIFICATE:** The Contractor and Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, First floor and submit to the Contract Specialist upon request or as specified in the Contract Documents. Tax Identification numbers for both the Bidder and the listed Subcontractors must be submitted on the City provided forms within these documents.

19. **BIDDER'S GUARANTEE OF GOOD FAITH (BID SECURITY) FOR DESIGN-BID-BUILD CONTRACTS:**

19.1. For bids $250,000 and above, bidders shall submit Bid Security at bid time. Bid Security shall be in one of the following forms: a cashier's check, or a properly certified check upon some responsible bank; or an approved corporate surety bond payable to the City of San Diego for an amount of not less than 10% of the total bid amount.

19.2. This check or bond, and the monies represented thereby, will be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into the contract and furnish the required final performance and payment bonds.

19.3. The Bidder agrees that in the event of the Bidder's failure to execute this contract and provide the required final bonds, the money represented by the cashier's or certified check will remain the property of the City; and the Surety agrees that it will pay to the City the damages, not exceeding the sum of 10% of the amount of the Bid, that the City may suffer as a result of such failure.

19.4. At the time of bid submission, bidders must upload and submit an electronic PDF copy of the aforementioned bid security. Whether in the form of a cashier's check, a properly certified check or an approved corporate surety bond payable to the City of San Diego, the bid security must be uploaded to the City's eBidding system. By 5PM, 3 working days after the bid opening date, all bidders must provide the City with the original bid security.

19.5. Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original by 5PM, 3 working days after the bid opening date shall cause the bid to be rejected and deemed **non-responsive**.

Due to circumstances related to Covid-19, until further notice, all original bid bond submittals must be received by 5 PM, 3 working days after bid opening.

Upon circumstances returning to normal business as usual, the original bid bond shall once again be due by 5 PM the day after bid opening.

Original Bid Bond shall be submitted to:
Purchasing & Contracting Department, Public Works Division
1200 3rd Ave., Suite 200, MS 56
San Diego, California, 92101
To the Attention of the Contract Specialist on the Front Page of this solicitation.

20. AWARD OF CONTRACT OR REJECTION OF BIDS:

20.1. This contract may be awarded to the lowest responsible and reliable Bidder.

20.2. Bidders shall complete ALL eBid forms as required by this solicitation. Incomplete eBids will not be accepted.

20.3. The City reserves the right to reject any or all Bids, to waive any informality or technicality in Bids received, and to waive any requirements of these specifications as to bidding procedure.

20.4. Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City within 3 Working Days of the bid opening, written notice from the Bidder which shows proof of honest, credible, clerical error of a material nature, free from fraud or fraudulent intent; and of evidence that reasonable care was observed in the preparation of the Bid.

20.5. A bidder who is not selected for contract award may protest the award of a contract to another bidder by submitting a written protest in accordance with the San Diego Municipal Code.

20.6. The City of San Diego will not discriminate in the award of contracts with regard to race, religion creed, color, national origin, ancestry, physical handicap, marital status, sex or age.

20.7. Each Bid package properly signed as required by these specifications shall constitute a firm offer which may be accepted by the City within the time specified herein.

20.8. The City reserves the right to evaluate all Bids and determine the lowest Bidder on the basis of the base bid and any proposed alternates or options as detailed herein.

21. BID RESULTS:

21.1. The availability of the bids on the City's eBidding system shall constitute the public announcement of the apparent low bidder. In the event that the apparent low bidder is subsequently deemed non-responsive or non-responsible, a notation of such will be made on the eBidding system. The new ranking and apparent low bidder will be adjusted accordingly.

21.2. To obtain the bid results, view the results on the City's web site, or request the results by U.S. mail and provide a self-addressed, stamped envelope. If requesting by mail, be sure to reference the bid name and number. The bid tabulations will be mailed to you upon their completion. The results will not be given over the telephone.

22. THE CONTRACT:

22.1. The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 14 days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.

22.2. If the Bidder takes longer than 14 days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

22.3. If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.

22.4. Pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 14 Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.

22.5. The award of the Contract is contingent upon the satisfactory completion of the above-mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee and approval as to form by the City Attorney's Office. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.

23. **EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 3-9, "TECHNICAL STUDIES AND SUBSURFACE DATA", and the proposal forms (e.g., Bidding Documents). The submission of a Bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and scope of work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.

24. **CITY STANDARD PROVISIONS:** This contract is subject to the following standard provisions. See The WHITEBOOK for details.

24.1. The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug-Free Workplace.

24.2. The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.

24.3. The City of San Diego Municipal Code §22.3004 for Contractor Standards.

24.4. The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.

24.5. Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.

24.6. The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).

24.7. The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

25. PRE-AWARD ACTIVITIES:

25.1. The contractor selected by the City to execute a contract for this Work shall submit the required documentation as specified herein and in the Notice of Intent to Award. Failure to provide the information as specified may result in the Bid being rejected as **non-responsive.**

25.2. The decision that bid is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

Bond No. 2329964
Premium: $57,050
Premium will be adjusted based on final contract amount

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

Ahrens Mechanical, a corporation, as principal, and Swiss Re Corporate Solutions America Insurance Corporation, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of **SIX MILLION THREE HUNDRED NINETY NINE THOUSAND NINE HUNDRED THIRTY TWO DOLLARS AND EIGHTY CENTS ($6,399,932.80)** for the faithful performance of the annexed contract, and in the sum of **SIX MILLION THREE HUNDRED NINETY NINE THOUSAND NINE HUNDRED THIRTY TWO DOLLARS AND EIGHTY CENTS ($6,399,932.80)** for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract with the City of San Diego, California, then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvement commencing with Civil Code Section 9100 of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

The Surety expressly agrees that the City of San Diego may reject any contractor or subcontractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Principal.

The Surety shall not utilize the Principal in completing the improvements and work specified in the Agreement in the event the City terminates the Principal for default.

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND (continued)

THE CITY OF SAN DIEGO

By: Berric Doringo

Print Name: Berric Doringo
Deputy Director
Purchasing & Contracting Dept.

Date: 10/5/2022

APPROVED AS TO FORM

Mara W. Elliott, City Attorney

By:

Print Name: Bonny Hsu
Deputy City Attorney

Date: October 5, 22

CONTRACTOR Ahrens Mechanical

By:

Print Name: GREGORY S. AHRENS

Date: 12 AUG 2022

SURETY Swiss Re Corporate Solutions America Insurance Corporation

By:
Attorney-In-Fact

Print Name: Anne wright

Date: 8/11/22

Agent: 250 Riverview Pkwy #401, Santee, CA 92071
Local Address of Surety

Agent: (619) 937-0164
Local Phone Number of Surety

$57,050
Premium

2329965
Bond Number

SWISS RE CORPORATE SOLUTIONS

SWISS RE CORPORATE SOLUTIONS AMERICA INSURANCE CORPORATION F/K/A NORTH AMERICAN SPECIALTY INSURANCE COMPANY ("SRCSAIC")
SWISS RE CORPORATE SOLUTIONS PREMIER INSURANCE CORPORATION F/K/A WASHINGTON INTERNATIONAL INSURANCE COMPANY ("SRCSPIC")
WESTPORT INSURANCE CORPORATION ("WIC")

GENERAL POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, THAT SRCSAIC, a corporation duly organized and existing under laws of the State of Missouri, and having its principal office in the City of Kansas City, Missouri, and SRCSPIC, a corporation organized and existing under the laws of the State of Missouri and having its principal office in the City of Kansas City, Missouri, and WIC, organized under the laws of the State of Missouri, and having its principal office in the City of Kansas City, Missouri, each does hereby make, constitute and appoint:

MATTHEW C. GAYNOR, ANDY ROBERTS, and ANNE WRIGHT

JOINTLY or SEVERALLY

Its true and lawful Attorney(s)-in-Fact, to make, execute, seal and deliver, for and on its behalf and as its act and deed, bonds or other writings obligatory in the nature of a bond on behalf of each of said Companies, as surety, on contracts of suretyship as are or may be required or permitted by law, regulation, contract or otherwise, provided that no bond or undertaking or contract or suretyship executed under this authority shall exceed the amount of:

FIFTY MILLION ($50,000,000.00) DOLLARS

This Power of Attorney is granted and is signed by facsimile under and by the authority of the following Resolutions adopted by the Boards of Directors of both SRCSAIC and SRCSPIC at meetings duly called and held on the 18th of November 2021 and WIC by written consent of its Executive Committee dated July 18, 2011.

"RESOLVED, that any two of the President, any Managing Director, any Senior Vice President, any Vice President, the Secretary or any Assistant Secretary be, and each or any of them hereby is, authorized to execute a Power of Attorney qualifying the attorney named in the given Power of Attorney to execute on behalf of the Corporation bonds, undertakings and all contracts of surety, and that each or any of them hereby is authorized to attest to the execution of any such Power of Attorney and to attach therein the seal of the Corporation; and it is

FURTHER RESOLVED, that the signature of such officers and the seal of the Corporation may be affixed to any such Power of Attorney or to any certificate relating thereto by facsimile, and any such Power of Attorney or certificate bearing such facsimile signatures or facsimile seal shall be binding upon the Corporation when so affixed and in the future with regard to any bond, undertaking or contract of surety to which it is attached."

SWISS RE CORPORATE SOLUTIONS AMERICA INS CORP CORPORATE SEAL 1973 MISSOURI

SWISS RE CORPORATE SOLUTIONS PREMIER INS CORP CORPORATE SEAL MISSOURI

By_____
Erik Janssens, Senior Vice President of SRCSAIC & Senior Vice President of SRCSPIC & Senior Vice President of WIC

By_____
Gerald Jagrowski, Vice President of SRCSAIC & Vice President of SRCSPIC & Vice President of WIC

WESTPORT INSURANCE CORPORATION CORPORATE SEAL MISSOURI

IN WITNESS WHEREOF, SRCSAIC, SRCSPIC, and WIC have caused their official seals to be hereunto affixed, and these presents to be signed by their authorized officers

this 29TH day of APRIL, 2022

Swiss Re Corporate Solutions America Insurance Corporation
Swiss Re Corporate Solutions Premier Insurance Corporation
Westport Insurance Corporation

State of Illinois
County of Cook ss

On this 29TH day of APRIL, 20 22, before me, a Notary Public personally appeared Erik Janssens, Senior Vice President of SRCSAIC and Senior Vice President of SRCSPIC and Senior Vice President of WIC and Gerald Jagrowski, Vice President of SRCSAIC and Vice President of SPCSPIC and Vice President of WIC, personally known to me, who being by me duly sworn, acknowledged that they signed the above Power of Attorney as officers of and acknowledged said instrument to be the voluntary act and deed of their respective companies.

YASMIN A. PATEL OFFICIAL SEAL Notary Public, State of Illinois My Commission Expires May 28, 2023

Yasmin A. Patel, Notary

I, Jeffrey Goldberg, the duly elected Senior Vice President and Assistant Secretary of SRCSAIC and SRCSPIC and WIC, do hereby certify that the above and foregoing is a true and correct copy of a Power of Attorney given by said SRCSAIC and SRCSPIC and WIC, which is still in full force and effect.
IN WITNESS WHEREOF, I have set my hand and affixed the seals of the Companies this 11th day of August, 20 22.

Jeffrey Goldberg, Senior Vice President & Assistant Secretary of SRCSAIC and SRCSPIC and WIC

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of San Diego)

On August 11, 2022 before me, Andrew Roberts, Notary Public
(insert name and title of the officer)

personally appeared Anne Wright,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature _____ **(Seal)**

ANDREW ROBERTS
Notary Public - California
San Diego County
Commission # 2317220
My Comm. Expires Dec 26, 2023

ATTACHMENTS

ATTACHMENT A

SCOPE OF WORK

SCOPE OF WORK

1. **SCOPE OF WORK:** This contract will provide upgrades to the plant's storm water drainage system to divert and contain an initial volume of storm water in a diversion structure and pump the retained storm water to the plant's sanitary sewer system. This work shall consist of the following main tasks: Modification to the existing gravity storm drain system, addition of a new diversion structure with pump station. Modifications to divert storm water from one drainage sub-basin to the plant's 36-inch centrate pipe. The project includes ADA work and revegetation.

1.1. The Work shall be performed in accordance with:

1.1.1. The Notice Inviting Bids and Plans numbered **41872-01-D** through **41872-63-D**, inclusive.

2. **LOCATION OF WORK:** The location of the Work is as follows:

Appendix E – Location Map.

3. **CONTRACT TIME:** The Contract Time for completion of the Work, including the **120** day Plant Establishment Period, shall be **300 Working Days**.

ATTACHMENT B

PHASED FUNDING PROVISIONS

PHASED FUNDING PROVISIONS

1. PRE-AWARD

1.1. Within 10 Working Days of the Notice of Intent to Award, the Contractor must contact the Project Manager to discuss fund availability for each phase and shall also submit the following:

1.1.1. Construction Cost Loaded Schedule in accordance with 6-1, "CONSTRUCTION SCHEDULE AND COMMENCEMENT OF THE WORK" and 7-3, "PAYMENT.

1.2. Contractor's failure to perform any of the following may result cancelling the award of the Contract:

1.2.1. Meeting with the City's Project Manager to discuss the Phased Funding Schedule.

1.2.2. Agreeing to a Phased Funding Schedule within **thirty** days of meeting with the City's Project Manager.

2. POST-AWARD

2.1. Do not start any construction activities for the next phase until the Notice to Proceed (NTP) has been issued by the City. The City will issue a separate NTP for each phase.

2.2. The City may issue the NTP for a subsequent phase before the completion of the preceding phase.

PHASED FUNDING SCHEDULE AGREEMENT

The particulars left blank below, such as the total number of phases and the amounts assigned to each phase, will be completed with funding specific information from the Pre-Award Schedule and Construction Cost Loaded Schedule submitted to and approved by the City.

BID NUMBER: K-22-2096-DBB-3

CONTRACT OR TASK TITLE: Metropolitan Biosolids Center (MBC) Storm Drain Diversion Project

CONTRACTOR: Ahrens Mechanical

Funding Phase	Phase Description	Phase Start	Phase Finish	Not-to-Exceed Amount
1	Mobilization, Shoring Installation, Storm Drain Bypass, Force main and Collector Piping. Partial Install of Pump Station and Separator.	NTP	7/31/2023	$3,922,600.00
2	Complete install of Pump Station and Separator. Finish Collector Piping and Site work. Landscaping & Irrigation.	8/1/2023	NOC	$2,477,332.80
			Contract Total	$6,399,932.80

Notes:

1) WHITEBOOK section 7-3.10, "Phased Funding Compensation" applies.
2) The total of all funding phases shall be equal to the TOTAL BID PRICE as shown on BID SCHEDULE 1 - PRICES.
3) This PHASED FUNDING SCHEDULE AGREEMENT will be incorporated into the CONTRACT and shall only be revised by written modifications to the CONTRACT.

CITY OF SAN DIEGO

PRINT NAME: Dino Cizfre

Construction Senior Engineer

Signature: _____

Date: 8/26/22

PRINT NAME: Brian Vitelle

Design Senior Engineer

Signature: _____

Date: 8/25/2022

CONTRACTOR

PRINT NAME: Ahrens Mechanical

Title: Project Manager - Brian Jurlina

Signature: _____

Date: 08/22/2022

ATTACHMENT C

EQUAL OPPORTUNITY CONTRACTING PROGRAM

EQUAL OPPORTUNITY CONTRACTING PROGRAM (EOCP)

SECTION A - GENERAL REQUIREMENTS

A. INTRODUCTION.

1. This document sets forth the following specifications:
   a) The City's general EOCP requirements for all Construction Contracts.
   b) Special Provisions for Contracts subject to SLBE and ELBE requirements only.
2. Additional requirements may apply for state or federally funded projects.
3. These requirements shall be included as Contract provisions for all Subcontracts.
4. The City specified forms, instructions, and guides are available for download from the EOCP's web site at: http://www.sandiego.gov/eoc/forms/index.shtml

B. GENERAL.

1. The City of San Diego promotes equal employment and subcontracting opportunities.
2. The City is committed to ensuring that taxpayer dollars spent on public Contracts are not paid to businesses that practice discrimination in employment or subcontracting.
3. The City encourages all companies seeking to do business with the City to share this commitment.

C. DEFINITIONS.

1. For the purpose of these requirements: Terms "Bid" and "Proposal", "Bidder" and "Proposer", "Subcontractor" and "Subconsultant", "Contractor" and "Consultant", "Contractor" and "Prime Contractor", "Consultant" and "Professional Service Provider", "Suppliers" and "Vendors", "Suppliers" and "Dealers", and "Suppliers" and "Manufacturers" may have been used interchangeably.
2. The following definitions apply:
   a) **Emerging Business Enterprise (EBE)** - A for-profit business that is independently owned and operated; that is not a subsidiary or franchise of another business and whose gross annual receipts do not exceed the amount set by the City Manager and that meets all other criteria set forth in regulations implementing Municipal Code Chapter 2, Article 2, Division 36. The City Manager shall review the threshold amount for EBEs on an annual basis and adjust as necessary to reflect changes in the marketplace.
   b) **Emerging Local Business Enterprise (ELBE)** - A Local Business Enterprise that is also an Emerging Business Enterprise.

c) **Minority Business Enterprise (MBE)** - A certified business that is at least fifty-one percent (51%) owned by one or more minority individuals, or, in the case of a publicly owned business at least fifty-one percent (51%) of the stock is owned by one or more minority individuals; and (2) whose daily business operations are managed and directed by one or more minorities owners. Minorities include the groups with the following ethnic origins: African, Asian Pacific, Asian Subcontinent, Hispanic, Native Alaskan, Native American, and Native Hawaiian.

d) **Women Business Enterprise (WBE)** - A certified business that is at least fifty-one percent (51%) owned by a woman or women, or, in the case of a publicly owned business at least fifty-one percent (51%) of the stock is owned by one or more women; and (2) whose daily business operations are managed and directed by one or more women owners.

e) **Disadvantaged Business Enterprise (DBE)** - a certified business that is at least fifty-one percent (51%) owned by socially and economically disadvantaged individuals, or, in the case of a publicly owned business at least fifty-one percent (51%) of the stock is owned by one or more socially and economically disadvantaged individuals; and (2) whose daily business operations are managed and directed by one or more socially and economically disadvantaged owners.

f) **Disabled Veteran Business Enterprise (DVBE)** - A certified business that is at least fifty-one percent (51%) owned by one or more disabled veterans; and (2) business operations must be managed and controlled by one or more disabled veterans. Disabled Veteran is a veteran of the U.S. military, naval, or air service; the veteran must have a service-connected disability of at least 10% or more; and the veteran must reside in California.

g) **Other Business Enterprise (OBE)** - Any business which does not otherwise qualify as a Minority, Woman, Disadvantaged, or Disabled Veteran Business Enterprise.

h) **Small Business Enterprise (SBE)** - A for-profit business that is independently owned and operated; that is not a subsidiary or franchise of another business and whose gross annual receipts do not exceed the amount set by the City Manager and that meets all other criteria set forth in regulations implementing Municipal Code Chapter 2, Article 2, Division 36. The City Manager shall review the threshold amount for SBEs on an annual basis and adjust as necessary to reflect changes in the marketplace. A business certified as a Micro Business (MB) or a Disabled Veteran Business Enterprise (DVBE) by the State of California and that has provided proof of such certification to the City Manager shall be deemed to be an SBE.

i) **Small Local Business Enterprise (SLBE)** - A Local Business Enterprise that is also a Small Business Enterprise.

D. CITY'S EQUAL OPPORTUNITY COMMITMENT.

1. **Nondiscrimination in Contracting Ordinance.**

a) You, your Subcontractors, and Suppliers shall comply with the requirements of the City's Nondiscrimination in Contracting Ordinance, San Diego Municipal Code §§22.3501 through 22.3517.

You shall not discriminate on the basis of race, gender, gender expression, gender identity, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers. You shall provide equal opportunity for Subcontractors to participate in subcontracting opportunities. You understand and agree that the violation of this clause shall be considered a material breach of the Contract and may result in Contract termination, debarment, or other sanctions.

You shall include the foregoing clause in all Contracts between you and your Subcontractors and Suppliers.

b) **Disclosure of Discrimination Complaints.** As part of its Bid or Proposal, you shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against you in a legal or administrative proceeding alleging that you discriminated against your employees, Subcontractors, vendors, or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

c) Upon the City's request, You agree to provide to the City, within 60 Calendar Days, a truthful and complete list of the names of all Subcontractors and Suppliers that you have used in the past 5 years on any of your Contracts that were undertaken within the San Diego County, including the total dollar amount paid by you for each Subcontract or supply Contract.

d) You further agree to fully cooperate in any investigation conducted by the City pursuant to the City's Nondiscrimination in Contracting Ordinance, Municipal Code §§22.3501 through 22.3517. You understand and agree that violation of this clause shall be considered a material breach of the Contract and may result in remedies being ordered against you up to and including contract termination, debarment, and other sanctions for the violation of the provisions of the Nondiscrimination in Contracting Ordinance. You further understand and agree that the procedures, remedies, and sanctions provided for in the Nondiscrimination in Contracting Ordinance apply only to violations of the Ordinance.

E. EQUAL EMPLOYMENT OPPORTUNITY OUTREACH PROGRAM.

1. You, your Subcontractors, and Suppliers shall comply with the City's Equal Employment Opportunity Outreach Program, San Diego Municipal Code §§22.2701 through 22.2707.

   You shall not discriminate against any employee or applicant for employment on any basis prohibited by law. You shall provide equal opportunity in all employment practices. You shall ensure that your Subcontractors comply with this program. Nothing in this section shall be interpreted to hold you liable for any discriminatory practices of your Subcontractors.

   You shall include the foregoing clause in all Contracts between you and your Subcontractors and Suppliers.

2. If the Contract is competitively solicited, the selected Bidder shall submit a Work Force Report (Form BB05) within 10 Working Days after receipt by the Bidder to the City for approval as specified in the Notice of Intent to Award letter.

3. The selected Bidder shall submit an Equal Employment Opportunity Plan if a Work Force Report is submitted and if the City determines that there are under-representations when compared to County Labor Force Availability data.

4. If the selected Bidder submits an Equal Employment Opportunity Plan, it shall include the following assurances:

   a) You shall maintain a working environment free of discrimination, harassment, intimidation, and coercion at all Sites and in all facilities at which your employees are assigned to Work.

   b) You shall review your EEO Policy annually with all on-Site supervisors involved in employment decisions.

   c) You shall disseminate and review your EEO Policy with all employees at least once a year, post the policy statement and EEO posters on all company bulletin boards and job sites, and document every dissemination, review, and posting with a written record to identify the time, place, employees present, subject matter, and disposition of meetings.

   d) You shall review, at least annually, all supervisors' adherence to and performance under the EEO Policy and maintain written documentation of these reviews.

   e) You shall discuss your EEO Policy Statement with Subcontractors with whom you anticipate doing business, including the EEO Policy Statement in your Subcontracts, and provide such documentation to the City upon request.

f) You shall document and maintain a record of all Bid solicitations and outreach efforts to and from Subcontractors, contractor associations, and other business associations.

g) You shall disseminate your EEO Policy externally through various media, including the media of people of color and women, in advertisements to recruit. Maintain files documenting these efforts and provide copies of these advertisements to the City upon request.

h) You shall disseminate your EEO Policy to union and community organizations.

i) You shall provide immediate written notification to the City when any union referral process has impeded your efforts to maintain your EEO Policy.

j) You shall maintain a current list of recruitment sources, including those outreaching to people of color and women, and provide written notification of employment opportunities to these recruitment sources with a record of the organizations' responses.

k) You shall maintain a current file of names, addresses and phone numbers of each walk-in applicant, including people of color and women, and referrals from unions, recruitment sources, or community organizations with a description of the employment action taken.

l) You shall encourage all present employees, including people of color and women employees, to recruit others.

m) You shall maintain all employment selection process information with records of all tests and other selection criteria.

n) You shall develop and maintain documentation for on-the-job training opportunities, participate in training programs, or both for all of your employees, including people of color and women, and establish apprenticeship, trainee, and upgrade programs relevant to your employment needs.

o) You shall conduct, at least annually, an inventory and evaluation of all employees for promotional opportunities and encourage all employees to seek and prepare appropriately for such opportunities.

p) You shall ensure that the company's working environment and activities are non-segregated except for providing separate or single-user toilets and necessary changing facilities to assure privacy between the sexes.

F. SUBCONTRACTING.

1. The City encourages all eligible business enterprises to participate in City contracts as a Contractor, Subcontractor, and joint venture partner with you, your Subcontractors, or your Suppliers. You are encouraged to take positive

steps to diversify and expand your Subcontractor solicitation base and to offer subcontracting opportunities to all eligible business firms including SLBEs, ELBEs, MBEs, WBEs, DBEs, DVBEs, and OBEs.

2. For Subcontractor participation level requirements, see the Contract Documents where applicable.

3. For the purposes of achieving the mandatory Subcontractor participation percentages, City percentage calculations will not account for the following:

   a) "Field Orders" and "City Contingency" Bid items.

   b) Alternate Bid items.

   c) Allowance Bid items designated as "EOC Type II".

4. Allowance Bid items designated as "EOC Type I" will be considered as part of the Base Bid and will be included in the percentage calculation.

5. Each joint venture partner shall be responsible for a clearly defined Scope of Work. In addition, an agreement shall be submitted and signed by all parties identifying the extent to which each joint venture partner shares in ownership, control, management, risk, and profits of the joint venture.

G. LISTS OF SUBCONTRACTORS AND SUPPLIERS.

1. You shall comply with the Subletting and Subcontracting Fair Practices Act, Public Contract Code §§4100 through 4113, inclusive.

2. You shall list all Subcontractors who will receive more than 0.5% of the total Bid amount or $10,000, whichever is greater on the form provided in the Contract Documents (Subcontractors list).

3. The Subcontractors list shall include the Subcontractor's name, telephone number including area code, physical address, Scope of Work, the dollar amount of the proposed Subcontract, the California contractor license number, the Public Works contractor registration number issued pursuant to Section 1725.5 of the Labor Code, and the Subcontractor's certification status with the name of the certifying agency.

4. The listed Subcontractor shall be appropriately licensed pursuant to Contractor License Laws.

5. For Design-Build Contracts, refer to the RFQ and RFP for each Project or Task Order.

H. SUBCONTRACTOR AND SUPPLIER SUBSTITUTIONS.

1. Listed Subcontractors and Suppliers shall not be substituted without the Express authorization of the City or its duly authorized agent.

2. Request for Subcontractor or Supplier substitution shall be made in writing to Purchasing & Contracting Department, Public Works Division, Attention Contract Specialist, 1200 3rd Ave., Suite 200, MS 56, San Diego, CA 92101 with a copy to the Engineer.

3. The request shall include a thorough explanation of the reason(s) for the substitution, including dollar amounts and a letter from each substituted Subcontractor or Supplier stating that they (the Subcontractors or Suppliers) release all interest in working on the Project and written confirmation from the new Subcontractor or Supplier stating that they agree to work on the Project along with the dollar value of the Work to be performed.

4. Written approval of the substitution request shall be received by you or from the City or its authorized officer prior to any unlisted Subcontractor or Supplier performing Work on the Project.

5. Substitution of Subcontractors and Suppliers without authorization shall subject you to those penalties set forth in Public Contract Code §4110.

6. Requests for Supplier substitution shall be made in writing at least 10 Days prior to the provision of materials, supplies, or services by the proposed Supplier and shall include proof of written notice to the originally listed Supplier of the proposed substitution.

7. A Contractor whose Bid is accepted shall not:

    a) Substitute a person as Subcontractor or Supplier in place of the Subcontractor or Supplier listed in the original bid, except that the City, or it's duly authorized officer, may consent to the substitution of another person as a Subcontractor or Supplier in any of the following situations:

        i. When the Subcontractor or Supplier listed in the Bid, after having a reasonable opportunity to do so, fails or refuses to execute a written Contract for the scope of work specified in the subcontractor's bid and at the price specified in the subcontractor's bid, when that written contract, based upon the general terms, conditions, plans, and specifications for the project involved or the terms of the subcontractor's written bid, is presented to the subcontractor by the prime contractor.

        ii. When the listed Subcontractor or Supplier becomes insolvent or the subject of an order for relief in bankruptcy.

        iii. When the listed Subcontractor or Supplier fails or refuses to perform his or her subcontract.

        iv. When the listed Subcontractor fails or refuses to meet bond requirements as set forth in Public Contract Code §4108.

        v. When you demonstrate to the City or it's duly authorized officer, subject to the provisions set forth in Public Contract Code §4107.5, that the name of the Subcontractor was listed as the result of an inadvertent clerical error.

        vi. When the listed Subcontractor is not licensed pursuant to Contractor License Law.

vii. When the City, or it's duly authorized officer, determines that the Work performed by the listed Subcontractor or that the materials or supplies provided by the listed Supplier are substantially unsatisfactory and not in substantial accordance with the Plans and specifications or that the Subcontractor or Supplier is substantially delaying or disrupting the progress of the Work.

viii. When the listed Subcontractor is ineligible to work on a public works project pursuant to §§1777.1 or 1777.7 of the Labor Code.

ix. When the City or its duly authorized agent determines that the listed Subcontractor is not a responsible contractor.

b) Permit a Contract to be voluntarily assigned or transferred or allow it to be performed by anyone other than the original Subcontractor, Supplier listed in the original Bid without the consent of the City, or it's duly authorized officer.

c) Other than in the performance of "Change Orders" causing changes or deviations from the Contract, sublet or subcontract any portion of the Work, or contract for materials or supplies in excess of 0.5% of your total bid or $10,000, whichever is greater, as to which his or her original Bid did not designate a Subcontractor or Supplier.

8. Following receipt of notice from you of the proposed substitution of a Subcontractor or Supplier, the listed Subcontractor or Supplier who has been so notified shall have 5 Working Days within which to submit written objections to the substitution to the Contract Specialist with a copy to the Engineer. Failure to file these written objections shall constitute the listed Subcontractor or Supplier's consent to the substitution. If written objections are filed, the City shall give notice in writing of at least 5 Working Days to the listed Subcontractor or Supplier of a hearing by the City on your request for substitution.

I. PROMPT PAYMENT.

1. You or your Subcontractors shall pay to any subcontractor, not later than 7 Calendar Days of receipt of each progress payment, unless otherwise agreed to in writing, the respective amounts allowed you on account of the Work performed by the Subcontractors, to the extent of each Subcontractor's interest therein. In cases of Subcontractor performance deficiencies, you shall make written notice of any withholding to the Subcontractor with a copy to the Contracts Specialist. Upon correction of the deficiency, you shall pay the Subcontractor the amount previously withheld within 14 Calendar Days after payment by the City.

2. Any violation of California Business and Professions Code, §7108.5 concerning prompt payment to Subcontractors shall subject the violating Contractor or Subcontractor to the penalties, sanctions, and other remedies of that section. This requirement shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to you or your Subcontractor in the event of a dispute involving late payment or nonpayment by the Prime Contractor, deficient subcontract performance, or noncompliance by a Subcontractor.

J. PROMPT PAYMENT OF FUNDS WITHHELD TO SUBCONTRACTORS.

1. The City will hold retention from you and will make prompt and regular incremental acceptances of portions, as determined by the Engineer, of the Work and pay retention to you based on these acceptances.
2. You or your Subcontractors shall return all monies withheld in retention from a Subcontractor within 30 Calendar Days after receiving payment for Work satisfactorily completed and accepted including incremental acceptances of portions of the Work by the City.
3. Federal law (49CFR26.29) requires that any delay or postponement of payment over 30 Calendar Days may take place only for good cause and with the City's prior written approval. Any violation of this provision by you or your Subcontractor shall subject you or your Subcontractor to the penalties, sanctions, and other remedies specified in §7108.5 of the Business and Professions Code.
4. These requirements shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to you or your Subcontractor in the event of a dispute involving late payment or nonpayment by you, deficient subcontract performance, or noncompliance by a Subcontractor.

K. CERTIFICATION.

1. The City accepts certifications of DBE, DVBE, MBE, SMBE, SWBE, or WBE by any of the following certifying agencies:
   a) Current certification by the State of California Department of Transportation (CALTRANS) as DBE, SMBE, or SWBE.
   b) Current MBE, WBE, or DVBE certification from the California Public Utilities Commission.
   c) DVBE certification is received from the State of California's Department of General Services, Office of Small and Minority Business.
   d) Current certification by the City of Los Angles as DBE, WBE, or MBE.
   e) Subcontractors' valid proof of certification status (copies of MBE, WBE, DBE, or DVBE certifications) shall be submitted as required.

L. CONTRACT RECORDS AND REPORTS.

1. You shall maintain records of all subcontracts and invoices from your Subcontractors and Suppliers for work on this project. Records shall show name, telephone number including area code, and business address of each Subcontractor, Supplier, and joint venture partner, and the total amount actually paid to each firm. Project relevant records, regardless of tier, may be periodically reviewed by the City.

2. You shall retain all records, books, papers, and documents pertinent to the Contract for a period of not less than 5 years after Notice of Completion and allow access to said records by the City's authorized representatives.

3. You shall submit the following reports using the City's web-based contract compliance (Prism® portal):

    a. **Monthly Payment.** You shall submit Monthly Payment Reporting by the 10th day of the subsequent month. Incomplete and/or delinquent reporting may cause payment delays, non-payment of invoices, or both.

4. The records maintained under item 1, described above, shall be consolidated into a Final Summary Report, certified as correct by an authorized representative of the Contractor. The Final Summary Report shall include all subcontracting activities and be sent to the EOCP Program Manager prior to Acceptance. Failure to comply may result in assessment of liquidated damages or withholding of retention. The City will review and verify 100% of subcontract participation reported in the Final Summary Report prior to approval and release of final retention to you. In the event your Subcontractors are owed money for completed Work, the City may authorize payment to subcontractor via a joint check from the withheld retention.

EQUAL OPPORTUNITY CONTRACTING PROGRAM (EOCP)

SECTION B - SLBE-ELBE SUBCONTRACTING REQUIREMENTS

THESE SPECIAL PROVISIONS SUPPLEMENT THE POLICIES AND REQUIREMENTS ESTABLISHED BY THE CITY OF SAN DIEGO EQUAL OPPORTUNITY CONTRACTING PROGRAM SPECIFIED IN THE CITY'S GENERAL EOCP REQUIREMENTS.

A. GENERAL.

1. It is the City's policy to encourage greater availability, capacity development, and contract participation by SLBE and ELBE firms in City contracts. This policy is, in part, intended to further the City's compelling interest to stimulate economic development through the support and empowerment of the local community, ensure that it is neither an active nor passive participant in marketplace discrimination, and promote equal opportunity for all segments of the contracting community.

2. The City is committed to maximizing subcontracting opportunities for all qualified and available firms.

3. This policy applies to City-funded construction contracts. Bidders shall be fully informed of this policy as set forth in these specifications. Mandatory or voluntary subcontracting percentages, Bid Discounts, and restricted competitions are specified in the Contract Documents.

4. You shall make subcontracting opportunities available to a broad base of qualified Subcontractors and shall achieve the minimum SLBE-ELBE Subcontractor participation identified for your project.

5. Failure to subcontract the specified minimum (mandatory) percentages of the Bid to qualified available SLBE-ELBE Subcontractors will cause a Bid to be rejected as non-responsive unless the Bidder has demonstrated compliance with the affirmative steps as specified in the City's document titled "Small Local Business (SLBE) Program, INSTRUCTIONS FOR BIDDERS COMPLETING THE GOOD FAITH EFFORT SUBMITTAL" and has submitted documentation showing that all required positive efforts were made prior to the Bid submittal due date. The required Good Faith Effort (GFE) documentation shall be submitted to the Contract Specialist. The instructions for completing the good faith effort submittal can be found on the City's website:

   https://www.sandiego.gov/sites/default/files/legacy/eoc/pdf/slbegfeinst.pdf

6. The current list of certified SLBE-ELBE firms and information for completing the GFE submittal can be found on the City's EOC Department website:

   http://www.sandiego.gov/eoc/programs/slbe.shtml

7. These requirements may be waived, at the City's sole discretion, on projects deemed inappropriate for subcontracting participation.

B. DEFINITIONS.

1. The following definitions shall be used in conjunction with these specifications:

   a) **Bid Discount** – Additional inducements or enhancements in the bidding process that are designed to increase the chances for the selection of SLBE firms in competition with other firms.

   b) **Commercially Useful Function** – An SLBE-ELBE performs a commercially useful function when it is responsible for the execution of the Work and is carrying out its responsibilities by actually performing, managing, and supervising the Work involved. To perform a commercially useful function, the SLBE-ELBE shall also be responsible, with respect to materials and supplies used on the Contract, for negotiating price, determining quantity and quality, ordering the material, and installing (where applicable) and paying for the material itself.

      To determine whether an SLBE-ELBE is performing a commercially useful function, an evaluation will be performed of the amount of Work subcontracted, normal industry practices, whether the amount the SLBE-ELBE firm is to be paid under the contract is commensurate with the Work it is actually performing and the SLBE-ELBE credit claimed for its performance of the Work, and other relevant factors. Specifically, an SLBE-ELBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of meaningful and useful SLBE-ELBE participation, when in similar transactions in which SLBE-ELBE firms do not participate, there is no such role performed.

   c) **Good Faith Efforts (GFE)** – Documentation of the Bidder's intent to comply with SLBE Program goals and procedures included in the City's SLBE Program, Instructions for Completing Good Faith Effort Submittal available from the City's EOCP website or the Contract Specialist.

   d) **Independently Owned, Managed, and Operated** – Ownership of a SLBE-ELBE firm shall be direct, independent, and by individuals only. Business firms that are owned by other businesses or by the principals or owners of other businesses that cannot themselves qualify under the SLBE-ELBE eligibility requirements shall not be eligible to participate in the Program. Moreover, the day-to-day management of the SLBE-ELBE firm shall be direct and independent of the influence of any other businesses that cannot themselves qualify under the SLBE-ELBE eligibility requirements.

   e) **Joint Venture** – An association of two or more persons or business entities that is formed for the single purpose of carrying out a single defined business enterprise for which purpose they combine their

capital, efforts, skills, knowledge, or property. Joint ventures shall be established by written agreement to qualify for this program.

f) **Local Business Enterprise ("LBE")** – A firm having a Principal Place of Business and a Significant Employment Presence in San Diego County, California that has been in operation for 12 consecutive months and a valid business tax certificate. This definition is subsumed within the definition of Small Local Business Enterprise.

g) **Minor Construction Program** – A program developed for bidding exclusively among SLBE-ELBE Construction firms.

h) **Principal Place of Business** – A location wherein a firm maintains a physical office and through which it obtains no less than 50% of its overall customers or sales dollars.

i) **Protégé** – A firm that has been approved and is an active participant in the City's Mentor-Protégé Program and that has signed the required program participation agreement and has been assigned a mentor.

j) **Significant Employee Presence** – No less than 25% of a firm's total number of employees are domiciled in San Diego County.

C. SUBCONTRACTOR PARTICIPATION.

1. For the purpose of satisfying subcontracting participation requirements, only 1st tier SLBE–ELBE Subcontractors will be recognized as participants in the Contract according to the following criteria:

   a) For credit to be allowed toward a respective participation level, all listed SLBE-ELBE firms shall have been certified by the Bid due date.

   b) The Subcontractor shall perform a commercially useful function for credit to be allowed toward subcontractor participation levels. The Subcontractor shall be required by you to be responsible for the execution of a distinct element of the Work and shall carry out its responsibility by actually performing and supervising its own workforce.

   c) If the Bidder is seeking the recognition of materials, supplies, or both towards achieving any mandatory subcontracting participation level, the Bidder shall indicate on Form AA40 – Named Equipment/Material Supplier List with the Bid the following:

      i. If the materials or supplies are obtained from a SLBE-ELBE manufacturer, the Bidder will receive 100% of the cost of the materials or supplies toward SLBE participation. For the purposes of counting SLBE-ELBE participation, a manufacturer is a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the Contract and of the general character described by the specifications.

ii. If the materials or supplies are obtained from a SLBE-ELBE supplier, the Bidder will receive 60% of the cost of the materials or supplies toward SLBE participation. For the purposes of counting SLBE-ELBE participation a Supplier is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the Contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a supplier, the firm shall be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A person may be a supplier in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating, or maintaining a place of business if the person both owns and operates distribution equipment for the products. Any supplementing of the suppliers' own distribution equipment shall be by a long-term lease agreement and shall not be on an ad hoc or contract-by-contract basis.

iii. If the materials or supplies are obtained from a SLBE-ELBE, which is neither a manufacturer nor a supplier, the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, fees or transportation charges for the delivery of materials or supplies required on a job site will be counted toward SLBE-ELBE participation, provided the fees are reasonable and not excessive as compared with fees customarily allowed for similar services. No portion of the cost of the materials and supplies themselves will be counted toward SLBE-ELBE participation.

d) If the Bidder is seeking the recognition of SLBE-ELBE Trucking towards achieving any mandatory subcontracting participation level, the Bidder shall indicate it on Form AA35 – List of Subcontractors with the Bid. The following factors will be evaluated in determining the credit to be allowed toward the respective participation level:

i. The SLBE-ELBE shall be responsible for the management and supervision of the entire trucking operation for which it is getting credit on a particular Contract and there shall not be a contrived arrangement for the purpose of counting SLBE-ELBE participation.

ii. The SLBE-ELBE shall itself own and operate at least 1 fully licensed, insured, and operational truck used on the Contract.

iii. The SLBE-ELBE receives credit for the total value of the transportation services it provides on the Contract using trucks it owns, insures, and operates using drivers it employs.

iv. The SLBE-ELBE may lease trucks from another SLBE-ELBE firm including an owner-operator who is certified as a SLBE-ELBE. The SLBE-ELBE who leases trucks from another SLBE-ELBE receives credit for the total value of the transportation services the lessee SLBE-ELBE provides on the contract.

v. The SLBE-ELBE may also lease trucks from a non-SLBE-ELBE firm, including an owner-operator. The SLBE-ELBE who leases trucks from a non-SLBE-ELBE is entitled to credit for the total value of transportation services provided by non-SLBE-ELBE lessees not to exceed the value of transportation services provided by SLBE-ELBE owned trucks on the contract. Additional participation by non-SLBE-ELBE lessees receive credit only for the fee or commission it receives as a result of the lease arrangement.

vi. A lease shall indicate that the SLBE-ELBE has exclusive use of and control over the truck. This does not preclude the leased truck from working for others during the term of the lease with the consent of the SLBE-ELBE so long as the lease gives the SLBE-ELBE absolute priority for use of the leased truck.

D. SLBE-ELBE SUBCONTRACTOR PARTICIPATION PERCENTAGES.

1. Contracts valued at $1,000,000 and above will be considered Major Public Works Contracts and will include a mandatory Subcontractor participation requirement for SLBE–ELBE firms.

   a) The Bidder shall achieve the mandatory Subcontractor participation requirement or demonstrate GFE.

   b) The Bidders shall indicate the participation on Forms AA35 - List of Subcontractors and AA40 - Named Equipment/Material Supplier List as applicable regardless of the dollar value.

   c) An SLBE-ELBE Bidder may count its own participation toward achieving the mandatory goal as long as the SLBE-ELBE Bidder performs 51% of the Contract Price.

2. Contracts Valued over $500,000 and under $1,000,000 will also be considered Major Public Works Contracts and will include the mandatory subcontractor participation requirements described above and the following:

   a) 5% bid discount for SLBE-ELBE firms.

   b) Non-certified Contractor will receive 5% bid discount if they achieve the specified mandatory Subcontracting participations.

c) Bid discounts shall not apply if the award will result in a total contract cost of $50,000 in excess of the apparent lowest Bid.

d) In the event of a tie bid between a SLBE-ELBE Bidder and a non-SLBE-ELBE Bidder, the SLBE-ELBE Bidder will be awarded the Contract.

e) In the event of a tie bid between a discounted Bid and a non-discounted Bid, the discounted Bid will be awarded the Contract.

3. Contracts valued over $250,000 up to $500,000 will be considered Minor Public Works Contracts and will be awarded through a competitive Bid process open only to City certified SLBE-ELBE firms. If there are no bidders or no responsible bidders, the Contract will be made available to all Bidders and will be subject to requirements listed in items 1 and 2 for Major Public Works Contracts above.

4. Contracts valued at $250,000 and below will also be considered Minor Public Works Contracts and will be awarded through a competitive bid process open only to City certified ELBEs unless there are less than 2 firms available at which it will be awarded through a competitive process open only to the City certified SLBE-ELBE firms. If there are no bidders or no responsible bidders, the Contract will be made available to all Bidders and subject to requirements listed in items 1 and 2 for Major Public Works Contracts above.

E. JOINT VENTURES.

1. The City may allow for Joint Venture bid discounts on some Contracts. Contracts that allow for Joint Venture bid discounts will be designated in Bid documents. A firm that is bidding or competing for City Contracts may partner with a certified SLBE or ELBE to compete for Contracts as a Joint Venture.

2. A Joint Venture shall be between two entities with the same discipline or license as required by the City. Joint ventures will receive bid discounts depending on the SLBE or ELBE percentage of participation. To be eligible for a discount, a Joint Venture Agreement shall be approved by the City at the time of Bid submittal. The maximum allowable discount shall be 5%. The parties shall agree to enter in the relationship for the life of the projects.

3. Joint Venture shall submit a Joint Venture Management Plan, a Joint Venture Agreement, or both at least 2 weeks prior to the Bid due date. Copies of the Joint Venture applications are available upon request to the Contract Specialist. Each agreement or management plan shall include the following:

a) Detailed explanation of the financial contribution for each partner.

b) List of personnel and equipment used by each partner.

c) Detailed breakdown of the responsibilities of each partner.

d) Explanation of how the profits and losses will be distributed.

e) Description of the bonding capacity of each partner.

f) Management or incentive fees available for any one of the partners (if any).

4. Each Joint Venture partner shall perform a Commercially Useful Function. An SLBE or ELBE that relies on the resources and personnel of a non-SLBE or ELBE firm will not be deemed to perform a Commercially Useful Function.

5. Each Joint Venture partner shall possess licenses appropriate for the discipline for which a proposal is being submitted. If a Joint Venture is bidding on a single trade project, at the time of bid submittal, each Joint Venture partner shall possess the requisite specialty license for that trade bid.

6. The SLBE or ELBE partner shall clearly define the portion of the Work to be performed. This Work shall be of the similar type of Work the SLBE or ELBE partner performs in the normal course of its business. The Joint Venture Participation Form shall specify the Bid items to be performed by each individual Joint Venture partner. Lump sum Joint Venture participation shall not be acceptable.

7. Responsibilities of the SLBE or ELBE Joint Venture Partner:

   a) The SLBE or ELBE partner shall share in the control, management responsibilities, risks and profits of the Joint Venture in proportion with the level of participation in the project.

   b) The SLBE or ELBE partner shall perform Work that is commensurate with its experience.

   c) The SLBE or ELBE partner shall use its own employees and equipment to perform its portion of the Work.

   d) The Joint Venture as a whole shall perform Bid items that equal or exceed 50% of the Contract Price, excluding the cost of manufactured items, in order to be eligible for a Joint Venture discount.

F. MAINTAINING PARTICIPATION LEVELS.

1. Credit and preference points are earned based on the level of participation proposed prior to the award of the Contract. Once the Project begins you shall achieve and maintain the SLBE-ELBE participation levels for which credit and preference points were earned. You shall maintain the SLBE-ELBE percentages indicated at the Award of Contract and throughout the Contract Time.

2. If the City modifies the original Scope of Work, you shall make reasonable efforts to maintain the SLBE-ELBE participation for which creditor preference points were earned. If participation levels will be reduced, approval shall be received from the City prior to making changes.

3. You shall notify and obtain written approval from the City in advance of any reduction in subcontract scope, termination, or substitution for a designated SLBE-ELBE Subcontractor. Failure to do so shall constitute a material breach of the Contract.

4. If you fail to maintain the SLBE-ELBE participation listed at the time the Contract is awarded and have not received prior approval from the City, the

City may declare you in default and will be considered grounds for debarment under Chapter 2, Article 2, Division 8, of the San Diego Municipal Code.

G. SUBCONTRACTING EFFORTS REVIEW AND EVALUATION.

1. Documentation of your subcontracting efforts will be reviewed by EOCP to verify that you made subcontracting opportunities available to a broad base of qualified Subcontractors, negotiated in good faith with interested Subcontractors, and did not reject any bid for unlawful discriminatory reasons. The EOCP review is based on the federal "Six Good Faith Efforts" model.

2. The GFEs are required methods to ensure that all ELBE and SLBE firms have had the opportunity to compete for the City's Public Works procurements. The Six Good Faith Efforts, also known as affirmative steps, attract and utilize ELBE and SLBE firms:

   a) Ensure ELBE firms are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities.

   b) Make information of forthcoming opportunities available to SLBE-ELBE firms and arrange time for Contracts and establish delivery schedules, where requirements permit, in a way that encourages and facilitates participation by SLBE-ELBE firms in the competitive process. This includes posting solicitations for Bids or proposals to SLBE-ELBE firms for a minimum of 10 Working Days before the Bid or Proposal due date.

   c) Consider in the contracting process whether firms competing for large Contracts could subcontract with SLBE-ELBE firms.

   d) Encourage contracting with a consortium of ELBE-SLBE firms when a Contract is too large for one of these firms to handle individually.

   e) Use the services and assistance of the City's EOC Office and the SLBE-ELBE Directory.

   f) If you award subcontracts, require your Subcontractors to take the steps listed above.

H. GOOD FAITH EFFORT DOCUMENTATION.

1. If the specified SLBE-ELBE Subcontractor participation percentages are not met, you shall submit information necessary to establish that adequate GFEs were taken to meet the Contract Subcontractor participation percentages. See the City's document titled "Small Local Business (SLBE) Program, INSTRUCTIONS FOR BIDDERS COMPLETING THE GOOD FAITH EFFORT SUBMITTAL." The instructions for completing the good faith effort submittal can be found on the City's website:

   https://www.sandiego.gov/sites/default/files/legacy/eoc/pdf/slbegfeinst.pdf

I. SUBCONTRACTOR SUBSTITUTION.

1. Evidence of fraud or discrimination in the substitution of Subcontractors will result in sanctions including assessment of penalty fines, termination of Contract, or debarment. This section does not replace applicable California Public Contract Code.

J. FALSIFICATION OF SUB-AGREEMENT AND FRAUD.

1. Falsification or misrepresentation of a sub-agreement as to company name, Contract amount or actual Work performed by Subcontractors, or any falsification or fraud on the part your submission of documentation and forms pursuant to this program, will result in sanctions against you including assessment of penalty fines, termination of the Contract, or debarment. Instances of falsification or fraud which are indicative of an attempt by you to avoid subcontracting with certain categories of Subcontractors on the basis of race, gender, gender expression, gender identity, religion, national origin, ethnicity, sexual orientation, age, or disability shall be referred to the Equal Opportunity Contracting Program's Investigative Unit for possible violations of Article 2, Division 35 of the City Administrative Code, §§22.3501 et seq. (Nondiscrimination in Contracting).

K. RESOURCES.

1. The current list of certified SLBE-ELBE firms and information for completing the GFE submittal can be found on the City's EOC Department website:

   http://www.sandiego.gov/eoc/programs/slbe.shtml

ATTACHMENT D

PREVAILING WAGE

PREVAILING WAGE

1. **PREVAILING WAGE RATES:** Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding $25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding $15,000, the Contractor and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below.

   1.1. Compliance with Prevailing Wage Requirements. Pursuant to sections 1720 through 1861 of the California Labor Code, the Contractor and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.

      1.1.1. Copies of such prevailing rate of per diem wages are on file at the City and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm. Contractor and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.

      1.1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this Contract, such wage rate shall apply to the balance of the Contract.

   1.2. Penalties for Violations. Contractor and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed. This shall be in addition to any other applicable penalties allowed under Labor Code sections 1720 – 1861.

1.3. **Payroll Records.** Contractor and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Contractor shall require its subcontractors to also comply with section 1776. Contractor and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Contractor is responsible for ensuring its subcontractors submit certified payroll records to the City.

1.3.1. Contractor and their subcontractors shall also furnish records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required by Labor Code section 1771.4.

1.4. **Apprentices.** Contractor and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Contractor is held responsible for the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.

1.5. **Working Hours.** Contractor and their subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on contractors and subcontractors of $25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections1810 through 1815.

1.6. **Required Provisions for Subcontracts.** Contractor shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.

1.7. **Labor Code Section 1861 Certification.** Contractor in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Contractor certifies that "I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' 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."

1.8. **Labor Compliance Program**. The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego's Prevailing Wage Unit at 858-627-3200.

1.9. Contractor and Subcontractor Registration Requirements. This project is subject to compliance monitoring and enforcement by the DIR. A contractor or subcontractor shall not be qualified to bid on, be listed in a bid or proposal, subject to the requirements of section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, unless currently registered and qualified to perform public work pursuant to Labor Code 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.

1.9.1. A Contractor's inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.

1.9.2. By submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Contractor shall provide proof of registration for themselves and all listed subcontractors to the City at the time of bid or proposal due date or upon request.

1.10. Stop Order. For Contractor or its subcontractors engaging in the performance of any public work contract without having been registered in violation of Labor Code sections 1725.5 or 1771.1, the Labor Commissioner shall issue and serve a stop order prohibiting the use of the unregistered contractors or unregistered subcontractor(s) on ALL public works until the unregistered contractor or unregistered subcontractor(s) is registered. Failure to observe a stop order is a misdemeanor.

1.11. List of all Subcontractors. The Contractor shall provide the list of subcontractors (regardless of tier), along with their DIR registration numbers, utilized on this Contract prior to any work being performed; and the Contractor shall provide a complete list of all subcontractors with each invoice. Additionally, Contractor shall provide the City with a complete list of all subcontractors (regardless of tier) utilized on this contract within ten working days of the completion of the contract, along with their DIR registration numbers. The City shall withhold final payment to Construction Management Professional until at least thirty (30) days after this information is provided to the City.

1.12. Exemptions for Small Projects. There are limited exemptions for installation, alteration, demolition, or repair work done on projects of $25,000 or less. The Contractor shall still comply with Labor Code sections 1720 et. seq. The only recognized exemptions are listed below:

1.12.1. Registration. The Contractor will not be required to register with the DIR for small projects. (Labor Code section 1771.1).

1.12.2. Certified Payroll Records. The records required in Labor Code section 1776 shall be required to be kept and submitted to the City of San Diego, but will not be required to be submitted online with the DIR directly. The Contractor will need to keep those records for at least three years following the completion of the Contract. (Labor Code section 1771.4).

1.12.3. List of all Subcontractors. The Contractor shall not be required to hire only registered subcontractors and is exempt from submitting the list of all subcontractors that is required in section 1.11 above. (Labor code section 1773.3).

ATTACHMENT E

SUPPLEMENTARY SPECIAL PROVISIONS

SUPPLEMENTARY SPECIAL PROVISIONS

The following Supplementary Special Provisions (SSP) modifies the following documents:

1. The **2021 Edition** of the Standard Specifications for Public Works Construction (The "GREENBOOK").

2. The **2021 Edition** of the City of San Diego Standard Specifications for Public Works Construction (The "WHITEBOOK"), including the following:

   a) General Provisions (A) for all Construction Contracts.

SECTION 1 – GENERAL, TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-2 TERMS AND DEFINITIONS. To the "WHITEBOOK", item 55, "Normal Working Hours", ADD the following:

The **Normal Working Hours** are **7:00 AM** to **3:30 PM**.

SECTION 2 - SCOPE OF THE WORK

2-2 PERMITS, FEES, AND NOTICES. To the "WHITEBOOK", ADD the following:

2. The City will obtain, at no cost to you, the following permits:

   a) Building Permit (Contractor is responsible for pulling the construction permit and submitting the deffered submittals)

3. a) Work is located within the fligt path of aircrafts, you shall obtain a construction permit for tall equipment (such as cranes) through Federal Aviation Administration (FAA).

SECTION 3 – CONTROL OF THE WORK

3-2 SELF-PERFORMANCE. To the "GREENBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. You shall perform, with your own organization, Contract Work amounting to at least **50%** of the Base Bid.

3-9 TECHNICAL STUDIES AND SUBSURFACE DATA. To the "WHITEBOOK", ADD the following:

5. In preparation of the Contract Documents, the designer has relied upon the following reports of explorations and tests at the Work Site:

   a) Geotechnical Reports

6. The reports listed above are available for review at the following link:

https://drive.google.com/drive/folders/11OB7bfskJ4369HqI96jOUJHp8xZ6xfbO?usp=sharing

3-10 SURVEYING. To the "GREENBOOK" and "WHITEBOOK", DELETE in its entirety and SUBSTITUTE with the following:

3-10 SURVEYING (DESIGN-BID-BUILD).

3-10.1 General.

1. You shall provide all required site layout and general grade checking work not specified in 3-10.2, "Survey Services Provided by City".
2. Notify the City, in writing, at least 2 Working Days prior to requesting survey services provided by the City.

3-10.2 Survey Services Provided by City.

1. Unless otherwise noted, monument perpetuation, including mark-outs, will be performed by the City. Coordination of these services will be your duty, through the Resident Engineer. If, at any time, an existing survey monument is, or will be, destroyed or disturbed during the course of construction you shall notify the Resident Engineer so that the monument is preserved or perpetuated in accordance with state law.
2. The following surveying services, as defined in Cal. Bus. & Prof. Code §8726, shall be provided by the City:
    a) Locating or establishing a minimum of 4 project geodetic survey control points that provide horizontal and vertical reference values for site feature and structure layout reference locations.
    b) Locating, establishing, or reestablishing project site boundary lines, survey monuments, right-of-way lines, or easement lines.
    c) Locating or establishing building design structure locations (building corners or envelope limits) sufficient for structure construction.

3-10.3 Payment.

1. The payment for site layout and general grade checking Work, coordination, and preservation of all survey related marks shall be included in the Contract Price.

SECTION 4 - CONTROL OF MATERIALS

4-3.4 Specialty Inspection Paid for by the Contractor. To the "WHITEBOOK", ADD the following:

2. The specialty inspections required are listed as follows:
    a) Special Reinforced Concrete Structures

4-6 TRADE NAMES. To the "WHITEBOOK", ADD the following:

11. You shall submit your list of proposed substitutions for an "equal" item **no later than 5 Working Days after the of issuance the Notice of Intent to Award** and on the City's Product Submittal Form available at:

https://www.sandiego.gov/ecp/edocref/

SECTION 5 – LEGAL RELATIONS AND RESPONSIBILITIES

5-4 INSURANCE. To the "GREENBOOK", DELETE in its entirety and SUBSTITUTE with the following:

5-4 INSURANCE.

1. The insurance provisions herein shall not be construed to limit your indemnity and defense duties set forth in the Contract.

5-4.1 Policies and Procedures.

1. You shall procure the insurance described below, at your sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or Subcontractors.
2. Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.
3. You shall maintain this insurance as required by this Contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this Contract. Your duties under the Contract, including your indemnity obligations, are not limited to the insurance coverage required by this Contract.
4. If you maintain broader coverage or higher limits than the minimums shown below, City requires and shall be entitled to the broader coverage or the higher limits maintained by you. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to City.
5. Your payment for insurance shall be included in the Contract Price you bid. You are not entitled to any additional payment from the City to cover your insurance, unless the City specifically agrees to payment in writing. Do not begin any Work under this Contract or allow any Subcontractors to begin work, until you have provided, and the City has approved, all required insurance.
6. Policies of insurance shall provide that the City is entitled to 30 days advance written notice of cancellation or non-renewal of the policy or 10 days advance written notice for cancellation due to non-payment of premium. Maintenance of specified insurance coverage is a material element of the Contract. Your

failure to maintain or renew coverage and to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

5-4.2 Types of Insurance.

5-4.2.1 General Liability Insurance.

1. Commercial General Liability Insurance shall be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.
2. The policy shall cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured's contract (including the tort liability of another assumed in a business contract).
3. There shall be no endorsement or modification limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. You shall maintain the same or equivalent insurance for at least 10 years following completion of the Work.
4. All costs of defense shall be outside the policy limits. Policy coverage shall be in liability limits of not less than the following:

General Annual Aggregate Limit	Limits of Liability
Other than Products/Completed Operations	$10,000,000
Products/Completed Operations Aggregate Limit	$10,000,000
Personal Injury Limit	$5,000,000
Each Occurrence	$5,000,000

5-4.2.2 Commercial Automobile Liability Insurance.

1. You shall provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of $1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles ("Any Auto").
2. All costs of defense shall be outside the limits of the policy.

5-4.2.3 Workers' Compensation Insurance and Employers Liability Insurance.

1. In accordance with the provisions of California Labor Code section 3700, you shall provide, at your expense, Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable

state workers' compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with this requirement.

2. Statutory Limits shall be provided for Workers' Compensation Insurance as required by the state of California, and Employer's Liability Insurance with limits of no less than $1,000,000 per accident for bodily injury or disease.

3. By signing and returning the Contract, you certify that you are aware of the provisions of California's Workers' Compensation laws, including Labor Code section 3700, which requires every employer to be insured against liability for workers' compensation or to undertake self-insurance, and that you will comply with these provisions before commencing the Work.

5-4.2.4 Contractors Pollution Liability Insurance.

1. You shall procure and maintain at your expense or require your Subcontractor, as described below, to procure and maintain Contractors Pollution Liability Insurance applicable to the Work being performed, with a limit no less than $2,000,000 per claim or occurrence and $4,000,000 aggregate per policy period of one year.

2. All costs of defense shall be outside the limits of the policy.

3. You shall obtain written approval from the City for any insurance provided by your Subcontractor instead of you.

4. For approval of a substitution of your Subcontractor's insurance, you shall certify that all activities for which the Contractors Pollution Liability Insurance will provide coverage will be performed exclusively by the Subcontractor providing the insurance. The deductible shall not exceed $25,000 per claim unless the City has provided prior, written approval.

5. Occurrence based policies shall be procured before the Work commences. Claims Made policies shall be procured before the Work commences, shall be maintained for the Contract Time, and shall include a 12-month extended Claims Discovery Period applicable to this contract or the existing policy or policies that shall continue to be maintained for 12 months after the completion of the Work without advancing the retroactive date.

5-4.2.5 Contractors Hazardous Transporters Pollution Liability Insurance.

1. You shall procure and maintain at your expense or require your Subcontractor, as described below, to procure and maintain Contractors Hazardous Transporters Pollution Liability Insurance, including contractual liability coverage to cover liability arising out of transportation of hazardous or toxic, materials, substances, or any other pollutants by you or any Subcontractor in an amount no less than $2,000,000 limit per occurrence and $4,000,000 aggregate per policy period of one year.

2. All costs of defense shall be outside the limits of the policy.

3. You shall obtain written approval from the City from any insurance provided by a Subcontractor instead of you..

4. To obtain City approval of a Subcontractor's insurance coverage in lieu of the Contractor's insurance, the Contractor shall certify that all activities under the Contractor's Hazardous Transporters Pollution Liability Insurance will be performed exclusively by the Subcontractor providing the insurance. The deductible shall not exceed $25,000 per claim without prior approval of the City

5. Occurrence based policies shall be procured before the Work commences. Claims Made policies shall be procured before the Work commences, shall be maintained for the duration of this contract, and shall include a 12-month extended Claims Discovery Period applicable to this Contract or the existing policy or policies that shall continue to be maintained for 12 months after the completion of the Work under this Contract without advancing the retroactive date.

5-4.2.6 Contractors Builders Risk Property Insurance.

1. You shall provide at your expense, and maintain until Final Acceptance of the Work, a Special Form Builders Risk Policy or Policies. This insurance shall be in an amount equal to the replacement cost of the completed Work (without deduction for depreciation) including the cost of excavations, grading, and filling. The policy or policies limits shall be 100 percent of the value of the Work under this Contract, plus 15 percent to cover administrative costs, design costs, and the costs of inspections and construction management.

2. Insured property shall include material or portions of the Work located away from the Site but intended for use at the Site and shall cover material or portions of the Work in transit. The policy or policies shall include as insured property scaffolding, falsework, and temporary buildings located at the Site. The policy or policies shall cover the cost of removing debris, including demolition.

3. The policy or policies shall provide that all proceeds shall be payable to the City as Trustee for the insured, and shall name the City, the Contractor, Subcontractors, and Suppliers of all tiers as named insured. The City, as Trustee, will collect, adjust, and receive all monies that become due and payable under the policy or policies, may compromise any and all claims , and will apply the proceeds of this insurance to the repair, reconstruction, or replacement of the Work.

4. Any deductible applicable to the insurance shall be identified in the policy or policies documents. The responsibility for paying the part of any loss not covered because of the deductibles shall be apportioned among the parties, except for the City, as follows: if there is more than one claimant for a single occurrence, then each claimant shall pay a pro-rata share of the per occurrence deductible based upon the percentage of their paid claim to the total paid for insured. The City shall be entitled to 100 percent of its loss. You

shall pay the City any portion of the loss not covered because of a deductible; at the same time the proceeds of the insurance are paid to the City as Trustee.

5. Any insured, other than the City, making claim to which a deductible applies shall be responsible for 100 percent of the loss not insured because of the deductible.

5-4.2.8 Architects and Engineers Professional Insurance (Errors and Omissions Insurance).

1. For Contracts with required engineering services, including Design-Build and preparation of engineered Traffic Control Plans (TCP) by you, you shall keep or require all of your employees and Subcontractors, who provide professional engineering services under Contract, to provide to the City proof of Professional Liability coverage with a limit of no less than **$1,000,000** per claim and **$2,000,000** aggregate per policy period of one year.
2. You shall ensure the following:
   a) The policy retroactive date is on or before the date of commencement of the Project.
   b) The policy will be maintained in force for a period of three years after completion of the Project or termination of the Contract, whichever occurs last. You agree that, for the time period specified above, there will be no changes or endorsements to the policy that affect the specified coverage.
3. If professional engineering services are to be provided solely by the Subcontractor, you shall:
   a) Certify this to the City in writing, and
   b) Agree in writing to require the Subcontractor to procure Professional Liability coverage in accordance with the requirements set forth here.

5-4.3 Rating Requirements. Except for the State Compensation Insurance Fund, all insurance required by this Contract shall be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the state of California, and that have been approved by the City.

5-4.3.1 Non-Admitted Carriers. The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the state of California and is included on the List of Approved Surplus Lines Insurers (LASLI list).

All policies of insurance carried by non-admitted carriers shall be subject to all of the requirements for policies of insurance provided by admitted carriers described in this Contract.

5-4.4 **Evidence of Insurance.** You shall furnish the City with original Certificates of Insurance, including all required amendatory endorsements (or copies of the applicable policy language effecting coverage required by this clause), prior to your commencement of Work under this Contract. In addition, The City reserves the right to require complete, certified copies of all required insurance policies, including endorsements, required by these specifications, at any time.

5-4.5 **Policy Endorsements.**

5-4.5.1 **Commercial General Liability Insurance.**

5-4.5.1.1 **Additional Insured.** To the fullest extent permitted by law and consistent with the limiting provisions set forth at California Civil Code section 2782, California Insurance Code section 11580.04, and any applicable successor statutes limiting indemnification of public agencies that bind the City, the policy or policies shall be endorsed to include as an Additional Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of:

i. Ongoing operations performed by you or on your behalf,

ii. your products,

iii. your work, e.g., your completed operations performed by you or on your behalf, or

iv. premises owned, leased, controlled, or used by you.

5-4.5.1.2 **Primary and Non-Contributory Coverage.** The policy shall be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives. Further, it shall provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

5-4.5.1.3 **Project General Aggregate Limit.** The policy or policies shall be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work shall reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit shall be in addition to the aggregate limit provided for the products-completed operations hazard.

5-4.5.2 **Workers' Compensation Insurance and Employers Liability Insurance.**

5-4.5.2.1 **Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City and its respective elected officials, officers, employees, agents, and representatives for losses paid under the

terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

5-4.5.3 Contractors Pollution Liability Insurance Endorsements.

5-4.5.3.1 Additional Insured. To the fullest extent permitted by law and consistent with the limiting provisions set forth at California Civil Code section 2782, California Insurance Code section 11580.04, and any applicable successor statutes limiting indemnification of public agencies that bind the City, the policy or policies shall be endorsed to include as an Additional Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of: Ongoing operations performed by you or on your behalf, your products, your work, e.g., your completed operations performed by you or on your behalf, or premises owned, leased, controlled, or used by you.

5-4.5.3.2 Primary and Non-Contributory Coverage. The policy or policies shall be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

5-4.5.3.3 Severability of Interest. For Contractors Pollution Liability Insurance, the policy or policies shall provide that your 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 and shall provide cross-liability coverage.

5-4.5.4 Contractors Hazardous Transporters Pollution Liability Insurance Endorsements.

5-4.5.4.1 Additional Insured. To the fullest extent permitted by law and consistent with the limiting provisions set forth at California Civil Code section 2782, California Insurance Code section 11580.04, and any applicable successor statutes limiting indemnification of public agencies that bind the City, the policy or policies shall be endorsed to include as an Additional Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of: Ongoing operations performed by you or on your behalf, your products, your work, e.g., your completed operations performed by you or on your behalf, orpremises owned, leased, controlled, or used by you.

5-4.5.4.2 Primary and Non-Contributory Coverage. The policy or policies shall be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to

operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

5-4.5.4.2 **Severability of Interest.** For Contractors Hazardous Transporters Pollution Liability Insurance, the policy or policies shall provide that your 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, and shall provide cross-liability coverage.

5-4.5.5 **Builders Risk Endorsements.**

5-4.5.5.1 **Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and that arise from Work performed by the Named Insured for the City.

5-4.5.5.2 **Builders Risk – Partial Utilization.** If the City desires to occupy or use a portion or portions of the Work prior to Acceptance,, the City will notify you, and you shall immediately notify your Builder's Risk insurer and obtain an endorsement that the policy or policies shall not be cancelled or lapse on account of any use or occupancy. You shall obtain the endorsement prior to the City's occupation and use.

5-4.6 **Deductibles and Self-Insured Retentions.** You shall disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided. The City may require you to purchase coverage with a lower retention or provide proof of ability to pay losses and related investigations, claim administration, and defense expenses within the retention. The policy language shall provide, or be endorsed to provide, that the self-insured retention may be satisfied by either the named insured or City.

5-4.7 **Reservation of Rights.** The City reserves the right, from time to time, to review your insurance coverage, limits, deductibles, and self-insured retentions to determine if they are acceptable to the City. The City will reimburse you, without overhead, profit, or any other markup, for the cost of additional premium for any coverage requested by the Engineer, but not required by this Contract.

5-4.8 **Notice of Changes to Insurance.** You shall notify the City, in writing, 30 days prior to any material change to the policies of insurance provided under this Contract. This written notice is in addition to the requirements of paragraph 8 of Section 5-4.1. Policies of insurance shall provide that the City is entitled to 30 days advance written notice of cancellation or non-renewal of the policy or 10 days advance written notice for cancellation due to non-payment of premium. Maintenance of specified insurance coverage is a material element of the Contract. Your failure to maintain or renew

coverage and to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

5-4.9 **Excess Insurance.** Policies providing excess coverage shall follow the form of the primary policy or policies, including, all endorsements.

SECTION 6 – PROSECUTION AND PROGRESS OF THE WORK

6-1.1 **Construction Schedule.** To the "WHITEBOOK", ADD the following:

3. Refer to the Sample City Invoice materials in **Appendix D – Sample City Invoice with Cashflow Forecast** and use the format shown.

4. The **120 Calendar Day** Plant Establishment Period is included in the stipulated Contract Time and shall begin with the acceptance of installation of the vegetation plan in accordance with Section 801-6, "MAINTENANCE AND PLANT ESTABLISHMENT".

ADD:

6-6.1.1 **Environmental Document.**

1. The City of San Diego has prepared a **Notice of Exemption** for **Metropolitan Biosolids Center (MBC) Storm Water Diversion Project (Metro Biosolids Center Storm Drain Diversion)**, Project No**. B-19197.02.06**, as referenced in the Contract Appendix. You shall comply with all requirements of the **Notice of Exemption** as set forth in **Appendix A.**

2. Compliance with the City's environmental document shall be included in the Contract Price, unless separate bid items have been provided.

SECTION 7 – MEASUREMENT AND PAYMENT

7-3.1 **General.** To the "WHITEBOOK", ADD the following:

1. The Lump Sum Bid item for "**Engineered Shoring, Sheeting and Bracing(Pump Station and Storage)** shall include temporary sheeting, shoring, and bracing or equivalent method, which price shall constitute full compensation for completion of all planning, design, engineering fees, furnishing and constructing, and removal and disposal of such temporary sheeting, shoring, and bracing as a lump sum item, complete, as required for the prosecution of the Work, required for temporary or permanent support of any structures, pipelines or utilities and required under the provisions of any permits, and in accordance with the requirements of OSHA and the Construction Safety Orders of the State of California, pursuant to the provisions of Section 6707 of the California Labor Code as specified in the Plans, Contract Documents, and Technical Specifications.

2. The Lump Sum Bid item for "**Landscape**" shall include purchase and installation of container plants, landscape mulch, amendments, root barriers

etc. as specified in the Revegetation Plans, Contract Documents, and Technical Section Attachment F.

3. The Lump Sum Bid item for "**Irrigation System**" shall include: Cutting and capping existing irrigation lines within work areas prior to grading/excavating. Provide water tuck watering to landscape plants/landscape areas downstream of areas affected by irrigation cutting/capping. Provide water as necessary to keep exiting landscaping alive until the irrigation system is restored. Restore irrigation system to pre-project condition as specified in the Irrigation Plans, Contract Documents, and Technical Section Attachment F.

4. The Lump Sum Bid item for "**Hydrodynamic Separator**" shall include furnishing the hydrodynamic separator, concrete structure, and all necessary materials, equipment for installation of the Hydrodynamic Separator as shown on the Plans, Contract Documents, and Technical Specifications. Payment for Structure Excavation and backfill, loading, disposing of surplus material, stockpiling, and hauling it to its final location shall be included as part of this bid item.

5. The Square foot Bid item for "**Decomposed Granite (6 inch)**" shall include furnishing and installation as shown on the Plans, Contract Documents, and Technical Specifications.

6. The Lump Sum Bid item for "**Site Improvements (West)**" shall include mass grading, addition of fill material, finish grading, and preparation for surface improvements as shown on the Plans, Contract Documents, and Technical Specifications.

7. The Lump Sum Bid item for "**Site Improvements (Pump Station, Storage, Access Road)**" shall include mass grading, finish grading, and preparation for surface improvements as shown on the Plans, Contract Documents, and Technical Specifications. Payment for loading, disposing of surplus material, stockpiling, and hauling it to its final location shall be included as part of this bid item.

8. The Lump Sum Bid item for **"Precast Concrete Wetwell Pump Station and Above Grade Piping)**" shall include the precast concrete wetwell pump station, above grade piping, valves, and appurtenances and appurtenant work necessary for a complete and operational pump station as shown on the Plans, Contract Documents, and Technicals Specifications. Also included in this bid item is erection and installation of items related to the pump station not covered in other bid items, shall be included in this bid item. Payment for Structure Excavation and backfill, loading, disposing of surplus material, stockpiling, and hauling it to its final location shall be included as part of this bid item.

9. The Lump Sum Bid item for **"Underground Stormwater Storage Structure and Gas Piping"** shall include the underground stormwater storage structure, base materials, all other necessary materials, equipment, and installation as shown on the Plans, Contract Documents, and Technical Specifications. Payment includes protect-in-place or temporarily relocation of

the existing gas piping. Payment for Structure Excavation and backfill, loading, disposing of surplus material, stockpiling, and hauling it to its final location shall be included as part of this bid item.

10. The Lump Sum Bid item for **"Site Electrical – Panels, Duct Banks, & Cabling"** shall include power and site electrical including pullboxes, ductbanks, panelboards, switchboards, concrete, conduit, conductors and equipment and as required for the site and facility electrical such that facilities and equipment is complete and operational as shown on the Plans, Contract Documents, and Technical Specifications.

11. The Lump Sum Bid item for **"Instrumentation"** shall include all instrumentation and controls for the proposed facilities as shown on the Plans, Contract Documents, and Technical Specifications.

7-3.11 Compensation Adjustments for Price Index Fluctuations. To the "WHITEBOOK", ADD the following:

5. This Contract is not subject to the provisions of The "WHITEBOOK" for Compensation Adjustments for Price Index Fluctuations for paving asphalt.

SECTION 800 – MATERIALS

800-1.2.5 Mulch. To the "WHITEBOOK", item 3, subsection "i", ADD the following:

Type 9 Mulch shall be 2 or 4 inches maximum in size.

SECTION 1001 – CONSTRUCTION BEST MANAGEMENT PRACTICES (BMPs)

1001-1 GENERAL. To the "WHITEBOOK", ADD the following:

8. Based on a preliminary assessment by the City, this Contract is subject to Water Pollution Contol Plan **WPCP**.

TECHNICALS

CITY OF SAN DIEGO

ENGINEERING & CAPITAL PROJECTS

STORM DRAIN DIVERSION AT METRO BIOSOLIDS CENTER

FINAL DESIGN

TECHNICAL SPECIFICATIONS

STORM DRAIN DIVERSION AT METROPOLITAN BIOSOLIDS CENTER
TABLE OF CONTENTS FOR TECHNICAL SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - SITE WORK

DIVISION 3 - CONCRETE

- END OF TABLE OF CONTENTS -

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 GENERAL

A. The WORK to be performed under this Contract shall consist of furnishing all plant, tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation and services, including fuel, power, water, and essential communications, and performing all work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. This contract will provide upgrades to the plant's storm water drainage system to divert and contain an initial volume of storm water in a diversion structure and pump the retained storm water to the plant's sanitary sewer system. This work shall consist of the following main tasks:

1. Modification to the existing gravity storm drain system: This work shall involve demolition or modification of existing pipe, catch basins and clean outs and replacement with new pipe and components as indicated in the drawings.

2. Addition of a new diversion structure with pump station: The new structure and pump station shall house two submersible pumps and one motor operated sluice gate and shall allow plant staff to divert retained storm water away from the eastern land outfall and to the plant's sanitary system. A 6-inch force main shall convey the pumped storm water to a connection point with the plant drain piping located outside the pipe gallery.

3. Modifications to divert storm water from one drainage sub-basin to the plant's 36-inch centrate pipe. This modification shall involve one catch basin located just north of the ramp down to the pipe gallery in the northwest area of the plant. The existing catch basin shall be replaced and existing piping abandoned-in-place.

1.3 CONTRACT METHOD

A. The WORK hereunder will be constructed under a single lump sum contract.

1.4 WORK BY OTHERS

A. **Interference With Work On Utilities:** The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in

the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

B. **Concurrent Work by Other Contractors:** The CONTRACTOR's attention is directed to the fact that work may be conducted at or adjacent to the site by other contractors during the performance of the WORK of this Contract. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the work of such other contractors. The contractor shall determine from the owner all work by others that could impact the execution of work as described herein.

1.5 CONTRACTOR'S USE OF THE PROJECT SITE

A. The CONTRACTOR's use of the project site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices. The CONSTRUCTION MANAGER will assign a field trailer location and laydown area or areas to the CONTRACTOR. The laydown area(s) may be revised by the CONSTRUCTION MANAGER.

1.6 OWNER'S USE OF THE PROJECT SITE

A. The OWNER may utilize all or part of the existing site during the entire period of construction. The CONTRACTOR shall cooperate and coordinate with the OWNER and the CONSTRUCTION MANAGER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the OWNER shall be allowed access to the project site during the period of construction.

1.7 DEFINITIONS APPLICABLE TO TECHNICAL SPECIFICATIONS

A. The following words have the meaning defined in the Technical Portions of the WORK:

1. **Indicated** - is a word used to direct the CONTRACTOR to information contained on the drawings or in the Specifications. Terms such as "shown," "noted," "scheduled," and "specified" also may be used to assist in locating information but no limitation of location is implied or intended.

2. **Furnish** - means to supply and deliver to the site, to unload and unpack ready for assembly, installation, testing, and start-up.

3. **Install** - defines operations at the site including assembly, erection, placing, anchoring, applying, shaping to **dimension**, finishing, curing, protecting, and cleaning, ready for the OWNER's use.

4. **Provide** - is defined as **furnish** and install, ready for the intended use.

5. **Installer** - a person or firm engaged by the CONTRACTOR or any subcontractor for the performance of **installation**, erection, or application work at the site. Installers must be expert in the operations they are engaged to perform.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

** END OF SECTION **

SECTION 01014

WORK SEQUENCE

PART 1 – GENERAL

1.1 CONTINUITY OF PLANT OPERATIONS

A. MBC is currently and continuously receiving and treating sewage, and those functions shall not be interrupted except as specified herein. The CONTRACTOR shall coordinate the work to avoid any interference with normal operation of plant equipment and processes.

B. Bypassing of untreated or partially treated sewage to surface waters or drainage courses is prohibited during construction. In the event accidental bypassing is caused by the CONTRACTOR's operations, the OWNER shall immediately be entitled to employ others to stop the bypassing without giving written notice to the CONTRACTOR.

1.2 SUBMITTAL

A. In accordance with Section 01300, the CONTRACTOR shall submit a detailed outage plan and time schedule for operations which will make it necessary to remove pipeline, electrical circuit, equipment, or structure from service. The schedule shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the CONTRACTOR's method for preventing bypassing of other treatment units, the length of time required to complete said operation, the necessary plant, and equipment which the CONTRACTOR shall provide in order to prevent bypassing of associated treatment units.

B. The CONTRACTOR shall observe the following restrictions:

Systems or individual equipment items shall be isolated, dewatered, decommissioned, deenergized, or depressurized in accordance with the detailed outage plan and schedule. The CONSTRUCTION MANAGER shall be notified in writing at least one week in advance of the planned operation.

1.3 SEQUENCE AND SCHEDULE OF CONSTRUCTION

A. To permit continuous operation and meet the stormwater discharge compliance at MBC, the detailed work sequence plan shall include the following specific condition or criteria:

1. Storm drain demolition and replacement of existing gravity storm drain system along Bio-Solids Blvd (Work Area 4) shall not commence until after construction of the Storm Water Diversion Structure/Pump Station Facility (Work Area 3; not including site improvements and driveway) has been completed.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01040

COORDINATION WITH OPERATION OF EXISTING FACILITIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. MBC will be in continuous operation throughout the execution of this Contract. The CONTRACTOR, therefore, shall schedule and conduct his work so as to minimize interference with plant operation and maintenance. It is the intent of this Contract that the construction activity, insofar as possible, shall not interfere with the operation of the plant. The CONTRACTOR shall be responsible for coordinating and scheduling the Work in such a sequence that the existing and proposed plant will function properly with no disruption of treatment, bypassing or short-circuiting as specified in Section 01014.

1.2 OPERATIONS WORK PLAN

A. CONTRACTOR shall submit a written Work Plan for each area in specification Section 01014, Work Sequence, two weeks in advance of the time when construction operations will require connection to, or modification of, in-service portions of the existing facility. The plan shall describe the CONTRACTOR's method for preventing bypassing of other treatment units, the length of time required to complete Work for the said operations and the necessary plant and other equipment which the CONTRACTOR shall provide in order to prevent bypassing of associated treatment units. The Work Plan shall address each of the following coordination, planning, and scheduling activities:

1. Emergency procedures to stop accidental bypassing.

2. Planned operational disruptions.

3. Planned utility interruptions including electrical power, natural gas, potable water, and telephone services.

4. Temporary facilities.

5. Process units to be taken out of service.

6. Demolition Plan.

7. Connection of new and existing facilities.

8. Impact on Work sequence and construction schedule.

1.3 COORDINATION WITH OWNER

A. Delays in the construction schedule due to failure of the CONTRACTOR to adequately coordinate the Work with the OWNER sufficiently in advance of the Work shall not be considered as cause for extension of the Contract Time. It shall be the CONTRACTOR's responsibility to continuously keep the Owner informed of the construction schedule as the Work progresses. Submittal of the construction schedule required in Section 01310 shall not relieve the CONTRACTOR of the responsibility to coordinate the Work with the Owner nor give advance notifications as specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. When modifications, additions, or connections to existing facilities is required, the CONTRACTOR shall schedule such activities with the OWNER and CONSTRUCTION MANAGER. No system, structure, tankage, circuit, or individual process unit shall be modified, dewatered, drained, de-energized, or removed from existing facilities unless authorized, in writing, by the CONSTRUCTION MANAGER. Insofar as possible, no interconnections between existing systems and new systems shall be made until all the Work of the new system has been completed, and tested up to the point of interconnection to the existing system in accordance with specification Section 01680.

B. In addition to the normal schedule requirements as specified herein, the CONTRACTOR shall provide the CONSTRUCTION MANAGER two (2) weeks before event with a detailed breakdown and plan of Work activities to be conducted during a disruption period. The CONSTRUCTION MANAGER will then review the plan and advise the CONTRACTOR as to its suitability. Submission of a plan and request for disruption does not require or constitute approval by the OWNER. The OWNER will evaluate operational impacts of the disruption against operational requirements and respond accordingly. Constraints regarding known disruptions are addressed under specification Section 01014, Work Sequence.

C. The CONTRACTOR is expected to take maximum advantage of any component or system disruption. When planning Work for a disruption, all possible Work that can be accommodated by the disruption should be accomplished if practicable. All necessary preparatory Work is to be completed prior to the planned disruption, and all equipment, materials, and personnel needed to satisfy the Work requirements scheduled for the disruption period are to be available prior to initiation of the event. All planned operational disruptions shall be scheduled between the hours of 12:00 a.m. and 8:00 a.m. Disruptions of longer duration or at other times shall require written approval of the OWNER one month in advance of the event.

D. The CONTRACTOR shall connect new electrical equipment with a minimum of interruption to plant services. The CONTRACTOR shall inform the Construction Manger in writing two (2) weeks in advance of event, whenever the power supply must be interrupted to make required connections and shall inform him of the estimated duration of

the interruption. In no case shall the CONTRACTOR cause an intentional power interruption without written authority from the OWNER.

E. No extra payment will be made for any labor, materials, tools, equipment, or temporary facilities required during any disruption periods. All associated costs shall be included in the CONTRACTOR's lump sum base Bid. The CONTRACTOR is responsible for damages suffered by the OWNER as a result of the CONTRACTOR's failure to complete the required work within allotted disruption periods.

2.2 TEMPORARY FACILITIES

A. Whenever disruption of routine plant operation is required to accomplish the Work, the CONTRACTOR shall provide temporary facilities to ensure that all plant flows are accommodated and that treatment requirements are satisfied to the same quality as existing prior to the start of construction. Adequacy of temporary facilities shall be determined by the CONSTRUCTION MANAGER.

B. The CONTRACTOR shall submit to the CONSTRUCTION MANAGER for approval all detailed drawings showing equipment, piping, power, controls, and weather protection for all proposed temporary systems whether described in this section or anticipated by the CONTRACTOR. The submittals shall indicate equipment capacities.

2.3 SUBMITTALS

A. In accordance with specification Section 01300 and in addition to the requirements of that section, the following submittals shall be provided:

1. Area operations Work Plan.
2. Drawings of proposed temporary facilities.

PART 3 – EXECUTION

3.1 OPERATION

A. Unless otherwise specified, normal daily operation and maintenance of the existing wastewater treatment facilities will be performed by plant personnel. Whenever operational functions on existing facilities or new facilities which affect operating systems are required to permit construction operations, these functions will also be performed by plant personnel. The OWNER shall be notified at least 72 hours in advance of the need to operate valves, gates, equipment, or other actions that could affect plant operations.

3.2 TEMPORARY FACILITIES

A. The CONTRACTOR shall not use proposed new equipment in any temporary facility. Temporary facilities shall not be removed from service until the new proposed system has been satisfactorily tested and commissioned as specified in individual technical specification sections and Sections 01680. All temporary facilities shall be removed from

the site by the CONTRACTOR and shall remain the property of the CONTRACTOR when no longer required.

B. The OWNER shall operate all temporary process facilities while they are needed. All maintenance shall be provided by the CONTRACTOR. During the time of use of the temporary facility, the OWNER shall pay for all power and chemicals necessary to operate the systems.

C. All new Work shall be tested and reviewed for start-up by the manufacturer or the CONSTRUCTION MANAGER as appropriate prior to turning off the dewatering system. This requirement includes all pressure relief valves, subdrain systems, pipelines, equipment, and coatings. See Section 01680.

3.3 MODIFICATION OF EXISTING STRUCTURES

A. The CONTRACTOR shall alter or rework existing concrete structures as shown and specified. Generally, when items of equipment and piping are removed, the areas and surfaces from which items were removed shall be left with a neat appearance and finish compatible with surrounding areas, colors, and surfaces. Holes and pipe and conduit penetrations in walls and slabs shall be plugged smooth with grout. The CONTRACTOR shall do all painting, sanding, grouting, sacking, resurfacing, and other work as necessary to comply with the above requirements. Prior to structural modifications, all surfaces shall be subject to inspection by the CONSTRUCTION MANAGER. Colors shall match existing colors as closely as possible.

B. When removing materials or portions of existing structures and when making openings in walls and partitions, the CONTRACTOR shall take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, nor to damage the structures or contents by falling or flying debris.

C. All work of altering existing structures shall be done at such time and in such manner as will comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delay.

D. Where holes in existing masonry are required to be sealed, unless otherwise herein specified, they shall be sealed with cement mortar or concrete. The sides of the openings shall be provided with keyed joints and shall be suitably roughened to furnish a good bond and make a watertight joint. All loose or unsound material adjacent to the opening shall be removed and, if necessary, replaced with new material. The method of placing the mortar seal shall provide a suitable means of releasing entrapped air.

E. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.

F. Nonshrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.

3.4 BURIED PIPELINES

A. Buried pipelines 2 inches in diameter and larger to be abandoned during the course of the work shall be plugged at both ends with expanding grout as detailed on the drawings.

3.5 PERMITS AND EASEMENTS:

A. The CONTRACTOR will obtain the permits and the permanent easements required for the construction of the project. A National Pollutant Discharge Elimination System (NPDES) permit will be required if water from dewatering activities is discharged in local water courses. In addition, the CONTRACTOR shall obtain all temporary easements outside of the OWNER's property required for the CONTRACTOR's operations. The CONTRACTOR shall notify the CONSTRUCTION MANAGER immediately if it becomes apparent a permit or easement cannot readily be obtained.

3.6 DISPOSAL/HANDLING OF HAZARDOUS MATERIALS

A. The CONTRACTOR is solely responsible for storage, use and disposal of materials, including subcontractor materials classified as hazardous substances in accordance with HSWA 1984 and RCRA regulations. The OWNER reserves the right to designate the storage location of the hazardous materials and conduct periodic inspections on the site. The CONTRACTOR, after completion of construction shall remove and dispose of all construction related materials with hazardous waste classifications in accordance with local, state, and federal regulations.

3.7 SECURITY

A. The CONTRACTOR shall at all times be responsible for the security of his facilities and equipment. The OWNER will not take any responsibility for the CONTRACTOR's missing or damaged equipment, tools, or personal belongings.

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DEFINITION

A. "Cutting-and-Patching" is defined to include the cutting and patching of nominally completed and previously existing concrete, steel, wood, and miscellaneous metal structures; piping; and pavement in order to accommodate the coordination of the WORK, or the installation of other facilities or structures or to uncover other facilities and structures for access or inspection, or to obtain samples for testing, or for similar purposes.

1.2 REQUIREMENTS OF STRUCTURAL WORK

A. Structural work shall not be cut or patched in a manner that may result in a reduction of load-carrying capacity or load/deflection ratio.

B. Prior to cutting-and-patching the following categories of work, the CONTRACTOR shall obtain the CONSTRUCTION MANAGER'S approval to proceed:

1. Structural steel

2. Miscellaneous structural metals, including equipment supports, stair systems and similar categories of work

3. Structural concrete

4. Foundation construction

5. Bearing and retaining walls

6. Pressurized piping, vessels and equipment

1.3 OPERATIONAL AND SAFETY LIMITATIONS

A. The CONTRACTOR shall not cut or patch operational elements and safety-related components in a manner that may result in a reduction of capacities to perform in the manner intended or result in decreased operational life, increased maintenance, or decreased safety.

B. Prior to cutting-and-patching the following categories of work, the CONTRACTOR shall obtain the CONSTRUCTION MANAGER'S approval to proceed:

1. Sheeting, shoring and cross bracing

2. Operating systems and equipment

3. Water, moisture, vapor, air, smoke barriers, membranes and flashings

4. Noise and vibration control elements and systems
5. Control, communication, conveying and a electrical wiring systems

6. Fire protection systems

1.4 VISUAL REQUIREMENTS

A. The CONTRACTOR shall not cut or patch work which is exposed on the exterior or exposed in occupied spaces, in a manner that may result in a reduction of visual qualities or resulting in substantial evidence of the cut-and-patch work, both as judged solely by the CONSTRUCTION MANAGER. The CONTRACTOR shall remove and replace work judged by the CONSTRUCTION MANAGER to have been cut or patched in a visually unsatisfactory manner.

1.5 APPROVALS

A. Where prior approval of cutting-and-patching is required, the CONTRACTOR shall submit the request well in advance of time work will be performed. The request should include a description of why cutting-and-patching cannot reasonably be avoided, how it will be performed, how structural elements (if any) will be reinforced, products to be used, firms and tradesmen to perform the work, approximate dates of the work, and anticipated results in terms of structural, operational, and visual variations from the original WORK.

B. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

C. Where cutting-and-patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

D. Approval by the CONSTRUCTION MANAGER to proceed with the cutting-and-patching does not waive the CONSTRUCTION MANAGER'S right to later require complete removal and replacement of a part of the WORK found to be not in accordance with the Contract Documents or industry standards.

PART 2 - PRODUCTS

2.1 MATERIALS USED IN CUTTING-AND-PATCHING

A. The CONTRACTOR shall use material identical with the original materials where feasible. If identical materials are not available, the CONTRACTOR shall provide materials for cutting-and-patching which will result in equal-or-better work than the work being cut-and-patched, in terms of performance characteristics and visual effects where applicable.

B. Materials shall comply with the requirements of the technical specifications wherever applicable.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, the CONTRACTOR shall examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. The CONTRACTOR shall take corrective action before proceeding, if unsafe or unsatisfactory conditions, as determined by the CONSTRUCTION MANAGER, are encountered.

B. Before proceeding, the CONTRACTOR shall meet at the site with all subcontractors involved in cutting and patching, the CONSTRUCTION MANAGER, and any contractors or subcontractors. Areas of potential interference and conflict shall other effected be reviewed and procedures to resolve potential conflicts shall be determined.

3.2 PREPARATION

A. Provide temporary support of work to be cut.

B. Protect existing work during cutting-and-patching to prevent damage. Provide protection from adverse weather conditions for portions of the project that might be exposed during cutting-and-patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork that must remain in service. Do not remove or relocate until provisions have been made to bypass them.

E. Take precaution necessary to prevent fires and to prevent the false activation of fire alarms.

3.3 PERFORMANCE

A. Employ skilled workmen to perform cutting-and-patching. Proceed with cutting-and-patching at the earliest feasible time and complete without delay.

B. Cut existing work to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

C. Cut existing work using methods least likely to damage elements to be retained or adjoining construction. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations. Review as-built or record drawings if available.

D. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

E. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

F. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.

G. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.

H. Bypass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

I. Patch with durable seams that are as invisible as possible. Comply with tolerances as specified in these Contract Documents.

J. Where feasible, inspect and test patch areas to demonstrate integrity of the installation.

K. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that will minimize evidence of patching and refinishing.

L. Where removal of walls or partitions extends from one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.

M. At penetration of fire rated walls, ceilings, or floors, completely seal voids with suitable fire rated material to full thickness of the penetrated element.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting-and-patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

** END OF SECTION **

SECTION 01070

ABBREVIATIONS OF INSTITUTIONS

PART 1 - GENERAL

1.1 GENERAL

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.2 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturer's Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CBM	Certified Ballast Manufacturers
CEMA	Conveyors Equipment Manufacturer's Association

CGA	Compressed Gas Association
CLPCA	California Lathing and Plastering Contractors Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
FPL	Forest Products Laboratory
HI	Hydronics Institute
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IOS	International Organization for Standardization
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission Association
MTI	Marine Testing Institute
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NRCA	National Roofing Contractors Association
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
RIS	Redwood Inspection Service
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSA	Swedish Standards Association
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau

WCRSI	Western Concrete Reinforcing Steel Institute
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

** END OF SECTION **

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 GENERAL

A. **Titles of Sections and Paragraphs:** Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. **Applicable Publications:** Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the WORK is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

C. **Specialists, Assignments:** In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the CONTRACTOR has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the WORK; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with the CONTRACTOR.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the following documents.

B. References herein to "Building Code" or "Uniform Building Code" shall mean Uniform Building Code of the International Conference of Building Officials (ICBO). Similarly, references to "Mechanical Code" or "Uniform Mechanical Code," "Plumbing Code" or "Uniform Plumbing Code," "Fire Code" or "Uniform Fire Code," shall mean Uniform Mechanical Code, Uniform Plumbing Code and Uniform Fire Code of the International Conference of the Building Officials (ICBO). "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the WORK herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the order of precedence as listed in the SSPWC 3-7.2 shall govern. In those cases where a conflict cannot be resolved by utilizing the order of precedence, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the CONSTRUCTION MANAGER for clarification and directions prior to ordering or providing any materials or furnishing labor. The CONTRACTOR's bid shall reflect the most stringent Contract Document requirements.

D. The CONTRACTOR shall construct the WORK specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.

E. **Applicable Standard Specifications**: References in the Contract Documents to "Standard Specifications" or SSPWC shall mean the Standard Specifications for Public Works Construction 2021 and Greenbook 2021.

F. References herein to "OSHA Regulations for Construction" shall mean **Title 29, Part 1926, Construction Safety and Health Regulations,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

G. References herein to "OSHA Standards" shall mean **Title 29, Part 1910, Occupational Safety and Health Standards,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

H. **Applicable Safety Standards:** References herein to "Cal-OSHA" shall mean **State of California, Department of Industrial Relations, Construction Safety Orders,** as amended to date, and all changes and amendments thereto.

1.3 QUALITY ASSURANCE

A. Conform to reference standard by date of issue current on date for receiving bids.

B. Should the specified reference standards conflict with the Contract Documents, refer to paragraph 1.2 (c) of this Section.

1.4 SCHEDULE OF REFERENCES

AA Aluminum Association
1400 Crystal Drive
Suite 430
Arlington, VA 22202

ACI American Concrete Institute
38800 Country Club Dr.
Farmington Hills
Detroit, MI 48331-3439

ABMA American Bearing Manufacturers Association
1101 N. Fairfax Street, Suite 500
Alexandria, VA 22314

AGC	Associated General Contractors of America 2300 Wilson Blvd, Suite 300 Arlington, VA 22201
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480
AISC	American Institute of Steel Construction 130 East Randolph, Suite 2000 Chicago, IL 60611
AISI	American Iron and Steel Institute 25 Massachusetts Ave, NW Suite 800 Washington, DC 20001
ANSI	American National Standards Institute 1899 L Street, NW 11th Floor Washington, DC 20036
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191
ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5990
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive P.O. Box C700 West Conshohocken, PA 19428-2959
AWS	American Welding Society 8669 NW 36 Street, #130 Miami, FL 33166-6672
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173-4758
EJCDC	Engineers Joint Contract Documents Committee American Council of Engineering Companies 1015 15th Street NW, 8th Floor Washington, DC 20005

EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WRSIS) Washington Navy Yard, Building 197 Washington, DC 20407
IEEE	Institute of Electrical and Electronics Engineers 3 Park Ave, 17th Floor New York, NY 10016-5997
NEC	National Electric Code 1 Battery March Park Quincy, MA 02169-7471
NEMA	National Electrical Manufacturers' Association 1300 17th St N #900 Arlington, VA 22209
NFPA	National Fire Protection Association 1 Battery March Park Quincy, MA 02169-7471
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077-1083
PCI	Prestressed Concrete Institute 8770 W. Bryn Mawr Ave, Suite 1150 Chicago, IL 60631
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
UL	Underwriters' Laboratories, Inc. 5007 Lincoln Ave, Lisle, IL 60532

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

** END OF SECTION **

SECTION 01300

CONTRACTOR SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

A. All submittals by the CONTRACTOR shall be submitted to the CONSTRUCTION MANAGER.

B. Unless otherwise noted, within 14 days after the date of commencement as stated in the Notice to Proceed, the CONTRACTOR shall submit the following items to the CONSTRUCTION MANAGER for review:

1. A list of submittals with scheduled submission dates. This list shall include specification section number, description of the submittal, scheduled submission date, and anticipated approval date. The CONTRACTOR's schedule shall be based on a minimum of one resubmittal for each shop drawing and sample.

C. A list of all permits and licenses the CONTRACTOR is required to obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

D. The CONTRACTOR is responsible for identifying and delivering all submittals and/or permits required by the contract documents.

E. CONTRACTOR shall assume all responsibility and cost for changing submittals and/or equipment after their approval by the CONSTRUCTION MANAGER.

F. Thirty (30) calendar days shall be allowed for the Construction Manager or appropriate party for the review of each submittal required by this or any section of the Contract Documents.

1.2 SHOP DRAWINGS

A. Wherever called for in the Contract Documents, the CONTRACTOR shall furnish to the CONSTRUCTION MANAGER for review, electronic or PDF copy of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. The CONTRACTOR shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, and process systems and equipment:

1. Wiring and control diagrams of systems and equipment.

2. Complete manufacturer's specifications, including materials description and paint system.

3. Requirements for storage and protection prior to installation.

4. Installation procedures.

5. List of all requested exceptions to the Contract Documents and/or variations from the specified equipment.

B. All shop drawing submittals shall be accompanied by the CONSTRUCTION MANAGER's standard submittal transmittal form. The form may be obtained from the CONSTRUCTION MANAGER. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for resubmittal.

1. Sequentially number the transmittal forms. Resubmittals shall have original number with an alphabetic suffix.

2. Identify Contract, CONTRACTOR, Subcontractor and/or Supplier; pertinent drawing sheet and detail number(s), and specification section number, as appropriate. On standard drawings or data sheets, clearly indicate model and option being proposed and strike out all non-relevant data.

C. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, as appropriate, prior to transmittal to the CONSTRUCTION MANAGER.

D. Except as may otherwise be indicated herein, the CONSTRUCTION MANAGER will return PDF copy of each submittal to the CONTRACTOR with comments noted thereon, within 30 calendar days following their receipt by the CONSTRUCTION MANAGER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the CONSTRUCTION MANAGER by the second submission of a submittal item. The OWNER reserves the right to withhold monies ($1000.00) due the CONTRACTOR to cover additional costs of the CONSTRUCTION MANAGER's and DESIGN CONSULTANT's review beyond the second submittal. The CONSTRUCTION MANAGER's and DESIGN CONSULTANT's maximum review period for each submittal, will be 30 days per submittal and the CONTRACTOR's resubmittal shall be made within 30 days. Therefore, for a submittal that requires a second submittal before it is complete, the maximum period for that submittal could be 90 days.

E. If returned copies of a submittal are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.

F. If returned copies of a submittal are returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required, unless specifically required.

G. If a submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the CONSTRUCTION MANAGER.

H. Fabrication of an item shall be commenced only after the DESIGN CONSULTANT has reviewed the pertinent submittals and the CONSTRUCTION MANAGER has returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as

changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

I. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the CONSTRUCTION MANAGER. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the CONSTRUCTION MANAGER of any CONTRACTOR submittals will be made for any items which have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the CONSTRUCTION MANAGER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

J. The CONSTRUCTION MANAGER's and DESIGN CONSULTANT's review of CONTRACTOR shop drawing submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

K. The CONSTRUCTION MANAGER may schedule a submittal conference to provide for a rapid review of a submittal, should the project schedule warrant such a review. The CONSTRUCTION MANAGER, DESIGN CONSULTANT, CONTRACTOR, and a qualified manufacturer's representative shall attend the submittal conference.

1.3 CONTRACTOR'S SCHEDULE

A. The CONTRACTOR's construction schedules and reports shall be prepared and submitted to the CONSTRUCTION MANAGER in accordance with the provisions of Section 01311.

1.4 SAMPLES

A. Whenever, in the Specifications, samples are required, the CONTRACTOR shall submit not less than 4 samples of each such item or material to the CONSTRUCTION MANAGER for review by the DESIGN CONSULTANT.

B. Samples, as required herein, shall be submitted for acceptance a minimum of 30 days prior to ordering such material for delivery to the job site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the WORK.

C. All samples submitted to the CONSTRUCTION MANAGER shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and the Manufacturer's name for identification. Upon receiving acceptance of the DESIGN CONSULTANT, 2 sets of the samples will be returned to the CONTRACTOR by the CONSTRUCTION MANAGER. One set of samples will be retained by the DESIGN CONSULTANT, and one set of samples shall remain at the job site with the CONSTRUCTION MANAGER until completion of the WORK.

D. Unless indicated otherwise, all colors and textures of specified items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract time or price, the CONTRACTOR will clearly indicate same on the transmittal page of the submittal.

1.5 OWNER'S MANUAL

A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the OWNER'S MANUAL. The OWNER'S MANUAL shall be written so that it can be used and understood by the OWNER'S operation and maintenance staff.

B. The OWNER'S MANUAL shall be subdivided first by specification section number; second, by equipment item; and last, by "part." "Parts" shall conform to the following (as applicable):

1. Part 1 - Equipment Summary

a. Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

b. Form: The CONSTRUCTION MANAGER will supply an Equipment Summary Form for each item of mechanical, electrical and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

2. Part 2 - Operational Procedures

a. Procedures: Manufacturer-recommended procedures for the following shall be included in Part 2:

Installation
Adjustment
Start-up
Location of controls, special tools or other equipment required Related instrumentation needed for operation
Operating Procedures
Load Changes
Calibration
Shutdown
Troubleshooting
Disassembly
Reassembly
Realignment
Testing to determine performance efficiency
Tabulation of proper settings for all pressure relief valves, low and high pressure switches and other protection devices
List of all electrical relay settings including alarm and contact settings

3. Part 3 - Preventive Maintenance Procedures

a. Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component and by leaving the equipment in place.

b. Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade and type, and temperature ranges shall be covered.

4. Part 4 - Parts List

a. Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

b. Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

5. Part 5 - Wiring Diagrams

a. Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

6. Part 6 - Shop Drawings

a. Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.

7. Part 7- Safety

a. Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

8. Part 8 - Documentation

a. All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

C. The CONTRACTOR shall furnish to the CONSTRUCTION MANAGER 7 identical OWNER'S MANUALS. Each set shall consist of one or more volumes, each of which shall be labeled and bound in a standard size, 3-ring, loose leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents indicating all equipment in the manuals shall be prepared.

D. OWNER'S MANUALS shall be submitted in final form to the CONSTRUCTION MANAGER not later than the 75 percent of construction completion date. All discrepancies found by the CONSTRUCTION MANAGER in the OWNER'S MANUALS shall be corrected by the CONTRACTOR within 30 days from the date of written notification by the CONSTRUCTION MANAGER.

E. Incomplete or unacceptable OWNER'S MANUALS at the 75 percent construction completion point shall constitute sufficient justification to withhold the amount stipulated in Section 01700 from any monies due the CONTRACTOR.

F. When available from the equipment vendor, the CONTRACTOR shall submit one copy of available sections of the final OWNER'S MANUALS in an electronic media format. The information shall be provided on a compact disk in Microsoft Word format.

1.6 SPARE PARTS LIST

A. The CONTRACTOR shall furnish to the CONSTRUCTION MANAGER 7 copies of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the OWNER in inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be labeled and bound in standard size, 3-ring, loose leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

1.7 SAFETY PLAN

A. Prior to the performance of any work the CONTRACTOR will submit to the CONSTRUCTION MANAGER for review and comment two copies of a contract specific Safety/Health and Security Plan signed by an officer of the CONTRACTOR's organization. Adequacy is the responsibility of the CONTRACTOR. See Section 01520 for the required safety plan content.

B. Contractor required to submit and have approved a Job Safety Analysis (JSA). It should be noted that some of the work will be in confined space and in the vicinity of an inactive landfill where methane gases may be present. A JSA is required for, but not limited to, the following:

1. Concrete pours, reinforced steel, structural steel, excavations, trenching and shoring, forms, protective coatings, start-up procedures, roof work, dewatering, cranes and rigging, and demolition.

C. All employees that work at MBC are required to attend a MBC specific safety orientation meeting prior to any work. Any employee of any firm (prime and subcontractors alike) doing work at MBC must attend the short orientation class. Only those employees reporting to work at MBC must take the class.

1.8 Not Used

1.9 CHECKOUT PLAN

A. Submit a Checkout Plan as described in Section 01680, Physical Checkout; Shop, Field, and Functional Testing. The Checkout Plan shall define the sequence and schedule and procedures for physical checkout, shop testing, field testing, and functional testing of equipment and systems.

1.10 RECORD DOCUMENTS

A. The CONTRACTOR shall maintain and submit Record Documents in accordance with Section 01050, Field Engineering. Failure of the CONTRACTOR to maintain updated Record Documents shall result in delaying the CONTRACTOR'S monthly progress payments until the Record Documents are updated.

1.11 CONSTRUCTION FACILITIES PLAN

A. The CONTRACTOR shall submit a Construction Facilities Plan in accordance with Section 01505, Mobilization.

1.12 QUALITY CONTROL PLAN

A. The CONTRACTOR shall submit a Quality Control Plan in accordance with Section 01400, Quality Control.

1.13 EQUIPMENT INVOICES

A. San Diego Gas and Electric Company recently established an energy incentive program that enables the OWNER to obtain rebates for utilizing original energy efficient equipment. To receive these rebates, the OWNER is required to submit invoices from the original equipment manufacturer for these energy-saving items.

B. The CONTRACTOR shall submit original equipment manufacturer invoices to the CONSTRUCTION MANAGER for the following equipment:

1. All electric motors equal to or greater than 1 horsepower
2. All variable frequency drives

Failure of the CONTRACTOR to submit the above invoices to the CONSTRUCTION MANAGER prior to the date of Substantial Completion shall result in the CONTRACTOR being liable to the OWNER for any rebates due the OWNER. The CONSTRUCTION MANAGER will prepare a deductive change order, and the amount of any such rebate shall be deducted from monies due the CONTRACTOR.

1.14 PRECONSTRUCTION AUDIO/VISUAL RECORDING

A. The CONTRACTOR shall submit an audio/visual recording of the conditions of the construction area and easements obtained for project construction and the municipal roadways utilized for access to the construction site prior to the initiation of construction. The recording shall be made by the CONTRACTOR in the presence of the CONSTRUCTION MANAGER and other interested parties.

B. The extent of the audio/visual recording shall include, as a minimum, the construction area and easements obtained for project construction.

C. After the Contract is awarded and before starting the WORK, the CONTRACTOR shall make a thorough examination of all existing buildings, structures, and other improvements in the vicinity of the WORK as applicable, which might be damaged by construction operations, and at this time shall conduct a preconstruction audio/video documentation as follows:

1. The preconstruction audio/video documentation shall be conducted utilizing high resolution color video equipment specifically designed for this type of survey to provide a detailed record of preconstruction conditions. The documentation shall be on color video recording with an audio commentary and on-screen composite alphanumeric data, including time, date, station, location, and direction of travel and view. These data shall be recorded as "transparent" characters, without the use of

block out areas on the video image. The data shall be simultaneously and continuously generated so that subsequent editing or modifications of the documentation cannot be made without detection.

2. Make continuous inspection in the area of construction. At appropriate points, the property shall be viewed with a systematic combination of wide angle and close up views. Particular attention shall be given to existing damage, irregularities, high risk potential features and improvements. Features shall be viewed, with simultaneous recording of appropriate and objective audio remarks for enhancement, description and clarification of the video images. The continuous nature of the video, combined with the digital display, shall leave no doubt on close-up views as to the exact position and location of the object being viewed.

D. The above records and audio-visual recording are intended for use as indisputable evidence in ascertaining the extent of any damage which may occur as a result of the CONTRACTOR's operations and are for the protection of the CONTRACTOR and the OWNER. The recording will be a means of determining whether and to what extent damage, resulting from the CONTRACTOR's operations, occurred during the WORK. Prior to beginning construction, all records and audio-visual recording shall be turned over to and become the sole property of the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULING FOR SUBMITTALS

The CONTRACTOR is responsible for scheduling the time and sequence related to the submittals required to meet the contract required interim milestones completion dates The CONTRACTOR will not be allowed additional contract time or compensation due to delays associated with submittal approval time and time required for resubmittals. The costs associated with multiple reviews of a submittal may be withheld from monies due the CONTRACTOR by the OWNER to cover additional costs for the CONSTRUCTION MANAGER's and DESIGN CONSULTANT's review time.

Material Stock Sheet

Material/Equipment _____

Date Purchased _____

Vendor Name & Address _____

Telephone _____ Contact Person _____

Item Description	Part Number	Replacement Cost	Quantity Supplied

** END OF SECTION **

SECTION 01301

SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 GENERAL

A. This Section defines the process whereby the Schedule of Values (lump sum price breakdown) shall be developed and incorporated into the cost loading function of the CPM Schedule as specified in Section 01311. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.

The Schedule of Values shall be developed independent but simultaneous with the development of the CPM Schedule activities and logic as follows:

1.2 PRELIMINARY SCHEDULE OF VALUES

B. The CONTRACTOR shall submit a preliminary Schedule of Values for the major components of the WORK at the Preconstruction Conference in accordance with Section 01010. The listing shall include, at a minimum, the proposed value for the following major WORK components:

1. Mobilization: Percent of Contract Price.

2. The total value of electrical WORK.

3. The total value of Instrumentation and Control WORK.

4. The total value of Protective Coatings WORK.

5. The total value of yard mechanical WORK inclusive of excavation, pipe installation, testing and backfill of pipe, and all incidental WORK associated with underground pipe installations.

6. The total value of all mechanical WORK, exclusive of yard mechanical WORK included in Item 5 above. This includes all piping, valves, equipment, tanks, and appurtenances at new and existing structures. Additionally, this total value shall be broken down into separate values for each new and existing structure constructed or modified as a part of the WORK.

7. The total value of structural reinforced concrete WORK inclusive of all excavation, dewatering, subgrade preparation, backfill and incidental WORK for all new structures. Additionally, this total value shall be broken down into separate values for each new structure constructed as a part of the WORK. Miscellaneous and minor concrete WORK may be listed as one item in this breakdown.

8. The total value of site civil WORK inclusive of clearing and grubbing, paving, grading and drainage WORK.

9. The total value of all other WORK not specifically included in the above items.

The CONTRACTOR and CONSTRUCTION MANAGER shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the CONSTRUCTION MANAGER, these are necessary to establish fair and reasonable allocation of values for the major WORK components. Front end loading will not be permitted. The CONSTRUCTION MANAGER may require reallocation of major WORK components from items in the above listing if in the opinion of the CONSTRUCTION MANAGER such reallocation is necessary. This review and any necessary revisions shall be completed within 15 days from the date of Notice to Proceed.

2 DETAILED SCHEDULE OF VALUES

A. The CONTRACTOR shall prepare and submit a detailed Schedule of Values to the CONSTRUCTION MANAGER within 30 days from the date of Notice to Proceed. The detailed Schedule of Values shall be based on the accepted preliminary Schedule of Values for major WORK components. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The CONSTRUCTION MANAGER shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the CONSTRUCTION MANAGER, a greater number of Schedule of Values items than proposed by the CONTRACTOR is necessary, the CONTRACTOR shall add the additional items so identified by the CONSTRUCTION MANAGER.

1. The minimum detail of breakdown of the major WORK components is indicated below. Greater detail shall be provided as directed by the CONSTRUCTION MANAGER.

    a. Mobilization - no breakdown required.

    b. Section 01311, "Scheduling and Report," broken down by submittal.

    c. The electrical WORK shall be broken down by structure and yard facilities. Structures electrical WORK shall be broken down into conduit and raceway installation, cable and wire installation, electrical equipment installation, terminations and lighting. Yard facilities shall be broken down by duct bank designation and substations.

    d. Instrumentation and Control WORK shall be broken down by structure.

    e. Protective Coating WORK shall be broken down by structure and yard area. Where specific coating WORK at structures or yard areas may be critical to performing the WORK to meet milestone and Contract dates, such WORK shall be included as individual pay and Schedule activity items.

    f. Yard piping WORK shall be broken down into individual pipelines running from and to Contract termination points. Each pipeline shall be an individual pay item unless otherwise allowed by the CONSTRUCTION MANAGER.

g. Mechanical WORK shall be broken down within each structure to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.

h. Concrete structures shall be broken down into excavation, subgrade preparation, and appurtenant prefoundation WORK, concrete foundation construction, slabs on grade, etc. (sufficient breakdown shall be provided to accommodate necessary Schedule detail), hydrostatic structure testing where required and backfill.

i. Civil site WORK shall be broken down into individual drainage piping, drainage structures, site concrete, paving, excavation cut and fill, removal of existing pipe, clearing and grubbing and any other items determined to be necessary for the establishment of Pay and Schedule Activity items.

j. Equipment testing and plant startup broken down for completion milestones for each.

k. All other WORK not specifically included in the above items shall be broken down as necessary for establishment of pay and Schedule activity items.

The CONTRACTOR and CONSTRUCTION MANAGER shall meet and jointly review the detailed Schedule of Values within 35 days from the date of Notice to Proceed. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to determine if sufficient detail has been proposed to provide cost loading of the CPM Schedule activities. Any adjustments deemed necessary to the value allocation or level of detail shall be made by the CONTRACTOR and a revised detailed Schedule of Values shall be submitted within 40 days from the date of Notice to Proceed.

2. Following acceptance of the detailed Schedule of Values, the CONTRACTOR shall incorporate the values into the cost loading portion of the CPM Schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the Schedule of Values. Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities. Where such instances arise, the CONTRACTOR shall propose changes to the Schedule of Values and to the CPM Schedule activities to satisfy the CPM Schedule cost loading requirements.

3 CROSS REFERENCE LISTING

A. To assist in the correlation of the Schedule of Values and the CPM Schedule, the CONTRACTOR shall provide a Cross Reference Listing which shall be furnished in two parts. The first part shall list each Scheduled Activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list

the valued item with the respective Scheduled Activity or Activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values) the total cost for each scheduled item should be indicated.

B. These listings shall be updated and submitted in conjunction with the CPM monthly submittals as stated in Specification Section 01311.

C. Approved change orders reflected in the CPM Schedule shall be incorporated into the Schedule of Values as a single unit identified by the change order number.

4 CHANGES TO SCHEDULE OF VALUES

A. Changes to the CPM Schedule which add activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the CONSTRUCTION MANAGER. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the CONSTRUCTION MANAGER.

B. In the event that the CONTRACTOR and CONSTRUCTION MANAGER agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

5 LIQUIDATED DAMAGES

A. The Schedule of Values information is an integral part of the scheduling and reporting under Section 01311 and the progress payment information. As such, it is critical information to evaluating the project's progress and the proper planning of the OWNER'S and CONSTRUCTION MANAGER'S work effort as well as their financial obligations associated with this project. Accordingly, if any submittal required by this Section is found to be incomplete or is submitted later than required, the OWNER will suffer financial loss and, accordingly, liquidated damages will be assessed against the CONTRACTOR in accordance with Article 3 of the Agreement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

** END OF SECTION **

SECTION 01311

SCHEDULING AND REPORTING

PART 1 - GENERAL

1.1 GENERAL

A. The scheduling of the WORK under the Contract shall be performed by the CONTRACTOR in accordance with the requirements of this Section. The development of the schedule, the cost loading of the schedule, monthly payment requisitions and project status reporting requirements of the Contract shall employ computerized Critical Path Method (CPM) scheduling. The CPM Schedule shall be cost loaded based on the schedule of values as approved by the CONSTRUCTION MANAGER in accordance with the requirements of Section 01301. The CPM schedule and all reports should be prepared with "Primavera 6" software. Where submittals are required hereunder, the CONTRACTOR shall submit four copies of each submittal item.

1.2 QUALIFICATIONS

A. The CONTRACTOR shall attach a statement of computerized CPM capability to the Bid Forms in accordance with Section 00300, "Bid Forms - Bid" and shall verify that either the CONTRACTOR has in-house capability qualified to use CPM technique and the "Primavera 6" software or that the CONTRACTOR will employ a CPM consultant so qualified. In either event the statement shall identify the individual who will perform the CPM scheduling. Capability shall be verified by description of construction projects on which the individual has successfully applied computerized CPM and shall include at least two projects of similar nature, scope and value not less than one-half the Total Bid Price of this project. The statement shall also provide the contact persons for the referenced projects with current telephone and address information.

1.3 INITIAL SCHEDULE SUBMITTALS

A. The CONTRACTOR shall submit two short term schedule documents at the Preconstruction Conference which shall serve as the CONTRACTOR'S Plan of Operation for the initial 60 day period of the Contract Time and to identify the manner in which the CONTRACTOR intends to complete all work within the Contract Time. The CONTRACTOR shall submit (1) a 60-day Plan of Operation bar chart, and (2) a project overview bar chart type plan for all work as indicated below.

1. 60-Day Plan of Operation: During the initial 60 days of the Contract Time, the CONTRACTOR shall conduct Contract operations in accordance with the 60 day bar chart Plan of Operation. The bar chart so prepared and submitted shall show the accomplishment of the CONTRACTOR'S early activities (mobilization, permits, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, CPM submittals, initial site work and other submittals and activities required in the first 60 days).

2. **Project Overview Bar Chart**: The overview bar chart shall indicate the major components of the project work and the sequence relations between major components and subdivisions of major components. The overview bar chart shall indicate the relationships and time frames in which the various components of the

WORK will be made substantially complete and placed into service in order to meet the project milestones. Sufficient detail shall be included for the identification of subdivisions of major components into such activities as (1) excavation, (2) foundation subgrade preparation, (3) completion of all precast concrete structures, (4) completion of all structural concrete, (5) major mechanical work, (6) major electrical work, (7) instrumentation and control work, and (8) other important work for each major facility within the overall project scope. Planned durations and start dates shall be indicated for each work item subdivision. Each major component and subdivision component shall be accurately plotted on time scale sheets not to exceed 36-inch by 60-inch in size. Not more than four sheets shall be employed to represent this overview information.

The CONSTRUCTION MANAGER and the CONTRACTOR shall meet to review and discuss the 60-day Plan of Operation and project overview bar chart within 5 days after they have been submitted to the CONSTRUCTION MANAGER. The CONSTRUCTION MANAGER'S review and comment on the schedules shall be limited to Contract conformance (with the sequencing and milestone requirements as stated in Section 01010). The CONTRACTOR shall make corrections to the schedules necessary to comply with the Contract requirements and shall adjust the schedules to incorporate any missing information requested by the CONSTRUCTION MANAGER.

1.4 CPM SCHEDULE SUBMITTALS

A. **Original CPM Schedule Submittal**: With 45 days after the commencement date stated in the Notice to Proceed, the CONTRACTOR shall submit for review by the CONSTRUCTION MANAGER an electronic copy of the CPM Network Schedule and the Computerized Schedule Report tabulations. The information shall contain data compatible with Primavera 6 to generate network diagrams and schedule reports. This submittal shall have already been reviewed and approved by the CONTRACTOR'S Project Manager, Project Superintendent, and the Project Estimator prior to submission. The CPM Schedule shall be a time-scaled network diagram of the "i-j" activity-on-arrow or precedence type. The Network Diagram shall describe the activities to be accomplished and their logical relationships and show the Critical Path. The CONTRACTOR'S attention is directed to the requirement that the schedule shall contain sufficient detail and information to cost load the CPM schedule in accordance with the approved schedule of values as specified under Section 01301. Each installation and site work activity shall have been cost loaded as specified.

As stated in Paragraph 1.6 herein, all float indicated in the schedule shall belong to the project. The Computerized Schedule Report tabulations shall include the following:

1. Report of activities sorted by Activity Number. Activity Numbers, where practical, shall correlate to the Area Numbers designated in the Contract Drawings and further defined in Section 01010.

2. Report of activities sorted by Early Start date.

3. Report of activities sorted by Total Float.

4 Report of activities sorted by Responsibility Code. Responsibility Codes shall be established for the CONTRACTOR, CONSTRUCTION MANAGER, OWNER, subcontractors, suppliers, etc. These codes shall be identified in the Network Diagram.

5. A successor-predecessor report which shall identify the successor and predecessor activities for each activity and ties between schedule activities.

B. **Original CPM Schedule Review Meeting**: The CONTRACTOR shall, within 55 days from the commencement date stated in the Notice to Proceed, meet with the CONSTRUCTION MANAGER to review the original CPM schedule submittal. The CONTRACTOR shall have his Project Manager, Project Superintendent, and the Project Scheduler in attendance. The meeting will take place over a continuous [three-day] period. The CONSTRUCTION MANAGER'S review will be limited to the submittal's conformance to the Contract requirements. However, the review may also include:

1. Clarifications of the design intent, process, and startup requirements.

2. Directions to include activities and information missing from the submittal.

3. Requests to the CONTRACTOR to clarify his schedule.

C. **Revisions to the Original CPM Schedule**: Within 65 days after the commencement date stated in the Notice to Proceed, the CONTRACTOR shall have revised the original CPM schedule submittal to address all review comments from the original CPM schedule review meeting and resubmit the network diagrams and reports for the CONSTRUCTION MANAGER'S review. The CONSTRUCTION MANAGER, within 14 days from the date that the CONTRACTOR submitted his revised schedule will either (1) accept the schedule and cost loaded activities as submitted, or (2) advise the CONTRACTOR in writing to review any part or parts of the schedule which either do not meet the Contract requirements or are unsatisfactory for the CONSTRUCTION MANAGER to monitor the project's progress and status or evaluate monthly payment requests by the CONTRACTOR. The CONSTRUCTION MANAGER may accept the schedule with conditions that the first monthly CPM schedule update be revised to correct deficiencies identified. When the schedule is accepted, it shall be considered as the "Original CPM Construction Schedule" until an updated schedule has been submitted. The OWNER reserves the right to require that the CONTRACTOR adjust, add to, or clarify any portion of the schedule which may later be discovered to be insufficient for the monitoring of the WORK or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions or clarifications.

D. **Acceptance**: The acceptance of the CONTRACTOR'S schedule by the CONSTRUCTION MANAGER and OWNER will be based solely upon the schedule's compliance with the Contract requirements. By way of the CONTRACTOR assigning activity durations and proposing the sequence of the WORK, the CONTRACTOR agrees to utilize sufficient and necessary management and other resources to perform the work in accordance with the schedule. Upon submittal of a schedule update, the updated schedule shall be considered the "current" project schedule.

Submission of the CONTRACTOR'S progress schedule to the OWNER or CONSTRUCTION MANAGER shall not relieve the CONTRACTOR of his total responsibility for scheduling, sequencing, and pursuing the WORK to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed work.

E. **Monthly Updates and Periodic CPM Schedule Submittals**: Following the acceptance of the CONTRACTOR'S Original Construction Schedule, the CONTRACTOR shall monitor the progress of the WORK and adjust the schedule each month to reflect actual progress and any changes in planned future activities. Each schedule update submitted must be complete including all information requested in the original schedule submittal and that shown in Paragraph 1.7. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect the "as built" information by indicating when the work was actually started and completed.

Neither the submission nor the updating of the CONTRACTOR'S original schedule submittal nor the submission, updating, change or revision of any other report, curve, schedule or narrative submitted to the CONSTRUCTION MANAGER by the CONTRACTOR under this Contract, nor the CONSTRUCTION MANAGER'S review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying, in any way, the Contract completion date or milestone dates or of modifying or limiting, in any way, the CONTRACTOR'S obligations under this Contract. Only a signed, fully executed change order can modify these contractual obligations.

The monthly schedule update submittal will be reviewed with the CONTRACTOR during a monthly construction progress meeting held on the twentieth (20th) work day of each month. The goal of these meetings is to enable the CONTRACTOR and the CONSTRUCTION MANAGER to initiate appropriate remedial action to minimize any known or foreseen delay in completion of the WORK and to determine the amount of WORK completed since the last month's schedule update. The status of the WORK will be determined by the percent complete of each activity shown in the Network Diagram. These meetings are considered a critical component of the overall monthly schedule update submittal and the CONTRACTOR shall have appropriate personnel attend. As a minimum, these meetings shall be attended by the CONTRACTOR'S Project Manager and General Superintendent. The CONTRACTOR shall plan on the meeting taking no less than six (6) hours. Within seven (7) working days after the monthly progress meeting, the CONTRACTOR shall submit the revised CPM Network Diagram, the revised CPM computerized tabulations as noted in this Section, the revised successor/predecessor report, the Project Status Reports as defined by Paragraph 1.8 of this Section and the CONTRACTOR'S Application for Payment. Within five (5) working days of receipt of the above noted revised submittals, the CONSTRUCTION MANAGER will either accept or reject the monthly schedule update submittal. If accepted, the percent complete shown in the monthly update will be the basis for the Application for Payment to be submitted by the CONTRACTOR. If rejected, the update shall be corrected and resubmitted by the CONTRACTOR before the Application for Payment for the update period can be processed.

F. **Schedule Revisions**: The CONTRACTOR shall highlight or otherwise identify all changes to the Network Diagram Schedule Logic or activity durations made from the previous schedule. The CONTRACTOR shall modify any portions of the CPM schedule which become infeasible because of activities behind schedule or for any other valid reason.

1.5 CHANGE ORDERS

A. Upon approval of a change order, or upon receipt by the CONTRACTOR of authorization to proceed with additional work, the change shall be reflected in the next submittal of the CPM schedule by the CONTRACTOR. The CONTRACTOR shall utilize a sub-network in the schedule depicting the changed work and its effect on other activities. This sub-network shall be tied to the main network with the appropriate logic so that a true analysis of the Critical Path can be made.

1.6 CPM STANDARDS

A. **Definitions**: CPM, as required by this Section, shall be interpreted to be generally as outlined in the Association of General Contractors (AGC) publication, "The Use of CPM in Construction." except that either "i-j" arrow diagrams or precedence diagramming format may be utilized. In the case of conflicts between this specification and the AGC Document, this specification shall govern.

B. **Construction Schedules**: Construction schedules shall include a graphic network diagram and computerized construction schedule reports as described in Paragraph 1.8.

C. **Networks**: The CPM network shall be in a form of a time scaled "i-j" activity-on-arrow or precedence type diagram and may be divided into a number of separate sheets with suitable match lines relating the interface points among the sheets. Individual sheets shall not exceed 36-inch by 60-inch.

D. All construction activities and procurement shall be indicated in a time-scaled format and a calendar time line shall be shown along the entire sheet length. Each activity arrow or node shall be plotted so that the beginning and completion dates of each activity are accurately represented along the calendar time line. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities and free float for each non-critical activity. All activity items shall be identified by their respective Activity Number, Responsibility Code, Work Duration, and their Dollar Value. All non-critical path activities shall show their total float time in scale form by utilizing a dotted line or some other graphical means.

E. **Duration Estimates**: The duration estimate indicated for each activity shall be computed in working days and shall represent the single best estimate considering the scope of the activity work and resources planned for the activity. Except for certain non-labor activities, such as curing of concrete or delivery of materials, activity duration shall not exceed 10 working days nor be less than one working day unless otherwise accepted by the CONSTRUCTION MANAGER.

F. **Float Time**: Float time shall be as follows:

1. Definition: Unless otherwise provided herein, float as referenced in these documents, is total float. Total float is the period of time measured by the number of working days each non-critical path activity may be delayed before it and its succeeding activities become part of the critical path. If a non-critical path activity is delayed beyond its float period, that activity then becomes part of the critical path and controls the end date of the project. Thus, the delay of the non-critical path activity beyond its float period will cause delay to the project itself.

2. Float Ownership: Neither the OWNER nor the CONTRACTOR owns the float time. The project owns the float time. As such, liability for delay of the project completion date rests with the party actually causing delay to the project completion date. For example, if Party A uses some, but not all of the float time and Party B later uses the remainder of the float time as well as additional time beyond the float time, Party B shall be liable for the costs associated with the time that represents a delay to the project's completion date. Party A would not be responsible for any costs since it did not consume all of the float time and additional float time remained, therefore, the project's completion date was unaffected.

1.7 SCHEDULE REPORTS (FORMAT)

A. **Schedule Reports**: Schedule Reports shall be prepared based on the Construction Schedule, and shall include the following minimum data for each activity:

1. Activity Numbers and Responsibility Codes.
2. Work Order No.
3. CIP No.
4. Estimated Activity Duration.
5. Activity Description.
6. Activity's Percent Completion.
7. Early Start Date (Calendar Dated).
8. Early Finish Date (Calendar Dated).
9. Late Start Date (Calendar Dated).
10. Late Finish Date (Calendar Dated).
11. Status (Whether Critical).
12. Total Float for Each Activity.
13. Free Float for Each Activity.
14. Cost Value for Each Activity.

B. **Project Information**: Each Schedule Report shall be prefaced with the following summary data:

1. Project Name.
2. Contractor.
3. Work Order No.

4. CIP No.

5. Type of Tabulation.

6. Project Duration.

7. Contract Completion Date (revised to reflect time extensions).

8. The Commencement Date Stated in the Notice to Proceed.

9. The Data Date and Plot Date of the Network Diagram.

10. If an update, cite the new schedule completion date.

1.8 PROJECT STATUS REPORTING

A. In addition to the submittal requirements for the CPM scheduling identified in this Section, the CONTRACTOR shall provide monthly project status reports (Overview Bar Chart and a written narrative report) to be submitted in conjunction with the revised CPM Schedules as specified in Paragraph 1.4. Status reporting shall be in the form specified below.

B. The CONTRACTOR shall prepare and submit monthly an Overview Bar Chart schedule of the major project components. The overview bar chart schedule shall be a summary of the current CPM schedule (original and as updated and adjusted throughout the entire construction period). It shall be limited to not more than four sheets which shall not exceed 36-inch by 60-inch. The major project components shall be represented as time bars which shall be subdivided into various types of work including demolition, excavation and earthwork, yard piping, concrete construction, mechanical, electrical and instrumentation installations. Major components shall include each new structure by area designation, sitework, modifications to existing structures, tie-ins to existing facilities and plant startups.

Each major component and subdivision shall be accurately time scale plotted consistent with the project overview bar chart specified above. It shall represent the same status indicated by early start and finish activity information contained in the latest update of the CPM schedule. In addition, a percent completion shall be indicated for each major component and subdivision. The initial submittal of the overview bar chart schedule shall be made at the time that the revised original CPM schedule is submitted to the CONSTRUCTION MANAGER (65 days from the commencement date stated in the Notice to Proceed). The CONTRACTOR shall amend the overview schedule to include any additional detail required by the CONSTRUCTION MANAGER. The CONTRACTOR shall include any additional information requested by the CONSTRUCTION MANAGER at any time during the construction of the WORK.

C. The CONTRACTOR shall prepare monthly written narrative reports of the status of the project for submission to the CONSTRUCTION MANAGER. Written status reports shall include:

1. The status of major project components (Percent Complete, amount of time ahead or behind schedule) and an explanation of how the project will be brought back on schedule if delays have occurred.

2. The progress made on critical activities indicated on the CPM schedule.

3. Explanations for any lack of work on critical path activities planned to be performed during the last month.

4. Explanations for any schedule changes, including changes to the logic or to activity durations.

5. A list of the critical activities scheduled to be performed in the next two month period.

6. The status of major material and equipment procurement.

7. The value of materials and equipment properly stored at the site, but not yet incorporated into the work-in-place.

8. Any delays encountered during the reporting period.

9. An assessment of inclement weather delays and impacts to the progress of the WORK.

The CONTRACTOR may include any other information pertinent to the status of the project. The CONTRACTOR shall include additional status information requested by the CONSTRUCTION MANAGER.

1.9 INCLEMENT WEATHER PROVISIONS OF THE SCHEDULE

A. The CONTRACTOR'S construction schedule shall include at least 10 lost days on the CPM schedule's critical path due to inclement weather. Inclement weather delays shall be determined as specified in Section 00800.

1.10 LIQUIDATED DAMAGES

A. If any submittal required by this Section is determined by the CONSTRUCTION MANAGER to be incomplete or is submitted later than required, the OWNER will suffer financial loss and, accordingly, liquidated damages will be assessed against the CONTRACTOR in accordance with Article 3 of the Agreement.

PART 2 -- PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.1 DEFINITION

A. Specific quality control requirements for the WORK are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the WORK beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

1.2 PROJECT QUALITY CONTROL PLAN

A. The CONTRACTOR is responsible for producing WORK to meet the quality required by the contract documents and to perform the quality control efforts necessary to ensure those requirements are met. The CONSTRUCTION MANAGER's inspection of any WORK will not relieve the CONTRACTOR of the primary responsibility for such efforts.

B. The CONTRACTOR shall submit to the CONSTRUCTION MANAGER a Quality Control Plan for review and approval within 21 days of the Notice to Proceed. The submittal must be approved before construction WORK begins. The Quality Control Plan will include:

1. A description of the workings and structure of the CONTRACTOR's Quality Control Plan that will be implemented to assure quality WORK will be done.

2. A contract specific Inspection Plan that lists and describes the inspections that the CONTRACTOR will conduct, their frequency, acceptance criteria, and who will conduct each inspection. The Inspection Plan shall include the WORK to be performed by subcontractors, fabricators, and suppliers.

3. Identification of the individuals within the CONTRACTOR's organization who are responsible for quality assurance including their role and authority.

After completion of the CONSTRUCTION MANAGER's review of the CONTRACTOR's Quality Control Plan, the CONTRACTOR and CONSTRUCTION MANAGER will meet to discuss and define quality standards and expectations and to coordinate the CONSTRUCTION MANAGER's inspection efforts with the CONTRACTOR's planned efforts.

C. The CONTRACTOR's attention is directed to the Check Out Plan required by Specification Section 01680. At the CONTRACTOR's option, the Physical Checkout and Inspection portion of the Check Out Plan may be addressed in the Project Quality Plan as long as all elements of the Check Out Plan required by Specification Section 01680 are addressed in the Project Quality Control Plan.

D. The CONTRACTOR will be obligated to accommodate procedural changes to contract required quality control issues requested by the CONSTRUCTION MANAGER.

1.3 TESTING AND INSPECTION AT PLACE OF MANUFACTURE

A. The OWNER will provide all inspection and testing services within 50 miles of the geographical limits of the City of San Diego.

B. When required by the Special Provisions, regulatory permits, codes, or as noted on the plans or specifications, the OWNER / CONSTRUCTION MANAGER may elect to perform inspection and witness tests on materials, products, or equipment at the place of manufacture. The CONTRACTOR shall bear all costs for inspection and for witnessing factory tests by the OWNER's / CONSTRUCTION MANAGER's representatives as nominated by the OWNER. These costs shall include travel expenses, and expenses for lodging, meals, and car rental. If air travel is involved, it shall include coach class tickets. Costs paid by the CONTRACTOR for inspection and for witnessing factory tests shall not include the salaries or salary-related expenses of the inspectors.

C. The presence of the OWNER's / CONSTRUCTION MANAGER's representatives at the place of manufacture shall not relieve the CONTRACTOR of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents. The CONTRACTOR is obligated to meet the requirements of the Contract Documents, and any act or omission on the part of the OWNER / CONSTRUCTION MANAGER shall not relieve the CONTRACTOR of the obligation to fulfill the requirements of its contract.

D. As a minimum, the CONTRACTOR shall provide the CONSTRUCTION MANAGER and advance notice of fourteen (14) calendar days prior to the start of any testing at the place of manufacture. This notice period may be modified depending on the requirements of each specification section in the technical specifications of the Contract Documents.

E. When tests fail to meet the specified requirements, retesting because of non-conformance to specified requirements shall be performed by the same testing laboratory as directed by the OWNER / CONSTRUCTION MANAGER. The CONTRACTOR shall bear all costs for such retesting, including costs for additional trips for factory inspection and testing by OWNER's / CONSTRUCTION MANAGER's inspectors.

F. For samples and tests required by the CONTRACTOR for its own quality assurance program and needs, whether or not specified in the Contract Documents, costs shall be included in the Contract Price.

G. All other tests required by the specifications, regulatory permits, or referenced codes and standards are the responsibility of the CONTRACTOR, unless specifically noted otherwise.

1.4 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and

nature of the article or materials considered; however, the OWNER reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the CONSTRUCTION MANAGER will insure the OWNER that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by the OWNER of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the CONSTRUCTION MANAGER reserves the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the CONSTRUCTION MANAGER to require the removal or correction and reconstruction of any such work in accordance with the Contract Documents.

1.5 INSPECTION AND TESTING LABORATORY SERVICE

A. The OWNER will provide and pay for the services of an independent testing laboratory to perform routine testing of earth work and concrete at the site, (i.e. soil density; concrete strength, slump, and air content) and perform random tests of other areas previously completed and inspected by CONTRACTOR.

B. The OWNER’s testing laboratory will perform other inspections, testings, and other services specified in the contract documents, to be performed by the OWNER, or as required by the CONSTRUCTION MANAGER. The cost of these services will be paid for by the OWNER.

C. Reports will be submitted by the OWNER’s testing laboratory to the CONSTRUCTION MANAGER in duplicate, indicating observations and results of tests, and indicating compliance or non-compliance with Contract Documents.

D. The CONTRACTOR shall cooperate with the CONSTRUCTION MANAGER and OWNER’s testing laboratory by furnishing samples of materials, concrete design mix, equipment, tools, storage and other assistance as requested.

E. The CONTRACTOR shall notify the CONSTRUCTION MANAGER 24 hours prior to the expected time for operations requiring inspection and laboratory testing services.

F. Retesting required because of non-conformance to specified requirements shall be performed by the same testing laboratory as directed by the CONSTRUCTION MANAGER. The CONTRACTOR shall bear all costs from such retesting at no additional cost to the OWNER.

G. For samples and tests required for the CONTRACTOR's use, the CONTRACTOR shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the CONTRACTOR'S use shall be included in the Contract Price.

H. All tests required by the specifications or referenced codes and standards are the responsibility of the CONTRACTOR, unless specifically noted otherwise.

1.6 SPECIAL INSPECTION

A. The Uniform Building Code requires that special inspections be performed on certain structural elements of the project. The CONSTRUCTION MANAGER will perform all on-site special inspections required by section 306 of the 1991 version of the Uniform Building Code. The cost of these services when provided during normal WORK hours will be paid for by the OWNER.

B. When building components are fabricated off site, the CONTRACTOR must utilize a fabricator approved by the City of San Diego Development Services Department. If the CONTRACTOR elects to utilize a fabricator that is not approved by the Development Services Department, the CONTRACTOR shall provide a special inspector to preform continuous special inspection in the fabricator's shop. The CONTRACTOR shall be responsible for all costs associated with performing special inspection in the fabricator's shop.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

A. **Inspection**: The CONTRACTOR shall inspect materials or equipment upon arrival on the job site and immediately prior to installation. The CONTRACTOR shall reject damaged and defective items. This inspection shall include a review of Contract requirements; a check to assure that all materials and/or equipment have been tested, submitted, and approved; examination of the work area to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to assure that they conform to reviewed shop drawings or submittal data. This inspection shall also include instruction as necessary to assure that workmen know the requirements of the Contract as they pertain to the feature, an examination of the quality of workmanship, as well as a review of control testing for compliance with the Contract requirements.

B. **Measurements**: The CONTRACTOR shall verify measurements and dimensions of the WORK, as an integral step of starting each installation.

C. **Special Procedures:** Methods and facilities shall be provided to assure conformance with requirements for special process specifications such as welding, heat treating and nondestructive testing of materials. Certifications for personnel, procedures, and equipment shall be maintained as required to meet the requirement of the Contract Documents and all applicable codes.

D. **Manufacturer's Instructions**: Where installations include manufactured products, the CONTRACTOR shall comply with manufacturer's applicable instructions and

recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

3.2 MANUFACTURER'S FIELD INSTALLATION SERVICES AND REPORTS

A. When specified in individual specification sections, the CONTRACTOR shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, (test, adjust, and balance of equipment) and to provide instructions when necessary.

B. The CONTRACTOR shall report to the CONSTRUCTION MANAGER in writing any observations and site decisions or instructions given by the manufacturers' representative to the CONTRACTOR that are supplemental or contrary to manufacturers' written instructions.

C. The CONTRACTOR shall submit manufacturer representative's reports (in duplicate) within 10 days of each field visit, to the CONSTRUCTION MANAGER for review. If duration of field visit is greater than one week, submit weekly reports. The final report shall certify that equipment or system has been satisfactorily installed and is functioning correctly.

** END OF SECTION **

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 01505

MOBILIZATION

PART 1 - GENERAL

1.1 GENERAL

A. Mobilization shall include the acquisition of all permits; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the WORK. Mobilization shall include but not be limited to the following principal items:

1. Moving on to the site of all CONTRACTOR'S plant and equipment required for construction operations.

2. Installing temporary construction power, wiring, and lighting facilities.

3. Establishing fire protection system.

4. Developing construction water supply as required.

5. Providing all on-site communication facilities, including telephones and radios for CONTRACTOR personnel.

6. Providing on-site sanitary facilities and potable water facilities for CONTRACTOR personnel.

7. Arranging for and erection of CONTRACTOR'S storage yard as required.

8. Constructing and implementing security features and requirements in compliance with the Contract Documents.

9. Obtaining all required permits.

10. Having all OSHA required notices and establishment of safety programs.

11. Submitting initial submittals.

1.2 CONSTRUCTION FACILITIES PLAN

A. Prior to commencement of any field work, the CONTRACTOR shall submit a Construction Facilities Plan to CONSTRUCTION MANAGER for approval. Said plan shall show the layout, equipment, materials and procedures that CONTRACTOR proposes for construction of temporary electrical, telephone, lighting, heating, water, sanitation, field offices and sheds, and other similar site facilities.

B. The CONTRACTOR's site office and other construction facilities shall be a temporary nature. The CONTRACTOR shall be wholly responsible for the security its site office and laydown area, and for all its plant, materials, equipment and tools at all times.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The CONTRACTOR shall make arrangements with the appropriate utility agencies for temporary connections to the utilities. The CONTRACTOR is responsible for extending any utility services to the required point of use.

B. **Type of Services:** The types of utility services required for general temporary use at the project site, may include but are not limited to the following:

1. Water service

2. Storm sewer

3. Sanitary sewer

4. Electric power service

5. Telephone service

C. **Scheduled Uses:** The CONTRACTOR shall schedule the implementation and termination of service for each temporary utility or facility.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The CONTRACTOR shall provide either new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. Where a portion of a temporary utility is provided for the CONTRACTOR by a utility company, the CONTRACTOR shall provide the remainder with matching and compatible materials and equipment and shall comply with recommendations of the utility company.

PART 3 - EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. **General**: Wherever feasible, the CONTRACTOR shall engage the utility company to install temporary service to the project, or as a minimum, to make connection to existing utility service; shall locate services where they will not interfere with total project construction work, including installation of permanent utility services; shall maintain temporary services

as installed for required period of use; and shall relocate, modify or extend as necessary from time to time during that period as required to accommodate total project construction work.

3.2 ELECTRICAL SERVICE

A. **CONTRACTOR Operations:** The CONTRACTOR shall pay all costs for electrical system installation and usage charges associated with its operations.

B. **Approval of Electrical Connections:** All temporary connections for electricity shall be subject to approval of the CONSTRUCTION MANAGER and the power company representative, and shall be removed in like manner at the CONTRACTOR'S expense prior to final acceptance of the WORK.

C. **Separation of Circuits:** Unless otherwise permitted by the CONSTRUCTION MANAGER, circuits separate from lighting circuits shall be used for all power purposes.

D. **Construction Wiring:** All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Title 8, Industrial Relations, Subchapter 5, Electrical Safety Orders, California Administrative Code; and Subpart K of the OSHA Safety and Health Standards for Construction.

3.3 INSTALLATION OF POWER DISTRIBUTION SYSTEM

A. **Power:** The CONTRACTOR shall provide all necessary power required for its operations under the Contract, at no additional cost to the OWNER.

B. **Temporary Power Distribution**: The CONTRACTOR shall provide a weatherproof, grounded, temporary power distribution system sufficient to accommodate performance of entire WORK of the Contract, including but not necessarily limited to temporary electrical heating where indicated; operation of test equipment and test operation of building equipment and systems which cannot be delayed until permanent power connections are operable; temporary operation of other temporary facilities, including permanent equipment and systems which must be placed in operation prior to use of permanent power connections (pumps, HVAC equipment, elevators, and similar equipment); and power for temporary operation of existing facilities (if any) at the site during change-over to new permanent power system. Provide circuits of adequate size and proper power characteristics for each use; run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations, and result in least interference with performance of the WORK; provide rigid steel conduit or equivalent raceways for wiring which must be exposed on grade, floors, decks, or other recognized exposures to damage or abuse.

C. Provide power outlets for CONTRACTOR'S operations, with transformers, branch wiring and distribution boxes located safely and conveniently for the proposed construction activities. Provide flexible power cords as required.

D. Maintain main service disconnect and overcurrent protection at source distribution equipment.

E. Permanent convenience receptacles may not be utilized during construction.

3.4 INSTALLATION OF LIGHTING

A. **Construction Lighting:** All work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper work and to afford adequate facilities for inspection and safe working conditions.

B. **Temporary Lighting**: The CONTRACTOR shall provide a general, weatherproof, grounded temporary lighting system in every area of construction work, as soon as is practically feasible and provide sufficient illumination for safe work and traffic conditions; and run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations on grade, floors, decks, or other recognized areas of possible damage or abuse.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting shall not be utilized during construction without prior written approval of the CONSTRUCTION MANAGER.

3.5 WATER SUPPLY

A. **General:** The CONTRACTOR shall provide an adequate supply of water of a quality suitable for all domestic and construction purposes. The CONTRACTOR shall provide and operate all pumping facilities, pipelines, backflow preventers, valves, hydrants, storage tanks, and all other equipment necessary for the adequate development and operation of the water supply system. Water used for domestic purposes shall be free of contamination and shall conform to the requirements of the State and local authorities for potable water. The CONTRACTOR shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from the use of same, including discharge or waste of water therefrom.

The CONTRACTOR shall coordinate with the CONSTRUCTION MANAGER for obtaining water service connections. The CONTRACTOR shall at no additional cost to the OWNER, provide all facilities necessary to convey the water from the source to the points of use in accordance with the requirements of the Contract Documents.

Any water capacity charges and wet tap fees shall be paid by the OWNER. The CONTRACTOR shall pay all other water permit fees and any fees for the water meter(s). All charges for water use shall be paid for by the CONTRACTOR. The CONTRACTOR shall coordinate water testing of structures with other contractors on the site in an attempt to reuse water to the maximum extent possible.

As an option, the CONTRACTOR may obtain reclaimed water from the OWNER free of charge, at the convenience of the OWNER. When available, reclaimed water may be used up to a maximum rate of 150 gallons per minute and a total daily use of 75,000 gallons. OWNER does not guarantee the availability of reclaimed water at any time. CONTRACTOR's use of reclaimed water may not interfere with OWNER's operations, and supply may be discontinued without recourse. Reclaimed water use shall only be for underground construction and lift station startup purposes. Use of reclaimed water shall be

coordinated with Gerry Barca, Reclaimed Water Superintendent, at the Metropolitan Biosolids Center.

B. **Water Connections**: The CONTRACTOR shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission of the City of San Diego Water Department. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve, a meter, and a back flow preventer. The necessary equipment may be ordered from the City of San Diego Water Department.

3.6 INSTALLATION OF SANITARY FACILITIES

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of CONTRACTOR'S employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction. A sanitary sewer is available in the area designated for the CONTRACTOR's field office trailer.

B. **Sanitary and Other Organic Wastes**: The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR'S operations shall be disposed of away from the site in a manner satisfactory to the CONSTRUCTION MANAGER and in accordance with all laws and regulations pertaining thereto.

3.7 INSTALLATION OF FIRE PROTECTION

A. **Fire Protection:** All parts of the WORK shall be connected with the CONTRACTOR'S water supply system and shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the WORK, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR'S fire protection program shall conform to the requirements of Article 34, Section 1805, b of Cal-OSHA, and Subpart F of the OSHA Standards for Construction.

3.8 INSTALLATION OF COMMUNICATIONS

A. **Telephone Services:** The CONTRACTOR shall provide and maintain telephone service at its own field construction office during the progress of the WORK. The CONTRACTOR shall pay for all costs associated with its telephone service.

3.9 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity and to prevent accumulation of dust, fumes, vapors or gases.

3.10 OPERATIONS AND TERMINATIONS

A. **Inspections**: Prior to placing temporary utility services into use, the CONTRACTOR shall inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

B. **Protection**: The CONTRACTOR shall maintain distinct markers for underground lines, and protect from damage during excavating operations.

C. **Termination and Removal**: When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, the CONTRACTOR shall promptly remove installation unless requested by CONSTRUCTION MANAGER to retain it for a longer period. The CONTRACTOR shall complete and restore work which may have been delayed or affected by installation and use of temporary utilities, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

D. **Removal of Water Connections:** Before final acceptance of the WORK on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of the CONSTRUCTION MANAGER and to the agency owning the affected utility.

** END OF SECTION **

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 01520

SECURITY & SAFETY

PART 1 - GENERAL

1.1 SECURITY PROGRAM

A. The CONTRACTOR shall:

1. Protect the WORK from theft, vandalism, and unauthorized entry.

2. Initiate a site security system and program, at the time of mobilization onto the work-site, which provides adequate security for site stored and installed material. The Construction Manager shall determine adequacy of the security system. Considerations will include, but not be limited to:

   a. Daily security reports submitted to CONSTRUCTION MANAGER

   b. Full time security bonded guard 24 hours with communication capability at the site location for areas outside the gated perimeter of the MBC facility. Note: The City of San Diego maintains a full-time security service within the gated perimeter of the MBC facility.

3. Maintain the security program throughout the Contract duration.

4. The CONTRACTOR and Subcontractors are wholly responsible for the security of their storage compound and lay-down areas, and for all their plant, material, equipment and tools at all times.

5. Provide the CONSTRUCTION MANAGER with a list of 24 hour emergency phone numbers.

6. Up-to-date inventory of plant material, equipment, and tools will be submitted to the CONSTRUCTION MANAGER as inventory arrives on site.

1.2 ENTRY CONTROL

A. The CONTRACTOR shall:

1. Restrict entry of unauthorized personnel and vehicles onto the project or work site. Maintain copies of vehicle insurance cards or other proof of insurance on-site for vehicles permitted on-site.

2. Allow entry only to authorized persons with proper identification.

3. Maintain a Employee Log and Visitor Log and make the log available to the OWNER on request. This log shall be submitted to the CONSTRUCTION MANAGER bi-weekly or as necessary.

4. Require all visitors to sign the Visitor Acknowledgment of the Public Utilities Department Rules/Visitor Log which includes a release form. Copies of these forms shall be submitted to the CONSTRUCTION MANAGER every two weeks and maintained in the CONTRACTOR's security files on-site.

5. Require all employees to sign the Employee Acknowledgment of Public Utilities Department Rules Log included at the end of this section. All employees, including subcontractor employees and lower tier contractor employees, shall receive a new employee orientation which will include viewing of the Public Utilities Department Program Safety Videotape, additional information on specific hazards and rules related to the job(s) the employees may be exposed to (Videotape will be provided by the CONSTRUCTION MANAGER). Employee participation in the orientation training program shall be acknowledged by employee signature on the Employee Log.

6. The CONSTRUCTION MANAGER has the right to refuse access to the site or request that a person or vehicle be removed from the site if found violating any of the project safety, security conduct rules.

7. Implement a site badging system approved by the CONSTRUCTION MANAGER.

1.3 RESTRICTIONS

A. The CONTRACTOR shall not allow cameras on site or photographs taken except with approval of the OWNER or CONSTRUCTION MANAGER.

1.4 CONTRACTOR'S SAFETY PERSONNEL REQUIREMENTS

A. The CONTRACTOR shall assign an experienced, qualified construction safety representative for this Contract. The site safety representative shall be experienced in construction safety. This person may have other duties and must be of a supervisory level. The site safety representative shall be assigned full-time to the project site location. A resume outlining the qualifications of this person shall be submitted to the CONSTRUCTION MANAGER for review and acceptance prior to the start of work on the job site.

B. The person must be qualified in air monitoring, excavation and trench safety and all areas of general safe work practices.

C. The person shall ensure that all employees, subcontractor employees included, have received a formal new employee orientation.

1.5 HAZARDOUS SUBSTANCES AND THE RIGHT TO KNOW

A. The CONTRACTOR shall:

1. Provide the CONSTRUCTION MANAGER with a list of all hazardous substances which the CONTRACTOR anticipates to bring on site.

2. Provide a Material Safety Data Sheet (MSDS) to the CONSTRUCTION MANAGER prior to arrival of any hazardous substances on the project.

3. Submit for approval and implementation a Spill Control Plan to the CONSTRUCTION MANAGER. Refer to the Public Utilities Department Health and Safety Plan available from the Public Utilities Department Library for detailed requirements.

4. Stage storage area(s) must be approved by CONSTRUCTION MANAGER. Obtain approval of storage areas from the CONSTRUCTION MANAGER prior to storage of any hazardous materials.

1.6 JOB SAFETY ANALYSIS (JSA)

A. The CONTRACTOR shall:

1. Outline the sequence of the work, equipment to be used, identify hazards that may exist or may be created and what procedures and/or safety equipment will be used to eliminate or reduce these hazards. A written SCOPE OF WORK JSA shall be prepared and submitted prior to the start of construction activities on the project. The name of the competent person assigned to this activity will be included in the JSA.

2. Complete a written JSA, when requested by the CONSTRUCTION MANAGER, for any activity which may be of an unusual nature or involves unique hazards (Refer to Public Utilities Department Program Safety and Health Plan).

1.7 REPORTS

A. The CONTRACTOR shall:

1. Provide to the CONSTRUCTION MANAGER copies of the CONTRACTOR'S and all Subcontractors' safety program requirements to include:

a. First Aid Log (monthly)

b. OSHA 200 Injury Log (monthly)

c. Certification of new employee orientation (monthly)

d. Safety meeting reports and topics (monthly)

e. List of competent persons as required by Cal/OSHA and the Project Health and Safety Manual (when updated)

f. Report of weekly safety inspections conducted with the CONSTRUCTION MANAGER safety representative. Deficiencies will be returned to CONTRACTOR within 48 hours indicating corrective actions to be taken

g. Injury and accident reports within 24 hours of any incident. IMMEDIATE notification to the CONSTRUCTION MANAGER of an accident is REQUIRED.

h. Records of employee and supervisor training including subcontractors.

i. Copy of CONTRACTOR'S Safety and Health Plan submitted within 21 days of the Notice to Proceed.

2. A monthly audit of the CONTRACTOR's safety records and performance will be conducted by the CONSTRUCTION MANAGER. The CONTRACTOR's failure to mitigate hazards may be cause for delaying the approval of the monthly progress payment request.

1.8 PUBLIC UTILITES DEPARTMENT HEALTH AND SAFETY PLAN

A. The CONTRACTOR shall comply with the Program Safety and Health Manual.

B. The Program Safety and Health Manual sets forth basic responsibilities, guidelines, rules, and regulations for all personnel involved in the construction of the Public Utilities Department Projects. The manual does not cover the full spectrum of the published safety and health standards which are mandated by law.

C. In the event of a conflict between the provisions of the Program Safety and Health Manual and applicable local, state or federal safety and health laws, regulations and/or standards, or the Contract Documents, the more stringent shall apply.

1.9 PROJECT SITE SECURITY SERVICES AND ACCESS CONTROL

A. The CONTRACTOR shall:

1. Provide plant security service to restrict entry to the project site.

2. Monitor the passage of personnel, vehicles, materials and equipment entering and leaving the project site.

3. Patrol the project site to observe and report unauthorized entry or activities.

B. Specific requirements:

1. One security guard from a bonded security firm or company shall be provided continuously 24 hours/day, every day of the year for the duration of the contract.

2. Security guards shall be neat in appearance and dressed in company uniform at all times. Guard personnel shall be provided by a licensed security company. Each CONTRACTOR guard shall receive an orientation from the CONSTRUCTION MANAGER prior to start of work on this project. New guards shall not commence duties on site before receiving this orientation. All guards must be trained vehicle flaggers.

3. During working hours, the security guard shall be stationed continuously at the site entrance to monitor traffic entering and leaving the site. This guard shall inspect all traffic to ensure that all personnel, vehicles, and equipment possess a

current project identification badge approved for entry to the site. The security guard shall not allow entry to any visitors not properly dressed in long pants, shirt and work boots. At the direction of the CONSTRUCTION MANAGER, the CONTRACTOR's security guard shall perform lunch box and/or vehicle inspection for unauthorized removal of Public Utilities Department property. A security log shall be maintained continuously, and each shift shall prepare a shift report. This report shall be delivered to the CONSTRUCTION MANAGER on a daily basis.

C. Other duties:

The CONTRACTOR's security guard shall respond to requests from the CONSTRUCTION MANAGER to perform additional duties as follows:

1. Direct emergency vehicles or equipment to a pre-designated on-site location.

2. Verify vehicle passes and personnel badges.

3. Monitor labor action and document events, direct personnel, vehicles, materials, and equipment to the proper gate in the event a multiple gate system is implemented.

4. Direct traffic as requested by the CONSTRUCTION MANAGER including off-site traffic as may be required.

5. Monitor security for equipment and/or material temporarily stored along the access road or in the parking area.

6. Maintain a Visitor's Log and direct visitors to the proper offices of the CONSTRUCTION MANAGER or CONTRACTOR for authorization to enter the site.

7. Maintain records of insurance files for all vehicles permitted on-site.

8. Maintain daily security report files.

9. Notify on daily basis the CONSTRUCTION MANAGER of security violations and enter all facts regarding the incident in the Security Log. The Security Log shall be transmitted to the CONSTRUCTION MANAGER on a daily basis.

10. Upon approval by the OWNER, the guard shall assist the CONSTRUCTION MANAGER to remove personnel denied access to the site for violation of site regulations.

11. Enforce parking area regulations and site speed limit and obtain the name/vehicle license number of violators and report violators to the CONSTRUCTION MANAGER.

12. Inspect area lighting on a daily basis and report deficiencies to the CONSTRUCTION MANAGER.

13. Call the CONSTRUCTION MANAGER to report a fire, hazardous material spill, or medical emergency. Report the emergency to the fire department as directed by the CONSTRUCTION MANAGER.

14. Notify the CONSTRUCTION MANAGER of all unusual activities/occurrences.

D. CONTRACTOR provided facilities/equipment:

1. CONTRACTOR shall provide a portable self-contained security office to be placed at the entrance to the site as directed by the CONSTRUCTION MANAGER.

2. The Security Office shall have a cellular telephone until a regular telephone line is installed in the security office by the CONTRACTOR.

3. The Security office shall be equipped with interior and exterior lights. In the event of a power outage, a portable generator shall be provided by the CONTRACTOR until a temporary power line is installed by the CONTRACTOR or full power is returned to the site.

4. A portable toilet shall be provided and maintained by the CONTRACTOR in the vicinity of the Security Office for use of the security Guard.

5. The CONTRACTOR shall provide *a* portable, hand-held radio for on-site communications. If a radio is provided by the CONSTRUCTION MANAGER, the CONTRACTOR shall be responsible for the radio and its charging equipment. Cost of damage or loss while in the CONTRACTOR's control shall be paid by the CONTRACTOR.

6. CONTRACTOR shall provide a vehicle for the security guard to use after normal working hours to patrol the project area.

1.10 CONSTRUCTION MANAGER'S SAFETY RESPONSIBILITIES

A. The CONSTRUCTION MANAGER is responsible for the overall coordination and implementation of safe WORK practices and maintenance of a safe WORK environment at the various construction sites under its control.

B. The CONSTRUCTION MANAGER will ensure CONTRACTOR'S compliance with safety and security regulations and the Contract Documents, as well as maintenance of a safe and healthful WORK environment for employees of the CONTRACTOR and its Subcontractors.

C. The CONSTRUCTION MANAGER will make periodic inspections of each CONTRACTOR's WORK area. When possible, these inspections shall be made in conjunction with the CONTRACTOR's site safety representative. Written reports of all such inspections shall be presented to the affected CONTRACTOR.

D. The CONSTRUCTION MANAGER has authority to take the following actions in the name of the OWNER to maintain a safe and healthful WORK environment from craftsmen and others employed at the construction sites:

1. When presented with instances of imminent danger situation, i.e., activities which could result in death or serious physical injury to the employees or involve the general public, the CONSTRUCTION MANAGER has the authority to stop the WORK until such time as corrective action is taken to eliminate the hazard. In exercising this authority, the CONTRACTOR shall have no recourse against either the OWNER or the CONSTRUCTION MANAGER for any damages that may arise as a result of such stoppage. Established WORK schedules, contract milestones, or contract completion dated will not be extended to accommodate the period of any such stoppage.

2. The CONSTRUCTION MANAGER shall have the authority to effectively recommend to the OWNER the removal from the site of any person who is regarded as a frequent violator of safe work practices, or who fails to ensure persons working under their supervision or in a work place they control are not exposed to serious work hazards. Upon approval by the OWNER, said offender will be removed from the site by the CONTRACTOR's security guard.

3. When confronted with a non-imminent danger violation, the CONSTRUCTION MANAGER will advise the responsible CONTRACTOR of the condition and obtain a date from that CONTRACTOR by which the non-imminent danger condition will be abated. In addition, the responsible CONTRACTOR will erect a temporary barrier or adopt other means to prevent the exposure of its employees and others to the non-imminent danger condition. If the responsible CONTRACTOR fails to take corrective action by the agreed abatement date, the CONSTRUCTION MANAGER has authority to retain the necessary craftsmen to perform the WORK with the costs for all such labor and material being back charged against the responsible CONTRACTOR. In exercising this authority, the CONTRACTOR shall have no recourse against either the OWNER or the CONSTRUCTION MANAGER for any damages that may arise as a result of such stoppage. Established WORK schedules, contract milestones, or contract completion dated will not be extended to accommodate the period of any such stoppage.

E. The CONSTRUCTION MANAGER will assist the City of San Diego Environmental Services Department in the inspection of the construction projects and enforcement of identified violations.

1. The CONSTRUCTION MANAGER will assist the City of San Diego Environmental Services with their inspection.

2. The CONSTRUCTION MANAGER will notify the effected CONTRACTOR of the violations and date for corrective action.

3. If a CONTRACTOR fails to correct the violations in the time allotted, Safety Notice of Non-Compliance will be issued giving the CONTRACTOR 24 hours to comply.

4. Failure to correct these violations will result in the CONSTRUCTION MANAGER retaining services from others to correct the violations and back charge the responsible CONTRACTOR.

F. The CONTRACTOR will indemnify the CONSTRUCTION MANAGER and OWNER against fines, reasonable attorneys' fees, and defense costs resulting from citations issued to the CONSTRUCTION MANAGER by either federal, state, or local safety enforcement agencies due to the CONTRACTOR's failure to abide by applicable safety and health standards.

PART 2 - PRODUCTS

2.1 CONTRACTOR SAFETY AND SECURITY PLAN

A. Prior to the performance of any work the CONTRACTOR will submit to the CONSTRUCTION MANAGER for review and comment two copies of a contract specific Safety/Health and Security Plan signed by an officer of the CONTRACTOR's organization. Adequacy is the responsibility of the CONTRACTOR.

The CONSTRUCTION MANAGER will not review the CONTRACTOR's safety plan for the adequacy of the plan.

The plan shall:

1. identify the person(s) responsible for implementation and enforcement of Safety/Health and Security rules and regulations for this project.

2. generally address safe work procedures for the activities within the CONTRACTOR's scope of work.

3. include a new employee orientation program which addresses job and site-specific rules, regulations and hazards (see page 01520-2).

4. include the CONTRACTOR's Drug Free Workplace Policy.

5. include provisions to protect all of the CONTRACTOR's employees, other persons and organizations who may be affected by the work from injury, damage or loss.

6. comply with current OSHA, Cal OSHA, Project Health and Safety Manual, facility safety program (when applicable), and locally accepted safety codes, regulations and practices.

7. assign a qualified, experienced full-time site safety person when required. This person's resume shall be submitted to the CM for review and acceptance.

8. include a site-specific emergency action and evacuation plan.

9. include Hazard Communication/Right To Know Program.

10. include security procedures for the CONTRACTOR's work, tools, and equipment.

11. include the capability of providing the CONSTRUCTION MANAGER with documentation to show compliance with the CONTRACTOR's plan, plus accidents and investigation reports.

12. address any other contract specific requirement.

B. Provide a Job Safety Analysis (JSA) for the scope of work, prior to the start of work.

C. Review of the CONTRACTOR's Safety Plan by the CONSTRUCTION MANAGER shall not impose any duty or responsibility upon the CONSTRUCTION MANAGER for the CONTRACTOR's performance of the work in a safe manner.

However, if the plan is found by the CONSTRUCTION MANAGER not to meet the requirements established by OSHA, Cal OSHA, the Project Safety Manual, or other applicable codes and regulations, the Plan will be returned for revision. Acceptance of this Plan by the CONSTRUCTION MANAGER is required prior to the start of any site activity. Requests for additional contract time or compensation associated with delays in acceptance of the Plan, start of the work, or implementation of the Plan will not be approved by the OWNER.

D. The CONTRACTOR shall be fully responsible for the safety and health of its employees, its subcontractors and lower tier contractors during performance of its work.

E. The CONTRACTOR shall provide the CONSTRUCTION MANAGER with all safety reports, Job Safety Analysis, training records, safety representative's qualifications, and accident reports prepared in compliance with Cal OSHA and the Project Health and Safety Plan.

PART 3 - EXECUTION (NOT USED)

VISITOR
ACKNOWLEDGMENT OF THE PUBLIC UTILITES DEPARTMENT RULES

By Signing this Visitor's Log, I acknowledge that I understand and agree to abide by the project rules outlined below.

In consideration of my receipt of a visitor's pass as issued by the CONSTRUCTION MANAGER directly or indirectly for the City of San Diego, I waive on behalf of myself, my heirs, employer, legal representatives and assigns and hereby release and discharge the City of San Diego, CONSTRUCTION MANAGER, and their subcontractors and consultants and each of their directors, officers, employees, representatives and agents from any and all claims, actions, causes of action or any charge of any kind whatsoever which may arise or could arise in the future as a result of my being present at the facility including injury, death or property damage whether or not caused by the fault or negligence of any of the parties released hereunder.

I further acknowledge that I have been briefed on specific hazards, hazardous substances that are on site and the site emergency action procedure.

PROHIBITED ACTIVITIES

- Unauthorized removal or theft of OWNER's and/or other's property
- Violation of safety or security rules or procedures
- Possession of firearms or lethal weapons on jobsite
- Acts of sabotage
- Destruction or defacing OWNER's property
- Failure to use sanitary facilities
- Failure to report accidents or job related injuries
- Being under the apparent influence of drugs, alcohol or other intoxicants or in possession of drugs, alcohol or other intoxicants on the property
- Wearing shorts and/or tennis shoes on the work site
- Failure to wear a hardhat on the work site
- Gambling at any time on the project
- Fighting, threatening behavior, or engaging in dangerous horseplay on the project site
- Smoking on or in unauthorized areas on the project site
- Open fire cooking or making unauthorized fires on project property
- Selling items or conducting raffles without authorization
- Use of unauthorized cameras on the project
- Use of radio or television in the construction area
- Failure to park personal vehicle in authorized parking areas
- Failure to wear or present designated identification [Site Specific]
- Failure to use designated gates

I have read, understand and agree to abide by the PROGRAM SITE RULES. Furthermore, I understand failure to abide by these rules is grounds for being denied access to the project site. I have received a personal copy for my use and reference.

VISITOR LOG

THE SIGNING OF THIS LOG ACKNOWLEDGES I HAVE READ AND UNDERSTAND AND AGREE TO ABIDE BE THE PROJECT RULES OUTLINED ABOVE. <u>THIS IS NOT A VEHICLE ACCESS PERMIT.</u>

VISITOR'S NAME PRINT	SIGNATURE	COMPANY VISITED	DATE	IN	OUT

EMPLOYEE
ACKNOWLEDGMENT OF THE PUBLIC UTILITES DEPARTMENT RULES

By Signing this Employee Log, I acknowledge that I understand and agree to abide by the project rules outlined below.

PROHIBITED ACTIVITIES

- Unauthorized removal or theft of OWNER's and/or other's property
- Violation of safety or security rules or procedures
- Possession of firearms or lethal weapons on jobsite
- Acts of sabotage
- Destruction or defacing OWNER's property
- Failure to use sanitary facilities
- Failure to report accidents or job related injuries
- Under the apparent influence of drugs, alcohol or other intoxicants or in possession of drugs, alcohol or other intoxicants on the property
- Wearing shorts and/or tennis shoes on the work site
- Failure to wear a hard hat on the work site
- Gambling at any time on the project
- Fighting, threatening behavior, or engaging in dangerous horseplay on the project
- Smoking on or in unauthorized areas on the project site
- Open fire cooking or making unauthorized fires on project property
- Selling items or conducting raffles without authorization
- Use of unauthorized cameras on the project
- Use of radio or television in the construction area
- Failure to park personal vehicle in authorized parking area
- Failure to wear or present designated identification [Site Specific]
- Failure to use designated gates

I have read, understand and agree to abide by the PROGRAM SITE RULES. Furthermore, I understand failure to abide by these rules is grounds for being denied access to the project site. I have received a personal copy for my use and reference.

EMPLOYEE LOG

BY SIGNING THIS LOG ACKNOWLEDGMENT I HAVE READ AND UNDERSTAND AND AGREE TO ABIDE BY THE PROJECT RULES OUTLINED ABOVE AND ALL STATE, FEDERAL, LOCAL OR ANY OTHER CONTRACT OBLIGATIONS THAT MAY APPLY. I FURTHER ACKNOWLEDGE THAT I HAVE BEEN ORIENTATED AS TO THE SITE SPECIFIC HAZARDS, ANY HAZARDOUS SUBSTANCES I MAY BE EXPOSED TO WHILE ON THE SITE AND THE SITE/COMPANY EMERGENCY ACTION PROCEDURES, BY A REPRESENTATIVE OF THE COMPANY.

EMPLOYEES (PRINT)	SIGNATURE	COMPANY NAME	DATE

Signature of Company Representative		Date Signed	

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.1 GENERAL

A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.

B. The CONTRACTOR shall verify the exact locations and depths of all utilities shown and the CONTRACTOR shall make exploratory excavations of all utilities that may interfere with the WORK. All such exploratory excavations shall be performed as soon as practicable after award of the contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR'S work. When such exploratory excavations show the utility location as shown to be in error, the CONTRACTOR shall so notify the CONSTRUCTION MANAGER.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.2 RIGHTS-OF-WAY

A. The CONTRACTOR shall not do any work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way involved until notified by the CONSTRUCTION MANAGER that the OWNER has secured authority therefor from the proper party. After authority has been obtained, the CONTRACTOR shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support or otherwise protect such pipeline, transmission line, ditch, fence, or structure or replace the same. When two or more contracts are being executed at one time on the same or adjacent land in such manner that work on one contract may interfere with that on another, the CONSTRUCTION MANAGER shall determine the sequence and order of the work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the CONSTRUCTION MANAGER to the contractor so desiring, to the extent, amount, in the manner, and at the times permitted. No such decision as to the method or time of conducting the work or the use of territory shall be made the basis of any claim for delay or damage, except as provided for temporary suspension of the WORK per the Contract Documents.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent

marker points that will be disturbed by the construction operations have been properly referenced. All survey markers or points disturbed by the CONTRACTOR shall be accurately restored after all street or roadway resurfacing has been completed.

1.4 RESTORATION OF PAVEMENT

A. **General:** All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the CONTRACT DOCUMENTS or in the requirements of the agency issuing the permit. All temporary and permanent pavement shall conform to the requirements of the affected pavement owner. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. **Temporary Resurfacing:** Wherever required by the public authorities having jurisdiction, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

C. **Permanent Resurfacing:** In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

D. **Restoration of Sidewalks or Private Driveways:** Wherever sidewalks or private roads have been removed for purposes of construction, the CONTRACTOR shall place suitable temporary sidewalks or roadways promptly after backfilling and shall maintain them in satisfactory condition for the period of time fixed by the authorities having jurisdiction over the affected portions before proceeding with the final restoration or, if no such period of times is so fixed, the CONTRACTOR shall maintain said temporary sidewalks or roadways until the final restoration thereof has been made.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

A. **General:** The CONTRACTOR shall protect all Underground Utilities and other improvements which may be impaired during construction operations. It shall be the CONTRACTOR'S responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. **Utilities to be Moved:** In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the CONTRACTOR, be notified by the CONSTRUCTION MANAGER to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the

CONSTRUCTION MANAGER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

C. Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the CONSTRUCTION MANAGER and the owner of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

D. **OWNER's Right of Access:** The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

E. **Underground Utilities Indicated:** Existing utility lines that are indicated or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the CONTRACTOR.

F. **Underground Utilities Not Indicated:** In the event that the CONTRACTOR damages any existing utility lines that are not indicated or the locations of which are not made known to the CONTRACTOR prior to excavation, a written report thereof shall be made immediately to the CONSTRUCTION MANAGER. If directed by the CONSTRUCTION MANAGER, repairs shall be made by the CONTRACTOR under the provisions for changes and extra work contained in the Contract Documents.

G. All costs of locating, repairing damage not due to failure of the CONTRACTOR to exercise reasonable care, and removing or relocating such utility facilities not shown in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the work which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such work will be paid for as extra work in accordance with the Contract Documents.

H. **Approval of Repairs:** All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.

I. **Maintaining in Service:** All oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the CONSTRUCTION MANAGER are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of

this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.6 TREES WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

A. **General:** The CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. All existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or the OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

B. **Trimming:** Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. All cuts over 1-1/2 inches in diameter shall be coated with an asphaltic emulsion material.

C. **Replacement:** The CONTRACTOR shall immediately notify the jurisdictional agency and/or the CONSTRUCTION MANAGER, if any tree is damaged by the CONTRACTOR'S operations. If, in the opinion of said agency or the CONSTRUCTION MANAGER, the damage is such that replacement is necessary, the CONTRACTOR shall replace the tree at its own expense. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the CONTRACTOR shall pay to the owner of said tree a compensatory payment acceptable to the tree owner, subject to the approval of the jurisdictional agency or CONSTRUCTION MANAGER. The size of the trees shall be not less than 1-inch diameter nor less than 6 feet in height.

1.7 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can locate the utilities and be present during such work if they so desire.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01550

SITE ACCESS AND STORAGE

PART 1 - GENERAL

1.1 HIGHWAY LIMITATIONS

A. NOT USED

1.2 TEMPORARY CROSSINGS

A. **General:** Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300 feet shall be provided. The CONTRACTOR shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.

B. **Temporary Bridges:** Wherever necessary, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the CONSTRUCTION MANAGER prior to excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street crossing shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit design to said authority for approval, as may be required.

C. **Street Use:** Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the WORK hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of the CONSTRUCTION MANAGER and proper governmental authority. Where excavation is being performed in primary streets, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe

boards shall be provided to retain excavated material if required by the CONSTRUCTION MANAGER or the agency having jurisdiction over the street. fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

.

1.3 CONTRACTOR'S WORK AND STORAGE AREA

A. The OWNER will designate and arrange for the CONTRACTOR's use, a portion of the property adjacent to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations relative to this contract.

B. The CONTRACTOR shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the WORK.

C. Lands to be furnished by the OWNER for camp sites, construction operation, concrete aggregate pits, roads and other purposes are indicated. Should the CONTRACTOR find it necessary to use any additional land for its camp or for other purposes during the construction of the WORK, it shall provide for the use of such lands at its own expense.

D. The CONTRACTOR shall construct and use a separate storage area for hazardous materials used in constructing the WORK.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

2. The CONTRACTOR shall develop and submit to the CONSTRUCTION MANAGER a plan for storing and disposing of the materials above.

3. The CONTRACTOR shall obtain and submit to the CONSTRUCTION MANAGER a single EPA number for wastes generated at the site.

4. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials. Such authorities are Cal-OSHA, AQMD, San Diego County Health Department, Regional Water Quality Control Board, and City of San Diego Industrial Waste Division.

5. The separate storage area shall be inspected by the City of San Diego Hazardous Materials Management Division prior to construction of the area, upon completion of construction of the area, and upon cleanup and removal of the area.

6. All hazardous materials which are delivered in containers shall be stored in the original containers until use. Hazardous materials which are delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

** END OF SECTION **

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 EXPLOSIVES AND BLASTING

A. The use of explosives on the WORK will not be permitted.

1.2 AIR QUALITY

A. **General:** The CONTRACTOR shall not create significant direct air quality impacts during the performance of the WORK. The CONTRACTOR shall take corrective measures, as required by the CONSTRUCTION MANAGER, to prevent significant air quality impacts during the work period.

B. **Dust Control:** The CONTRACTOR shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary to prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from its operations. The CONTRACTOR shall provide adequate watering or other dust control measures to control dust on the work site. Dust control shall prevent fugitive dust from leaving the work area. Dust control or ground cover on graded areas left exposed for more than 90 days shall be provided by the CONTRACTOR. If necessary, the CONTRACTOR shall wash or sweep the adjacent access roads on the construction site to keep adjoining public roads clean.

C. **Equipment Control:** All motorized construction vehicles operating onsite for more than 90 days shall have a low NOx emission engine tune-up. Documented proof of tune-ups shall be made available to the CONSTRUCTION MANAGER when requested.

D. **Management:** The CONTRACTOR shall encourage ride sharing among CONTRACTOR personnel and shall develop a voluntary ride share program.

1.3 RUBBISH CONTROL

A. During the progress of the WORK, the CONTRACTOR shall keep the site of the WORK and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The CONTRACTOR shall provide sufficient dumpsters and trash containers for collection of rubbish. The CONTRACTOR shall dispose of all rubbish and waste materials of any nature occurring at the work site, and shall establish regular intervals, at least weekly, for collection and disposal of such materials and waste. The CONTRACTOR shall also keep all roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and

Health Standards for Construction. The CONTRACTOR shall not dispose of rubbish or debris into storm drains or stream channels.

1.4 SANITATION

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

B. **Sanitary and Other Organic Wastes:** The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR'S operations shall be disposed of away from the site in a manner satisfactory to the CONSTRUCTION MANAGER and in accordance with all laws and regulations pertaining thereto.

1.5 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall be stored in accordance with the manufacturer's instructions. The CONTRACTOR shall maintain copies of Material Safety Data Sheets for all chemicals used or furnished by the CONTRACTOR. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

B. All chemicals used during the project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, fertilizer, disinfectants, polymers, reactants, fuel, oil, hydraulic fluid, detergent, paint, solvent, glue, or any other classification, shall be stored within a containment area that minimizes contact of the chemicals and the storage containers with precipitation and surface water flows due to precipitation or flows from adjacent areas. If precipitation or surface water flows contact the chemicals or the storage containers, the CONTRACTOR shall notify the CONSTRUCTION MANAGER to determine if the surface water has been contaminated or may be allowed to be discharged to the storm drains or stream channels. If the surface water flows have become contaminated due to contact with the chemicals or the storage containers, the CONTRACTOR shall provide for removal and/or treatment of the surface water flows at no additional costs to the OWNER. If spills occur in the containment area, the CONTRACTOR shall immediately notify the CONSTRUCTION MANAGER and shall contain and clean up the spill to prevent spilled material from entering storm drains, stream channels, or groundwater or from being absorbed by the underlying pavement or soil.

C. All chemicals shall be stored, handled, and used in compliance with the appropriate regulatory agency requirements.

1.6 HAZARDOUS MATERIALS

A. The CONTRACTOR shall collect waste oil, used oil filters, other waste petroleum materials, and any other CONTRACTOR generated hazardous materials. Remove and legally dispose of all waste petroleum products and any other CONTRACTOR generated

hazardous materials at suitable disposal facilities off of the job site at the CONTRACTOR'S expense.

B. On site temporary fuel storage facilities shall be constructed to comply with current regulations. Such facilities shall be diked to contain any fuel spills. Fuel tanks shall be properly grounded.

C. The CONTRACTOR shall park construction vehicles in locations designated by the CONSTRUCTION MANAGER. The CONTRACTOR shall provide oil drip pans to contain any oil leakage from construction vehicles.

1.7 EROSION AND SEDIMENT CONTROL

A. The CONTRACTOR shall provide and maintain all necessary erosion and sediment control measures throughout the construction period as required to minimize stormwater pollution from the CONTRACTOR'S work area. Erosion and sediment control measures may include straw bale dikes, sandbag dikes, silt fences, drainage swales, pipe drains, sediment traps, protective sheets, jute matting, hydro-seeding, and appropriate surface contouring.

B. The CONTRACTOR shall secure erosion control devices at the end of each work shift during the period from December 1 to March 31, or when rain is forecast prior to the next workday.

C. Grading activities shall be prohibited during the period when rain is falling at a rate in excess of 0.1 inches per hour. The CONTRACTOR shall immediately secure the site for erosion control and storm water runoff.

D. The CONTRACTOR shall be responsible for inspecting and maintaining erosion and sediment control measures in the CONTRACTOR'S work area before, during, and after storm events. The CONTRACTOR shall notify the CONSTRUCTION MANAGER if erosion and sediment control measures do not operate properly and shall take all necessary corrective action.

1.8 CULTURAL RESOURCES

A. The CONTRACTOR'S attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. The CONTRACTOR shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. The CONSTRUCTION MANAGER will issue a Stop Work Order directing the CONTRACTOR to cease all construction operations at the location of such potential cultural resources find.

2. Such Stop Work Order shall be effective until such time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the State Water Resources Control Board Cultural Resources Officer.

D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Water Resources Control Board Cultural Resources Officer, the CONTRACTOR shall suspend work at the location of the find under the provisions of the Contract Documents.

1.9 TRAFFIC

A. Work Hours: 7:00 am to 3:30 pm.

B. Truck Traffic: The CONTRACTOR shall schedule truck deliveries and hauling to and from the construction site prior to 2:30 p.m. on weekdays. Truck deliveries or hauling on weekends or holidays shall require prior approval by the CONSTRUCTION MANAGER.

1.10 PROGRESS CLEANING

A. The CONTRACTOR shall maintain areas free of waste materials, debris, and rubbish. The site shall be maintained in a clean and orderly condition. Broom all concrete or other finished work areas at least once per month, prior to each progress payment request. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, shoreline areas or elsewhere, remove such material or debris and legally dispose of it during the progress of the WORK.

B. Remove debris and rubbish from channels, wet wells, clarifiers, pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

1.11 SITE MAINTENANCE

A. The CONTRACTOR is responsible for site maintenance in the CONTRACTOR's work area, laydown area, and in all areas impacted by the CONTRACTOR's work activities. Such site maintenance activities include but are not limited to dust control, rubbish control, fence repair, maintenance of construction access roads and parking lots, and maintenance of erosion and sediment control facilities.

B. The CONSTRUCTION MANAGER may direct the CONTRACTOR to perform site maintenance activities in other areas of the project site. The cost of such site maintenance activities in areas other than those identified in Paragraph 1.11A will be reimbursed to the CONTRACTOR under the bid item entitled Allowance for Site Maintenance.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

** END OF SECTION **

SECTION 01600

PRODUCTS, MATERIALS, EQUIPMENT AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. The word "Products," as used herein, is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from CONTRACTOR's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying and erection of the WORK.

1.2 QUALITY ASSURANCE

A. **Source Limitations:** To the greatest extent possible for each unit of work, the CONTRACTOR shall provide products, materials, and equipment of a singular generic kind from a single source.

B. **Compatibility of Options:** Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

A. The CONTRACTOR shall deliver and store the WORK in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, the CONTRACTOR shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss. Materials delivered onsite without an approved submittal for verification shall be rejected and payment withheld.

1.4 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment including those provided by OWNER, by methods to prevent soiling and damage.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.5 STORAGE AND PROTECTION

A. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate-controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make the log available on request.

B. The CONTRACTOR shall comply with manufacturer's product storage requirements and recommendations.

C. The CONTRACTOR shall maintain manufacturer-required environmental conditions continually.

D. The CONTRACTOR shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

E. For mechanical and electrical equipment, the CONTRACTOR shall provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

F. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to acceptance by the OWNER in accordance with the Contract Documents.

1.7 INVESTIGATION OF FAILED PRODUCTS

A. Prior to disposal of failed products, materials, or equipment, the CONTRACTOR shall inform and report the causes of failure during or after construction to the CONSTRUCTION MANAGER.

1.8 PROPOSED SUBSTITUTES OR "OR-EQUAL" ITEM

A. Whenever materials or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier and/or Manufacturer, the naming of the item is intended to establish the type, function, and quality required. Unless expressly prohibited, materials or equipment of other suppliers and/or manufacturers may be accepted if sufficient information is submitted by the CONTRACTOR to the CONSTRUCTION MANAGER for DESIGN CONSULTANT's review to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitute product, material or equipment shall be upon the CONTRACTOR.

2. The DESIGN CONSULTANT will be the sole judge as to the type, function, and quality of any such substitute and the CONSTRUCTION MANAGER's decision shall be final.

3. The DESIGN CONSULTANT may require the CONTRACTOR to furnish at the CONTRACTOR'S expense additional data about the proposed substitute.

4. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute.

5. Acceptance by the DESIGN CONSULTANT of a substitute item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute.

6. The CONTRACTOR shall be responsible for resultant changes including design and construction changes and all additional costs resulting from the changes which the accepted substitution requires in the CONTRACTOR'S WORK, the WORK of its subcontractors and of other contractors, and shall effect such changes without cost to the OWNER.

B. The procedure for review by the CONSTRUCTION MANAGER will include the following:

1. If the CONTRACTOR wishes to provide a substitute item, the CONTRACTOR shall make written application to the CONSTRUCTION MANAGER on the "Substitution Request Form."

2. Unless otherwise provided by law or authorized in writing by the CONSTRUCTION MANAGER, he "Substitution Request Form(s)" shall be submitted within the 35-day period after award of the Contract.

3. Wherever a proposed substitute item has not been submitted within said 35-day period, or wherever the submission of a proposed substitute material or equipment has been judged to be unacceptable by the DESIGN CONSULTANT, the CONTRACTOR shall provide the material or equipment indicated in the Contract Documents.

4. The CONTRACTOR shall certify that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, and be similar and of equal substance to that indicated, and be suited to the same use as that specified.

5. The DESIGN CONSULTANT will evaluate each proposed substitute within a reasonable period of time.

6. As applicable, no shop drawing submittals shall be made for a substitute item nor shall any substitute item be ordered, installed, or utilized without the CONSTRUCTION MANAGER'S prior written acceptance of the CONTRACTOR'S "Substitution Request Form."

7. The CONSTRUCTION MANAGER will record the time required by the DESIGN CONSULTANT in evaluating substitutions proposed by the CONTRACTOR and in making changes by the CONTRACTOR in the Contract Documents occasioned thereby. Whether or not the DESIGN CONSULTANT accepts a proposed substitute, the CONTRACTOR shall reimburse the OWNER for the charges of the DESIGN CONSULTANT for evaluating each proposed substitute.

C. The CONTRACTOR's application using the "Substitution Request Forms" shall contain the following statements and information which shall be considered by the CONSTRUCTION MANAGER in evaluating the proposed substitution:

1. The evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR's achievement of substantial completion on time.

2. Whether or not acceptance of the substitute for use in the WORK will require a change in any of the Contract Documents to adopt the design to the proposed substitute.

3. Whether or not incorporation or use of the substitute in connection with the WORK is subject to payment of any license fee or royalty.

4. All variations of the proposed substitute from the items originally specified will be identified.

5. Available maintenance, repair, and replacement service will be indicated. The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other contractors affected by the resulting change.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01660

EQUIPMENT AND SYSTEM PERFORMANCE AND OPERATIONAL TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section contains requirements for the Contractor's performance in documenting testing work required under this contract. In addition, this section contains requirements the for the Contractor's performance during installed performance testing of all mechanical, electrical, instrumentation, and HVAC equipment and systems, including structures for watertight construction, provided under this contract. This section supplements but does not supersede specific testing requirements found elsewhere in this project manual.

1.2 QUALITY ASSURANCE

B. Contractor's Quality Assurance Manager:

1. The Contractor shall appoint an operations engineer or equally qualified operations specialist as Quality Assurance Manager to manage, coordinate, and supervise the Contractor's quality assurance program. Operations engineers shall be graduates from a minimum 4-year course in mechanical or civil engineering. Operations specialists shall have equivalent experience in plant operation and maintenance. The quality assurance program shall include:
    a. A testing plan setting forth the sequence in which all testing work required under this project manual will be implemented.
    b. A documentation program to record the results of all equipment and system tests.
    c. An installed performance testing program for all mechanical, electrical, instrumentation, and HVAC equipment and systems installed under this contract.
    d. A calibration program for all instruments, meters, monitors, gages, and thermometers installed under this contract.
    e. A calibration program for all instruments, gages, meters, and thermometers used for determining the performance of equipment and systems installed under this contract.
    f. A testing schedule conforming to the requirements specified in paragraph 2.02 Testing Schedule.
2. For the purposes of this section, a system shall include all items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The Quality Assurance Manager shall coordinate the activities of all subcontractors and suppliers to implement the requirements of this section.

C. Calibration:

1. All test equipment (gages, meters, thermometers, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed under this contract shall be calibrated to within plus or minus 2 percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gages shall be calibrated in accordance with

ANSI/ASME B40.1. Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a certified calibration curve.

2. Liquid flow meters, including all open channel flow meters and all meters installed in pipelines with diameters greater than 2 inches shall be calibrated in situ using either the total count or dye dilution methods. Gas flow meters installed in piping systems with diameters greater than 6 inches shall be calibrated in situ using the pitot tube velocity averaging method. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than 10 percent to at least 75 percent of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three test runs with results which agree within plus or minus 2 percent.

D. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/ASME B40.1	Gauges Pressure Indicating Dial Type—Elastic Element
ASTM E77	Method for Verification and Calibration of Liquid-in-Glass Thermometers
ASHRAE 41.8	Standard Methods of Measurement of Flow of Gas
Dye Dilution Calibration Method	Flow Measurements in Sanitary Sewers By Dye Dilution, Turner Designs Mountain View, California,
	Flow Measurement in Sewer Lines by the Dye Dilution Method, Journal of the Water Pollution Control Federation, Vol. 55, Number 5, May, 1983, pg. 531
	Flow Measurement in Open Channels and Closed Conduits, Vol 1, U.S. Department of Commerce, National Bureau of Standards, pg. 361
	Techniques of Water-Resources Investigations of the United States Geological Survey, Chapter 16, Measurement of Discharge Using Tracers

1.3 SUBMITTALS

A. Submittal material, to be submitted in accordance with Section 01300, shall consist of the following:
   1. A complete description of the Contractor's plan for documenting the results from the test program in conformance with the requirements of paragraph 2.02 Documentation Plans, including:
      a. Proposed plan for documenting the calibration of all test instruments.
      b. Proposed plan for calibration of all instrument systems, including flow meters and all temperature, pressure, weight, and analysis systems.
      c. Sample forms for documenting the results of field pressure and performance tests.
   2. The credentials and certification of the testing laboratory proposed by the Contractor for calibration of all test equipment.
   3. Preoperational check-out procedures, reviewed and approved by the respective equipment manufacturers.
   4. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by the Contractor for the systematic testing of all equipment and systems installed under this contract.
   5. A schedule and subsequent updates, presenting the Contractor's plan for testing the equipment and systems installed under this contract.
   6. A schedule establishing the expected time period (calendar dates) when the Contractor plans to commence operational testing of the completed systems, along with a description of the temporary systems and installations planned to allow operational testing to take place.
   7. A summary of the Quality Assurance Manager's qualifications, showing conformance to paragraph 1.02 Contractor’s Quality Assurance Manager requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor shall prepare test plans and documentation plans as specified in the following paragraphs. The Construction Manager will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and accepted.

2.2 DOCUMENTATION

A. Documentation Plans:
   1. The Contractor shall develop a records keeping system to document compliance with the requirements of this Section. Calibration documentation shall include identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.
   2. Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the Construction manager's witness and the Contractor's quality assurance manager. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:

a. Metallurgical tests
b. Factory performance tests
c. Accelerometer recordings made during shipment
d. Field calibration tests[1]
e. Field pressure tests[1]
f. Field performance tests[1]
g. Field operational tests[1]

3. Section 01999 contains samples showing the format and level of detail required for the documentation forms. The Contractor is advised that these are samples only and are not specific to this project nor to any item of equipment or system to be installed under this contract. The Contractor shall develop test documentation forms specific to each item of equipment and system installed under this contract. Acceptable documentation forms for all systems and items of equipment shall be produced for review by the Construction Manager as a condition precedent to the Contractor's receipt of progress payments in excess of 50 percent of the contract amount. Once the Construction Manager has reviewed and taken no exception to the forms proposed by the Contractor, the Contractor shall produce sufficient forms, at his expense, to provide documentation of all testing work to be conducted as a part of this contract.

B. Test Plans:

1. The Contractor shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this contract. Each test plan shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors' and manufacturers' representatives to be present and expected test duration. As a minimum, the test plans shall include the following features:
   a. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device.
   b. Calibration of all analysis instruments and control sensors.
   c. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the project manual.
   d. System tests designed to duplicate, as closely as possible, operating conditions described in the project manual.
2. Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.
3. As a condition precedent to receiving progress payments in excess of 75 percent of the contract amount, or in any event, progress payments due to the Contractor eight weeks in advance of the date the Contractor wishes to begin any testing work (whichever occurs earliest in the project schedule), the Contractor shall have submitted all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this contract. Once the Construction Manager has reviewed and taken no exception to the Contractor's test plans, the Contractor shall reproduce the plans

in sufficient number for the Contractor's purposes and an additional ten copies for delivery to the Construction Manager. No test work shall begin until the Contractor has delivered the specified number of final test plans to the Construction Manager.

C. Testing Schedule:

1. The Contractor shall produce a testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be in bar chart form, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with the Contractor's construction schedule specified in Section 01311. The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be submitted no later than 4 weeks in advance of the date testing is to begin. The Construction Manager will not witness any testing work for the purpose of acceptance until the Contractor has submitted a schedule to which the Construction Manager takes no exception. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of this project manual.

2.3 SYSTEM AND EQUIPMENT PERFORMANCE TESTS

A. Each item of mechanical, electrical, instrumentation, and HVAC equipment installed under this contract shall be tested to demonstrate compliance with the performance requirements of this project manual. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this contract shall be tested in accordance with the requirements of this project manual.

2.4 OPERATIONAL TESTS

A. Once all equipment and systems have been tested individually, the Contractor shall fill all systems except stormwater, wastewater, scum sludge and other wastewater derived systems with the intended process fluids. Stormwater and wastewater-derived process systems shall be filled with water. After filling operations have been completed, the Contractor shall operate all systems for a continuous period of not less than 5 days, simulating actual operating conditions to the greatest extent possible. The Contractor shall install temporary connections, bulkheads and make other provisions to recirculate process fluids or otherwise simulate anticipated operating conditions. During the operational testing period, the Contractor's Quality Assurance Manager and testing team shall monitor the characteristics of each machine and system and report any unusual conditions to the Construction Manager.

2.5 PRODUCT DATA

A. Product data, to be provided in accordance with Section 01300, shall be the original and three copies of all records produced during the testing program.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor's quality control manager shall organize teams made up of qualified representatives of equipment suppliers, subcontractors, the Contractor's independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this contract. The objective of the

testing program shall be to demonstrate, to the Construction Manager's complete satisfaction, that the structures, systems, and equipment constructed and installed under this contract meet all performance requirements and the facility is ready for the commissioning process to commence. In addition, the testing program shall produce baseline operating conditions for the Owner to use in a preventive maintenance program.

3.2 CALIBRATION OF FIXED INSTRUMENTS

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

B. All analysis instruments, sensors, gages, and meters used for performance testing shall be subject to recalibration to confirm accuracy after completion, but prior to acceptance of each performance test. All analysis instruments, sensors, gages, and meters installed under this contract shall be subject to recalibration as a condition precedent to commissioning under the provisions of Section 01680.

3.3 PERFORMANCE TESTS

A. General:
   1. Performance tests shall consist of the following:
      a. Pressure and/or leakage tests.
      b. Electrical testing as specified in Division 16.
      c. Wiring and piping, individual component, loop, loop commissioning and tuning testing as described in Division 13.
      d. Preoperational checkout for all mechanical and HVAC equipment. Preoperational check-out procedures shall be reviewed and approved by the respective equipment manufacturers.
      e. Initial operation tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems to demonstrate compliance with the performance requirements of this project manual.
   2. In general, performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the Construction Manager after receipt of a written request, complete with justification of the need for the change in sequence.

B. Pressure And Leakage Tests:
   1. Pressure and leakage tests shall be conducted in accordance with applicable portions of Divisions 3 and 15. All acceptance tests shall be witnessed by the Construction Manager. Evidence of successful completion of the pressure and leakage tests shall be the Construction Manager's signature on the test forms prepared by the Contractor.

C. Functional Checkout:
   1. Prior to energization (in the case of electrical systems and equipment), all circuits shall be rung out and tested for continuity and shielding in accordance with the procedures required in Division 16.

D. Component Calibration And Loop Testing:
   1. Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested in accordance with the procedures required in Division 13.

E. Electrical Resistance:
   1. Electrical resistance testing shall be in accordance with Division 16.

F. Preoperational Tests:
   1. Preoperational tests shall include the following:
      a. Alignment of equipment using reverse dial indicator method.
      b. Pre-operation lubrication.
      c. Tests per the manufacturers' recommendations for prestart preparation and preoperational check-out procedures.

G. Functional Tests:
   1. General: Once all affected equipment has been subjected to the required preoperational check-out procedures and the Construction Manager has witnessed and has not found deficiencies in that portion of the work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these specifications. If available, plant effluent may be employed for the testing of all liquid systems except gaseous, oil, or chemical systems. If not available, potable water shall be employed as the test medium. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Construction Manager. During the functional test period, the Contractor shall obtain baseline operating data on all equipment with motors greater than 1 horsepower to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the Owner to enter in a preventive maintenance system.
      a. Test results shall be within the tolerances set forth in the detailed specification sections of this project manual. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory functional test, any doubt, dispute, or difference should arise between the Construction Manager and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then the Construction Manager may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Construction Manager may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner. Otherwise, the costs shall be borne by the Contractor. Where the results of any functional test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by the Contractor at his expense.

b. The Contractor shall provide, at no expense to the Owner, all power, fuel, compressed air supplies, water, and chemicals, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.

2. Retesting: If under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, unless otherwise directed by the Construction Manager, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner, including the costs of the Construction Manager, as a result of repeating such tests.

3. Post-test Inspection: Once functional testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Construction Manager. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the Construction Manager at no cost to the Owner.

3.4 OPERATIONAL TESTS

A. The Contractor shall provide system operation testing. After completion of all performance testing and certification by the Construction Manager that all equipment complies with the requirements of the specifications, the Contractor shall fill all process units and process systems, except those employing domestic water, oil, air, or chemicals, with plant effluent, reclaimed or potable water, as available. All domestic water, oil, air, and chemical systems shall be filled with the specified fluid.

B. Upon completion of the filling operations, the Contractor shall circulate water through the completed facility for a period of not less than 48 hours, during which all parts of the system shall be operated as a complete facility at various loading conditions, as directed by the Construction Manager. The operational testing period shall commence after this initial period of variable operation. The operational testing period shall last for a period of 5 days. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

C. As-built documents specified in Section 01720 of facilities involved shall be accepted and ready for turnover to the Owner at the time of operational testing.

END OF SECTION

SECTION 01664

TRAINING

PART 1- GENERAL

1.1 DESCRIPTION

A. This section contains requirements for training the OWNER's personnel, by persons retained by the CONTRACTOR specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this contract.

1.2 QUALITY ASSURANCE

A. Where required by the detailed specifications, the CONTRACTOR shall provide on-the-job training of the OWNER's personnel. The training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

1.3 SUBMITTALS

A. The following information shall be submitted to the CONSTRUCTION MANAGER in accordance with the provisions of Section 01300. The material shall be reviewed and accepted by the CONSTRUCTION MANAGER as a condition precedent to receiving progress payments in excess of 50 percent of the contract amount and not less than 3 weeks prior to the provision of training.

1. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.

2. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.

PART 2- PRODUCTS

2.1 GENERAL

A. Where specified, the CONTRACTOR shall conduct training sessions for the OWNER's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available at least 30 days prior to the date scheduled for the individual training session.

2.2 LOCATION

A. Training sessions shall take place at the site of the work in the MBC Large Conference Room.

2.3 LESSON PLANS

A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.

B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids, and reference material shall be the property of the OWNER and shall be suitably bound for proper organization and easy reproduction. The CONTRACTOR shall furnish ten copies of necessary training manuals, handouts, visual aids and reference materials at least 1 week prior to each training session.

2.4 FORMAT AND CONTENT

A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:

1. Familiarization

   a. Review catalog, parts lists, drawings, etc., which have been previously provided for the plant files and operation and maintenance manuals.

   b. Check out the installation of the specific equipment items.

   c. Demonstrate the unit and indicate how all parts of the specifications are met.

   d. Answer questions.

2. Safety

   a. Using material previously provided, review safety references.

   b. Discuss proper precautions around equipment.

3. Operation

   a. Using material previously provided, review reference literature.

   b. Explain all modes of operation (including emergency).

   c. Check out OWNER's personnel on proper use of the equipment.

4. Preventive Maintenance

   a. Using material previously provided, review preventive maintenance (PM) lists including:

      1) Reference material.

2) Daily, weekly, monthly, quarterly, semiannual, and annual jobs.

b. Show how to perform PM jobs.

c. Show OWNER's personnel what to look for as indicators of equipment problems.

5. Corrective Maintenance

a. List possible problems.

b. Discuss repairs--point out special problems.

c. Open up equipment and demonstrate procedures, where practical.

6. Parts

a. Show how to use previously provided parts list and order parts.

b. Check over spare parts on hand. Make recommendations regarding additional parts that should be available.

7. Local Representatives

a. Where to order parts: name, address, telephone.

b. Service problems:

1) Who to call.

2) How to get emergency help.

8. Operation and Maintenance Manuals

a. Review any other material submitted.

b. Update material, as required.

PART 3 - EXECUTION

A. Training shall be conducted in conjunction with the operational testing and commissioning periods. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. The CONTRACTOR shall arrange to have the training conducted on consecutive days, with no more than 6 hours of classes scheduled for any one day. Concurrent classes shall not be allowed. Training shall be certified on Form 11000-B specified in Section 01999.

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

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

1. As a minimum classroom equipment training for operations personnel will include:

a. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.

b. Purpose and plant function of the equipment.

c. A working knowledge of the operating theory of the equipment.

d. Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.

e. Identify and discuss safety items and procedures.

f. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.

g. Operator detection, without test instruments, of specific equipment trouble symptoms.

h. Required equipment exercise procedures and intervals.

i. Routine disassembly and assembly of equipment if applicable (as judged by the OWNER on a case-by-case basis) for purposes such as operator inspection of equipment.

2. As a minimum, hands-on equipment training for operations personnel will include:

a. Identify location of equipment and review the purpose.

b. Identifying piping and flow options.

c. Identifying valves and their purpose.

d. Identifying instrumentation:

1) Location of primary element.

2) Location of instrument readout.

3) Discuss purpose, basic operation, and information interpretation.

e. Discuss, demonstrate, and perform standard operating procedures and round checks.

f. Discuss and perform the preventative maintenance activities.

g. Discuss and perform start-up and shutdown procedures.

h. Perform the required equipment exercise procedures.

i. Perform routine disassembly and assembly of equipment if applicable.

j. Identify and review safety items and perform safety procedures, if feasible.

3. Classroom equipment training for the maintenance and repair personnel will include:

a. Theory of operation.

b. Description and function of equipment.

c. Start-up and shutdown procedures.

d. Normal and major repair procedures.

e. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.

f. Routine and long-term calibration procedures.

g. Safety procedures.

h. Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.

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

a. Locate and identify equipment components.

b. Review the equipment function and theory of operation.

c. Review normal repair procedures.

d. Perform start-up and shutdown procedures.

e. Review and perform the safety procedures.

f. Perform OWNER approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

END OF SECTION

SECTION 01680

COMMISSIONING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section contains requirements for the Contractor's performance during the commissioning of the structures, equipment and systems constructed and installed during the course of this contract. All commissioning work, as described in this section, shall be performed by the Contractor.

1.2 QUALITY ASSURANCE

A. Cleanup:
   1. Following completion of the operational testing period, the Contractor shall remove, clean, and replace all permanent and temporary filters and strainers in all pipeline systems; replace all HVAC filters; dewater and clean all sumps; and dewater all process units for final inspection as a condition precedent to commissioning.

B. Commissioning Team:
   1. The Contractor shall assemble a commissioning team under the direction of an individual duly authorized to commit the Contractor's personnel and resources to respond to requests for assistance on the part of the Construction Manager or, through the Construction Manager, the Owner. The commissioning team shall consist of representatives of the Contractor's mechanical, electrical, and instrumentation subcontractors, and others as appropriate. The commissioning team shall be available at the site of the work during normal working hours (8 hours a day, 5 days a week, Saturdays, Sundays, and legal holidays excepted) and shall be available within 2 hours' notice at all other times upon notice by telephone. The commissioning team shall at all times be equipped and ready to provide for emergency repairs, adjustments, and corrections to the equipment and systems installed and modified as a part of this contract.

1.3 SUBMITTALS

A. The following information shall be submitted to the Construction Manager in accordance with the provisions of Section 01300:
   1. Detailed plans for commissioning each process unit and each system constructed or modified as a part of the work performed under this contract.
   2. The Contractor's plan for providing a commissioning team conforming to the requirements of paragraph 1.02 Commissioning Team during the commissioning period. The plan shall be complete with a daytime staffing plan and names, qualifications, and telephone numbers of those assigned to off-hour standby duty.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Working with representatives of the Owner and the Construction Manager, the Contractor shall develop and produce a detailed, written plan for the startup and initial operation, under actual operating conditions, of the equipment and systems installed and constructed under this contract. The document, after acceptance by the Construction Manager, shall serve as the guidance manual for the commissioning process.

PART 3 - EXECUTION

3.1 SUMMARY

A. After completion of the equipment and system performance and operational testing, where required, and agreement on the part of the Construction Manager that the systems did meet all test requirements, commissioning will begin. The commissioning period for each modified or new unit process system shall be 2 weeks. The Contractor shall remove all temporary piping, bulkheads, controls and other alterations to the permanent systems that may have been needed during the performance and operational testing and shall perform the tasks necessary to make the improvements constructed under this contract fully operational. The Construction Manager shall confirm in writing the date(s) that the system is ready for commissioning and on which actual commissioning activities commence. Activities conducted prior to such written confirmation shall not constitute commissioning. Since the new facility is intended to operate during wet weather storm events, the Contractor will be responsible for providing water into upstream manholes to simulate storm events during the defined commissisonig period. The following specific tasks are to be performed as a part of the commissioning process:
   1. Operation of new SDR piping feeding the diversion structure
   2. Operation of hydrodynamic separator
   3. Operation of underground storage units
   4. Operation of diversion structure including diversion gate and pumps
   5. Operation of storm water force main piping

B. The Owner's operation and maintenance personnel will be responsible for operation of the systems to be commissioned. The portion of the work to be commissioned shall be fully operational, performing all functions for which it was designed.

C. The Contractor shall be available at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being constructed. At the end of the commissioning period and when all corrections required by the Construction Manager to assure a reliable and completely operational facility are complete, the Construction Manager shall issue a completion certificate. Each system shall have been issued a completion certificate as a condition precedent to the final acceptance of the work of this contract.

** END OF SECTION **

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contract Closeout is the process that commences as the WORK nears Substantial Completion. It continues through Substantial Completion, and Final Acceptance of the WORK.

B. This specification section defines the overall changeover process from construction (by the CONTRACTOR) to plant operations (by the OWNER). This section defines the terms in this process, and outlines the responsibilities of the CONTRACTOR, the CONSTRUCTION MANAGER, and the OWNER.

1.2 CONTRACT CLOSEOUT SEQUENCE OF EVENTS

A. The sequence of events and their description listed below represent the suggested order of activities as the Contract proceeds from construction, through checkout, testing, Substantial Completion, and the Notice of Completion. Not all work will proceed in this exact order. Adjustments may be made, after approval by the CONSTRUCTION MANAGER, for the mutual benefit of the CONTRACTOR and the OWNER, if the situation so warrants. Any adjustment made in the sequence of events, to accommodate the CONTRACTOR, shall be at no additional cost to the OWNER.

B. Closeout Sequence of Events and Description

1. Checkout Plan - The CONTRACTOR will prepare a Checkout Plan in accordance with Section 01680. This plan becomes the basis for all checkout, shop, field, and functional testing. It includes schedules, personnel, test media, and equipment requirements, and shall fully define the CONTRACTOR's intended checkout process.

2. WORK Nears Completion - Signifies the start of checkout and testing. The CONTRACTOR shall indicate when work is ready for checkout and testing on a facility and/or system basis.

3. Contract Closeout Deliverables - The CONTRACTOR shall provide the following, in accordance with the Checkout Plan and as specified:

a. Shop Testing in accordance with the technical specifications and Section 01680.

b. Field Testing in accordance with the technical specifications and Section 01680.

c. Physical Checkout in accordance with the Contract Documents and Section 01680.

d. Functional Testing in accordance with the technical specifications and Section 01680.

e. OWNER's Manuals, in accordance with Section 01300.

f. Vendor Training, in accordance with the technical specifications.

g. Final Record Drawings, in accordance with Section 01720.

h. Written guarantees, where required.

i. Maintenance stock items; spare parts; special tools.

j. Bonds for roofing, maintenance, etc., as required.

k. Certificates of inspection and acceptance by local governing agencies having jurisdiction.

4. Pre-Final Inspection and Discrepancy List - The CONSTRUCTION MANAGER will conduct a pre-final inspection of the WORK prior to substantial completion. The CONSTRUCTION MANAGER will prepare a discrepancy list (punchlist). The discrepancy list includes items of work which do not conform to the Contract Documents, plus any additional items found to be missing, incomplete, damaged, incorrect, or constructed in an unworkmanlike manner. The CONTRACTOR shall correct all items on the discrepancy list.

5. Operational Demonstration - The CONTRACTOR shall conduct a 7-day Operational Demonstration of the facility in accordance with Section 01660 of the Specifications.

6. Substantial Completion - Following correction of items on the discrepancy list, and successful completion of the operational demonstration, the CONTRACTOR shall notify the CONSTRUCTION MANAGER that the WORK is substantially complete.

7. Final Inspection - Following written notice from the CONTRACTOR that the entire WORK is complete as outlined in Contract Documents, the CONSTRUCTION MANAGER, the OWNER, the CONTRACTOR, and the DESIGN CONSULTANT will conduct a final inspection to verify that the WORK is complete. The CONSTRUCTION MANAGER will prepare a final punchlist of all outstanding items.

8. Final Payment - After the CONTRACTOR has completed all final punchlist items, and completed all other requirements, the CONTRACTOR shall submit a final application for payment to the CONSTRUCTION MANAGER. The final payment application will include all necessary documentation, in addition to waivers or releases of all liens filed in connection with the WORK. The CONTRACTOR shall specifically release the OWNER from any claims not specifically renewed on the

final application for payment. After acceptance by the CONSTRUCTION MANAGER and the OWNER, the OWNER will make final payment to the CONTRACTOR after deducting all amounts to be retained under the provisions of the Contract Documents.

9. Notice of Completion - The OWNER will file a Notice of Completion with the County Recorder to begin the 30-day stop notice filing period.

10. Release of Retention - Not more than 35 days after filing the Notice of Completion, the OWNER will release to the CONTRACTOR all retainage, less any deductions to cover pending third party claims against the OWNER.

1.3 SUBSTANTIAL COMPLETION

A. Substantial Completion is defined in the General Provisions of the SSPWC.

B. Substantial Completion includes compliance with the following requirements:

1. The CONTRACTOR has, substantially completed the construction and erection of the WORK in conformance with the Contract Documents.

2. The CONTRACTOR has installed, adjusted, and successfully tested Products, equipment, systems as defined in Section 01680. The facilities are constructed as indicated by the erection, installation, and operations and maintenance instructions of the Suppliers.

3. The CONTRACTOR has provided and completed the following items as approved by the CONSTRUCTION MANAGER:

a. Contract Closeout Deliverables.

b. Special Supplier's Warranties.

c. Special Protective Maintenance Instructions for mothballed equipment.

1.4 PRE-FINAL AND FINAL INSPECTIONS

A. Pre-final and final inspections are surveys of the CONTRACTOR's work by the CONSTRUCTION MANAGER, the OWNER, and the DESIGN CONSULTANT in order to create a list of incomplete or unsatisfactory items of work.

B. Prior to the pre-final and final inspections, the CONTRACTOR must complete the following:

1. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

2. Clean equipment and fixtures by removing temporary labels, stains, dirt, and other foreign substances.

3. Clean or replace filters of operating equipment.

4. Clean debris from galleries, pipes, roofs, gutters, basins, pump wet wells, down spouts, tanks, drainage systems, and HVAC ducting.

5. Clean site; sweep paved areas, rake clean unpaved surfaces.

6. Remove waste and surplus materials, rubbish, fencing, equipment, temporary utilities, and construction facilities from the site.

C. The discrepancy list(s) and punchlist will include all items of work found to be unsatisfactory, missing, incomplete, damaged, incorrect, or improperly installed or constructed. Prior to Final Acceptance the CONTRACTOR shall correct the punchlist items by re-work, modification, or replacement, at the option of the CONSTRUCTION MANAGER and at no additional cost to the OWNER. The CONSTRUCTION MANAGER will reinspect punchlist items upon notice by the CONTRACTOR that they are complete.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove from the vicinity of the completed work, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the OWNER will be withheld until the CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the project site.

3.2 OWNER'S MANUAL SUBMITTAL

A. The CONTRACTOR'S attention is directed to the condition that one percent of the contract price will be deducted from any monies due the CONTRACTOR as progress payments, if at the 75 percent construction completion point, the approved OWNER'S MANUAL complying with Section 01300 has not been submitted. The aforementioned amount will be retained by the OWNER as the agreed, estimated value of the approved OWNER'S MANUALS. Any such retention of money for failure to submit the approved OWNER'S MANUALS on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the CONTRACTOR as specified in Contract Documents.

3.3 MAINTENANCE AND GUARANTEE

A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in the Contracts Documents.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private owner or public agency releasing the OWNER from further responsibility in connection with such repair or resurfacing.

C. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the OWNER. If the CONTRACTOR fails to make such repairs or replacements promptly, the OWNER reserves the right to do the work and the CONTRACTOR and his surety shall be liable to the OWNER for the cost thereof.

3.4 BOND

A. The CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and according to the Contract Documents.

** END OF SECTION **

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 01720

RECORD DRAWINGS

PART 1 – GENERAL

1.1 GENERAL

A. Record drawings refer to those documents maintained and annotated by the CONTRACTOR during construction and are defined as (1) a neatly and legibly marked set of contract drawings showing the final location of piping, equipment, electrical conduits, outlet boxes and cables; (2) additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the specifications; and (3) CONTRACTOR layout and installation drawings.

B. Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the CONSTRUCTION MANAGER during normal working hours at the CONTRACTOR's field office. At the completion of the work, prior to final payment, all record drawings shall be submitted to the CONSTRUCTION MANAGER.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DRAWING MARKUP

A. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

Additions - Red
Deletions - Green
Comments - Blue
Dimensions - Graphite*

*Legibly mark to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SCOPE

A. Operation and maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.

B. O&M instructions must be submitted and accepted before on-site training may start.

1.2 TYPES OF INFORMATION REQUIRED

A. General: O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. In addition, one or more of the following items of information shall be provided as applicable.

B. Operating Instructions

1. Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:

a. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.

b. Operator Prestart: Provide requirements to set up and prepare each system for use.

c. Start-Up, Shutdown, And Post shutdown Procedures: Provide a control sequence for each of these operations.

d. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.

e. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

f. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

g. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

C. Preventative Maintenance

1. The following information shall be provided for preventive and scheduled maintenance to minimize corrective maintenance and repair:

a. Lubrication Data: Provide lubrication data, other than instructions for lubrication in accordance with paragraph 1.02 Operator Service Requirements.

1) A table showing recommended lubricants for specific temperature ranges and applications;

2) Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

3) A lubrication schedule showing service interval frequency.

b. Preventive Maintenance Plan and Schedule: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.

D. Corrective Maintenance

1. Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.

a. Troubleshooting Guides and Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

b. Wiring Diagrams and Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.

c. Maintenance and Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.

d. Removal and Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of test and illustrations.

e. Spare Parts and Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

f. Corrective Maintenance Manhours: Provide manufacturer's projection of corrective maintenance man-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

E. Appendices

1. The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.

a. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

b. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

c. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

d. Testing Equipment And Special Tool Information: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3 TRANSMITTAL PROCEDURE

A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with Section 01300 accompanied by Transmittal Form 01730-A and Equipment Record Forms 01730-B and/or 01730-C, as appropriate, all as specified in Section 01999. The transmittal form shall be used as a checklist to ensure the manual is complete. Only complete sets of O&M instructions will be reviewed for acceptance.

B. 3 copies of the specified O&M information shall be provided. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment number as it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.

C. If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.

1.4 PAYMENT

A. Acceptable O&M information for the project must be delivered to the CONSTRUCTION MANAGER prior to the project being 65 percent complete. Progress payments for work in excess of 65 percent completion will not be made until the specified acceptable O&M information has been delivered to the CONSTRUCTION MANAGER.

1.5 FIELD CHANGES

A. Following the acceptable installation and operation of an equipment item, the item’s instructions and procedures shall be modified and supplemented by the CONTRACTOR to reflect any field changes or information requiring field data.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

*** END OF SECTION ***

SECTION 01743

DESIGN REQUIREMENTS FOR
NON-STRUCTURAL COMPONENTS AND NON-BUILDING STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Minimum structural requirements for the design, anchorage, and bracing of non-structural components such as architectural/mechanical/HVAC/electrical components, equipment, or systems, and non-building structures such as tanks.

B. The requirements of this section apply to design of the structural elements and features of equipment and to platforms/walkways that are provided with equipment or non-building structures.

C. This section applies to non-building structures and non-structural components that are permanently attached to structures as defined below and in ASCE 7.

D. Design and conform to criteria and design codes listed within this section. Engineering design is not required for attachments, anchorage, or bracing detailed on the Drawings or where the size of attachments, anchorage, or bracing is defined in specific technical specification sections.

E. The following non-structural components are exempt from seismic design loading requirements of this section.

1. Components in Seismic Design Category A.
2. Furniture (except permanent floor supported storage cabinets over 6 ft tall).
3. Temporary or movable equipment.
4. Architectural components in Seismic Design Category B other than parapets supported by bearing walls or shear walls provided that the component importance factor, I_p, is equal to 1.0.
5. Mechanical and electrical components in Seismic Design Category B.
6. Mechanical and electrical components in Seismic Design Category C provided that the component importance factor, I_p, is equal to 1.0.
7. Mechanical and electrical components in Seismic Design Categories D, E, or F where all of the following apply:
    a. The component importance factor, I_p, is equal to 1.0;
    b. The component is positively attached to the structure;
    c. Flexible connections are provided between the component and associated ductwork, piping, and conduit;
    d. And either:
        1) the component weighs 400 lb or less and has a center of mass located 4 ft or less above the adjacent floor level; or

2) the component weighs 20 lb or less, or in the case of a distributed systems, 5 lb/ft or less.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related section. Additional related sections may apply that are not specifically listed below.

1. Section 05502 Anchor Bolts

1.3 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
Aluminum Design Manual	Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AAMA	American Architectural Manufacturer's Association
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.3	Seismic Design of Liquid-Containing Concrete Structures
AISC 341	Seismic Provisions for Structural Steel Buildings
ACI 360	Specification for Structural Steel Buildings
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASTM C635	Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636	Installation for Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.6	Structural Welding Code – Stainless Steel
AWS D1.8	Structural Welding Code – Seismic Supplement
Cal/OSHA	The Division of Occupational Safety and Health of California
CBC	International Building Code with local amendments
NFPA-13	Installation of Sprinkler Systems
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration
SMACNA	Seismic Restraint Manual Guidelines for Mechanical Systems

1.4 DEFINITIONS

A. Structure: The structural elements of a building that resist gravity, seismic, wind, and other types of loads. Structural components include columns, posts, beams, girders, joists, bracing, floor or roof sheathing, slabs or decking, load-bearing walls, and foundations.

B. Non-structural Components: Non-structural portions of a building include every part of the building and all its contents, except the structural portions, that carry gravity loads and that may also be required to resist effects of wind, snow, impact, temperature and seismic loads. Non-structural components include, but are not limited to, ceilings, partitions, windows, equipment, piping, ductwork, furnishings, lights, etc.

C. Non-building Structures: Self-supporting structures that carry gravity loads and that may also be required to resist the effects of wind, snow, impact, temperature and seismic loads. Non-building structures include, but are not limited to, pipe racks, storage racks, stacks, tanks, vessels and structural towers that support tanks and vessels.

1.5 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for requested deviations to specification requirements, with the submittal is sufficient cause for rejection of the entire submittal with no further consideration.
4. For structural elements of non-structural components and non-building structures required to be designed per this section, provide Drawings and design calculations stamped by a California licensed professional engineer qualified to perform structural engineering.
5. List of non-structural components and non-building structures requiring wind and seismic design and anchorage.
6. Shop drawings showing details of complete wind and seismic bracing and anchorage attachment assemblies including connection hardware, and embedment into concrete.
7. Shop drawings showing plans, elevations, sections and details of equipment support structures and non-building structures, including anchor bolts, structural members, platforms, stairs, ladders, and related attachments.
8. Identify interface points with supporting structures or foundations, as well as size, location, and grip of required attachments and anchor bolts. Clearly indicate who will be providing each type of attachment/anchor bolt. Equipment vendor shall design anchor bolts, including embedment into concrete, and submit stamped calculations.
9. Calculations for supports, bracing, and attachments shall clearly indicate design criteria applied. Coordinate concrete embedment calculations with thickness and strength of concrete members. Submit a tabulation of the magnitude of unfactored (service level) equipment loads at each support point, broken down by

type of loading (dead, live, wind, seismic, etc.). Indicate impact factors applied to these loads in design calculations.

1.6 QUALITY ASSURANCE

A. Quality Control By Owner:

1. Special Inspection of non-structural components and non-building structures, and their anchorages shall be performed by the Special Inspector under contract with the Owner and in conformance with CBC Chapter 17. Special Inspector(s) and laboratory shall be acceptable to the Owner in their sole discretion. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements. Where sampling and testing required conforms to Special Inspection standards, such sampling and testing need not be duplicated.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide materials in conformance with information shown on the Drawings and in other technical specification sections. See individual component and equipment specifications for additional requirements.

2.2 DESIGN CRITERIA

A. Design Codes

Design	Code
Buildings/Structures:	California Building Code 2019 and ASCE 7-16
Reinforced concrete:	ACI 350-06 and ACI 350.3-06 for Concrete Liquid Containing Structures, ACI 318-14 for all other reinforced concrete
Structural steel:	AISC 360-16 and AISC 341-16
Aluminum:	Aluminum Design Manual, Latest Edition
Welding:	AWS Welding Codes, Latest Edition
Occupational health and safety requirements:	OSHA and Cal/OSHA

Note: When conflicting requirements occur, the most stringent requirements will govern the design.

B. Design Loads

1. Dead Loads:

a. Add an additional allowance for piping and conduit when supported and hung from the underside of equipment and platforms.

b. Typical allowance for piping and conduit: 20 psf

2. Uniform Live Loads:

Elevated grating floors:	100 psf
Columns:	No column live load reduction allowed
Exitways, stairs and landings:	100 psf
Equipment platforms, walkways/catwalks (other than exitways):	60 psf
Utility bridges:	75 psf per level

3. Wind Loads:

Code:	CBC 2019 & ASCE 7-16
Risk Category:	III
Basic Wind Speed (Ultimate, 3-second gust) for Risk Category Shown Above:	103 mph
Exposure:	C
Topographic Factor (K_{zt})	1.0

Note:

1. *Design exterior non-strutural components and non-building structures, unless located in a pit or basin, to withstand design wind loads without consideration of shielding effects by other structures.*

4. Seismic Loads:

Code:	CBC 2019 & ASCE 7-16
Risk Category:	III (Wastewater Treatment Facilities are Risk Category III)
0.2 Sec. Mapped Spectral Response, S_S:	1.06 g
1.0 Sec. Mapped Spectral Response, S_1:	0.37 g
Site Class:	C
0.2 Sec. Design Spectral Response, S_{DS}:	0.85 g
1.0 Sec. Design Spectral Response, S_{D1}:	0.37 g
Importance Factor (I_e):	1.25
Component Importance Factor (I_p):	1.0, except I_p=1.5 for components identified in Section 13.1.3 of ASCE 7
Seismic Design Category	D

Notes:

1. *Calculate seismic loads on the basis of governing building code. Include equipment operating loads in structure dead load.*
2. *Check individual members for seismic and full member live load acting simultaneously, except that flooded equipment loads (infrequent occurrence) need not be combined with seismic loads. Combine equipment operating loads with seismic loads.*

5. Impact Loads:
   a. Consider impact loads in design of support systems.
   b. Use the following impact load factors unless recommendations of the equipment manufacturer will cause a more severe load case:

Rotating machinery:	20% of moving load
Reciprocating machinery:	50% of moving load

6. Temperature: Include effects of temperature in design where non-structural components and non-building structures are exposed to differential climatic conditions. See climatic conditions below for temperature extremes.

C. Load Combinations: Design non-structural components and non-building structures to withstand load combinations as specified in the governing building code. Where the exclusion of live load or impact load would cause a more severe load condition for the member under investigation, ignore the load when evaluating that member.

D. Design Considerations

1. Design non-structural components and non-building structures for the following conditions:
2. Climatic Conditions:

Maximum design temperature:	90	degrees Fahrenheit
Minimum design temperature:	15	degrees Fahrenheit

E. Column Base Fixity

1. Design column bases as pinned connections. No moments shall be assumed to be transferred to foundations.
2. Where significant shear loads (greater than 5,000 lb. per anchor bolt) are transferred at column base plates, provide a shear key designed to transfer shear load.

F. Deflection

1. Maximum beam deflection as a fraction of span for walkways and platforms: L/240 for total load and L/360 for live load.
2. Maximum total load deflection for equipment support: L/450.

PART 3 EXECUTION

3.1 GENERAL

A. Make attachments and braces in such a manner that component force is transferred to the lateral force-resisting system of the structure. Base attachment requirements and size and number of braces per calculations submitted by Contractor.

B. Anchorage of equipment is specified to be made by cast-in anchor bolts in concrete elements unless specifically noted otherwise on the Drawings or other specification sections. Contractor is responsible for remedial work or strengthening (of concrete elements because of superimposed seismic loading) if anchor bolts are improperly installed or omitted due to lack of submittal review or improper placement for any reason, at no additional cost to Owner.

C. Provide anchor bolts in accordance with Section 05502. Base size of anchor bolts and embedment on submitted calculations.

D. Submit details of and calculations for anchorages prior to placement of concrete or erection of other structural supporting members. Submittals received after structural supports are in place will be rejected if proposed anchorage method would create an overstressed condition of the supporting member. Contractor is responsible for revisions to anchorages and/or strengthening of structural support so that there is no overstress condition, at no additional cost to Owner.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 01999

REFERENCE FORMS

PART 1 FORMS

1.1 DESCRIPTION

A. The forms listed below and included in this section are referenced from other sections of the project manual:

Form No.	Title
01300-A	Submittal Transmittal Form
01730-A	Operation and Maintenance Transmittal Form
01730-B	Equipment Record Form
01730-C	Equipment Record Form
09800-A	Coating System Inspection Checklist
16000-A	Wire and Cable Resistance Test Data Form
16000-B	Installed Motor Test Data Form
13300-A	Loop Wiring and Insulation Resistance Test Data Form
13300-C	Controller Calibration Test Data Form
13300-G	Field Switch Calibration Test Data Form
13300-H	Transmitter Calibration Test Data Form
13300-I	Miscellaneous Instrument Calibration Test Data Form
13300-J	Individual Loop Test Data Form
13300-K	Loop Commissioning Test Data Form
11000-A	Manufacturer's Installation Certification Form
11000-C	Unit Responsibility Certification Form
11176-A	Motor Data Form

01300-A. SUBMITTAL TRANSMITTAL FORM

Submittal Transmittal

Submittal Description:	Submittal No:[1]	Spec Section:

	Routing	Sent	Received
Owner:	Contractor/CM		
Project:	CM/Engineer		
	Engineer/CM		
Contractor:	CM/Contractor		

We are sending you:
☐ Attached
☐ Under separate cover via _____
☐ Submittals for review and comment
☐ Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action[a]	Reviewer initials	Review comments attached

[a]*Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected*
Attach additional sheets if necessary.

Contractor

Certify either a or b:

a. ☐ We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).

b. ☐ We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: _____

Contractor's Signature: _____

[1]See *Section 01300-1.2 B, Transmittal Procedure.*

01730-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date:	Submittal No:[2]
To:	Contract No:
	Spec. Section:
	Submittal Description:
Attention:	From:

Checklist	Contractor		Construction Manager	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks:

Contractor's Signature :

[2] See *Section 01300-1.2 B, Transmittal Procedure.*

01730-B. EQUIPMENT RECORD FORM

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours
LUBRICANTS: RECOMMENDED:							
ALTERNATIVE:							
MISC. NOTES:							

RECOMMENDED SPARE PARTS			
PART NO	QUAN	PART NAME	COST

ELECTRICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	V	AMP	HZ
PH	RPM	SF	DUTY
CODE	INSL. CL	DES	TYPE
NEMA DES	C AMB	TEMP RISE	RATING
MISC.			
MECHANICAL NAMEPLATE DATA			
EQUIP			
MAKE			
SERIAL NO.		ID NO.	
MODEL NO.		FRAME NO.	
HP	RPM	CAP	SIZE
TDH	IMP SZ	BELT NO.	CFM
PSI	ASSY NO.	CASE NO.	
MISC			

01730-C. EQUIPMENT RECORD FORM

EQUIP DESCRIP		EQUIP LOC	
EQUIP NO.	SHOP DWG NO.	DATE INST	COST
MFGR		MFGR CONTACT	
MFGR ADDRESS			PHONE
VENDOR		VENDOR CONTACT	
VENDOR ADDRESS			PHONE

MAINTENANCE REQUIREMENTS	D	W	M	Q	S	A	Hours

09800-A COATING SYSTEM INSPECTION CHECKLIST

Project Name

Owner		Coating System Manufacturer (CSM)	
General Contractor (GC)		Coating System Applicator (CSA)	
Area or Structure		Location within Structure	
Coating System (eg E-1)		Coating Type (eg Epoxy, etc.)	

Coating System Inspection Checklist

Step	Description		Name	Signature	Date
1	Completion of cleaning and substrate decontamination prior to abrasive blast cleaning.	GC QC			
		CSM QC			
		CSA QC			
2	Installation of protective enclosure of structure or area and protection of adjacent surfaces or structures that are not to be coated.	GC QC			
		CSM QC			
		CSA QC			
3	Completion of ambient condition control in structure or building area and acceptance of ventilation methods in structure or Area.	GC QC			
		CSM QC			
		CSA QC			
4	Completion of Surface Preparation for Substrates to Be Coated.	GC QC			
		CSM QC			
		CSA QC			
5	Completion of Primer Application.	GC QC			
		CSM QC			
		CSA QC			
6	Completion of Concrete Repairs If Required and Related Surface Preparation Rework Prior to Coating System Application.	GC QC			
		CSM QC			
		CSA QC			
7	Completion of Concrete Filler/ Surface Application to Concrete.	GC QC			
		CSM QC			
		CSA QC			
8	Completion of First Finish Coat Application and of Detail Treatment at Transitions or Terminations.	GC QC			
		CSM QC			
		CSA QC			
9	Completion of Second Finish Coat Application and of Detail Treatment at Transitions and Terminations.	GC QC			
		CSM QC			
		CSA QC			
10	Completion of Full and Proper Cure of Coating System.	GC QC			
		CSM QC			
		CSA QC			

Coating System Inspection Checklist

Step	Description		Name	Signature	Date
11	Completion of Testing of Cured Coating System including Adhesion, Holiday (Continuity) Testing and Dry Film Thickness.	GC QC			
		CSM QC			
		CSA QC			
12	Completion of Localized Repairs to Coating System Following Testing.	GC QC			
		CSM QC			
		CSA QC			
13	Final Acceptance of Coating System Installation Including Final Clean-Up Complying with Specification Requirements and the CSM's Quality Requirements.	GC QC			
		CSM QC			
		CSA QC			

16000-A. WIRE AND CABLE RESISTANCE TEST DATA FORM

Wire or Cable No.:_____ Temperature, °F: _____

Location of Test	Insulation resistance, megohms
1.	
2.	
3.	
4.	
5.	
6.	
7.	

.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

16000-B. INSTALLED MOTOR TEST DATA FORM

Motor Equipment Number: _____ Date of test: _____

Equipment Driven: _____

MCC Location: _____

				Ambient temp	°F
Resistance:					
Insulation resistance phase-to-ground megohms:					
Phase A		Phase B		Phase C	
Current at Full Load:					
Phase		Current, amps			
Phase		Current, amps			
Phase		Current, amps			
Thermal Overload Device:	Manufacturer/catalog #		Amperes		
Circuit breaker (MCP) setting:					

Motor Nameplate Markings:

Mfr		Mfr Model		Frame		HP	
Volts		Phase		RPM		Service factor**	
Amps		Freq		Ambient temp rating		°C	
Time rating			Design letter**				
	(NEMA 1-10.35)			(NEMA MG-1.16)			
Code letter			Insulation class				

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

_____ Date _____

13300-A. LOOP WIRING AND INSULATION RESISTANCE TEST DATA FORM

Loop No.: _____

List all wiring associated with a loop in table below. Make applicable measurements as indicated after disconnecting wiring.

Wire No.	Panel Tie	Field TB	Continuity Resistance[a]		Insulation Resistance[b]			
			Cond./ Cond.	Cond./ Shield	Shield/ Gnd.	Shield/ Cond.	Cond./ Gnd.	Shield/ Shield
A			--	(A/SH)				
B			(A/B)	--				
C			(A/C)	--				
D			(A/D)	--				
etc.								

NOTES:

a. Continuity Test. Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of ±2 ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.

b. Insulation Test. Connect one end of a 500 volt megger to the panel ground bus and the other sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-B. CONTROL CIRCUIT PIPING LEAK TEST FORM

Loop No.:_____

List tubing associated with loop in table below. Make applicable measurements after isolating any air consuming pilots from circuit.

Tube No.	Tubing Equivalent Length of 1/4-Inch Copper[a]	Test Period (seconds)	Permitted Pressure Drop (psi)[b]	Measured Pressure Drop (psi)
A				
B				
C				
D				
etc.				

NOTES:

a. Convert actual tubing and air motor volume to equivalent 1/4-inch copper tubing.

b. Pressure drop shall not exceed 1 psi per hundred feet 1/4-inch tubing per 5 seconds.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-C. CONTROLLER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____ Process Variable (PV) Scale: _____

Output: _____ Output Scale: _____

PV Scale Calibration

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

Connect output to PV for following tests:

Set Point (SP) Indicator Accuracy			Output Meter Accuracy			Controller Accuracy		
SP	PV Reading	Expected % Dev.	Actual Reading	Expected Reading	Actual % Dev.	OUTPUT	OUTPUT	% Dev.
(0%)								
(50%)								
(100%)								
% Deviation Allowed:				% Deviation Allowed:			% Deviation Allowed:	

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-G. FIELD SWITCH CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No: _____

Input: _____

Range: _____

Set Point(s): _____

Simulate process variable (flow, pressure, temperature, etc.) and set desired set point(s). Run through entire range of switch and calculate deadband.

Set Point	Incr. Input Trip Point	Decr. Input Trip Point	Calc. Deadband	Required Deadband

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-H. TRANSMITTER CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make & Model No.: _____ Serial No.: _____

Input: _____

Output: _____

Range: _____ Scale: _____

Simulate process variable (flow, pressure, temperature, etc.) and measure output with appropriate meter.

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-I. MISCELLANEOUS INSTRUMENT CALIBRATION TEST DATA FORM

(For instruments not covered by any of the preceding test forms, the Contractor shall create a form containing all necessary information and calibration procedures.)

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-J. INDIVIDUAL LOOP TEST DATA FORM

Loop No.: _____

Description: (Give complete description of loop's function using tag numbers where appropriate.)

P&ID No.: (Attach copy of P&ID.)

a. Wiring tested:

(Attach test form 13300-A)

b. Instrumentation tubing/piping tested:

(Attach test form 13300-B)

c. Instruments calibrated:

(Attach test forms 13300-C through I)

d. List step-by-step procedures for testing loop parameters. Test loop with instruments, including transmitters and control valves, connected and functioning. If it is not possible to produce a real process variable, then a simulated signal may be used with the Construction Manager's approval.

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

13300-K. LOOP COMMISSIONING TEST DATA FORM

Loop No.: _____

a. Loop tested:

(Attach test form 13300-J)

b. Controlled or connected equipment tests confirmed:

c. Give complete description of loop's interface with process.

d. With associated equipment and process in operation, provide annotated chart trace of loop response to changes in set points for verification of performance. This chart should demonstrate 1/4-amplitude damping as output adjusts to set point change. Show set points, starting and finishing times on chart, as well as any other pertinent data.

Connect 2-pen recorder to process variable (PV) and to controller output. Use 1 inch/second chart speed.

Pen 1 - PV - Connections:

Pen 2 - Output - Connections:

CERTIFIED _____ Date _____

Contractor's Representative

WITNESSED _____ Date _____

Owner's Representative

11000-A. MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No:	Specification section:
Equipment name:	
Contractor:	
Manufacturer of equipment item:	

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments:

Manufacturer	Contractor
Signature of Authorized Representative	Signature of Authorized Representative
Date	Date

11000-C. UNIT RESPONSIBILITY CERTIFICATION FORM

[PROJECT TITLE]

CERTIFICATE OF UNIT RESPONSIBILITY

FOR SPECIFICATION SECTION _____

_____

[SECTION TITLE]

In accordance with Section 11000-1.02 Unit Responsibility of the contract documents, the undersigned manufacturer of driven equipment ("manufacturer") accepts unit responsibility for all components of equipment furnished to the Project under specification Section_____ ,and for related equipment manufactured under sections___-____, _____, and _____ .

We have reviewed the requirements for sections 11000 and 43 23 03 where applicable) and all sections referencing this (these) section(s), including but not limited to drivers, supports for driving and driven equipment and all other specified appurtenances to be furnished to the Project by manufacturer. And, we have further reviewed, and modified as necessary, the requirements for associated variable speed drives and motor control centers. We hereby certify that all specified components are compatible and comprise a functional unit suitable for the specified performance and design requirements whether or not the equipment was furnished by us. We will make no claim nor establish any condition that problems in operation for the product provided under this specification Section _____ are due to incompatibility of any components covered by this Certificate of Unit Responsibility. Nor will we condition or void any warranty for the performance of the product of this specification Section _____ due to incompatibility of any components covered under this Certificate of Unit Responsibility.

Our signature on this Certificate of Unit Responsibility does not obligate us to take responsibility for, nor to warrant the workmanship, quality, or performance of related equipment provided by others under specification sections _____, _____, and _____. Our obligation to warranty all equipment provided by us shall remain unaffected.

Notary Public	Name of Corporation
Commission expiration date	Address
Seal:	By:
	Duly Authorized Official
	Legal Title of Official
	Date

11176-A. MOTOR DATA FORM

Equipment Name: _____ Equipment No(s): _____

Project Site Location: _____

Nameplate Markings

Mfr:		Mfr Model:		Frame:		Horsepower:	
Volts:		Phase:		RPM:		Service Factor:	
FLA:		LRA:		Frequency:		Amb Temp Rating:	ºC
Time rating:				Design Letter:			
	(NEMA MG1-10.35)				(NEMA MG-1.16)		
KVA Code Letter:				Insulation Class:			

The following information is required for explosion-proof motors only:

A. Approved by UL for installation in Class _____, Div _____, Group _____
B. UL frame temperature code ____ (NEC Tables 500-8B)

The following information is required for all motors 1/2 horsepower and larger:

A. Guaranteed minimum efficiency _____

(Section 43 05 21-2.04 Motor Efficiency)

B. Nameplate or nominal efficiency _____

Data Not Necessarily Marked on Nameplate

Type of Enclosure:			Enclosure Material:		
Temp Rise:		ºC (NEMA MG1-12.41,42)			
Space Heater included?	☐ Yes	☐ No	If Yes:	Watts	Volts
Type of motor winding over-temperature protection, if specified:					

Provide information on other motor features specified:

_____

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this section includes furnishing all materials, equipment and labor necessary to perform and complete demolition and/or abandonment of pavements, curbs, gutters, drains, catch basins, cleanouts, and storm drains as shown on the contract drawings.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01045 Cutting and Patching

2. Section 01530 Protection of Existing Facilities

3. Section 01560 Temporary Environmental Controls

4. Section 01700 Project Closeout

5. Section 02200 Earthwork

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The WORK of this Section shall comply with the current edition of the Uniform Building Code as adopted by the City of San Diego Municipal Code.

B. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted edition of the Regional and City of San Diego Supplement Amendments (Whitebook), and as specified in Section 01090.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit a demolition schedule in compliance with Section 01300. The demolition schedule shall provide a complete coordination schedule for demolition work including shut-off and continuation of utility services before the start of the demolition. The schedule shall indicate proposed methods and operations of facility demolition and provide a detailed sequence of demolition and removal work to ensure uninterrupted operation of occupied areas.

B. Before completion of the Work, the CONTRACTOR shall submit an Affidavit of Legal Disposal attesting to the lawful disposal of all demolished materials.

PART 2 - PRODUCTS

2.1 CONCRETE CAP

A. Concrete used for capping lines designated to be abandoned on the construction drawings shall be 560-C-3250.

PART 3 - EXECUTION

3.1 GENERAL

A. Structures and pipes shall be demolished, removed, or abandoned in compliance with SSPWC and Whitebook Section 306-3.3.

B. Pavements shall be demolished in compliance with SSPWC Section 401 and the requirements indicated herein.

3.2 POLLUTION CONTROL

A. Water sprinkling, temporary enclosures, chutes, and other suitable methods shall be used for dust suppression in compliance with SSPWC Section 3 and Section 01560.

B. Water shall not be used when it creates hazardous or objectionable conditions such as flooding, erosion, sedimentation, or pollution.

3.3 PROTECTION

A. Safe passage of persons around the area of demolition shall be provided. Operations shall be conducted to prevent injury to people and damage to adjacent buildings, structures, and other facilities in compliance with SSPWC Section 5.

B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished.

C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary and in accordance with SSPWC Section 400 and Section 01530.

D. Unless otherwise indicated, the CONTRACTOR shall protect and maintain all utilities in the proximity of the facilities to be demolished.

E. The CONTRACTOR shall protect nearby existing equipment from dust caused by demolition activities by covering, drop-curtains and other similar methods.

3.6 BELOW-GRADE DEMOLITION

A. Demolition of below grade areas shall be done as noted in the Contract Drawings.

B. Below-grade areas and voids resulting from demolition of structures shall be completely filled to a minimum compaction of 95%.

C. All fill and compaction shall be in accordance with Section 02200.

D. After fill and compaction, surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as indicated.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the OWNER. Alternate routes shall be provided around closed or obstructed traffic ways.

B. Site debris, rubbish, and other materials resulting from demolition operations shall be removed and disposed of in compliance with all laws and regulations. Burning of removed materials from demolished structures will not be permitted.

3.8 PATCHING AND REPAIRING

A. The CONTRACTOR shall provide patching, replacing, repairing, and refinishing of damaged areas involved in demolition as necessary to match the existing adjacent surfaces and in compliance with 01045.

B. The CONTRACTOR shall repair all damages caused to adjacent facilities by demolition at no additional cost to the OWNER.

C. After patching and repairing has been completed, the CONTRACTOR shall carefully remove splatterings of mortar from adjoining work (plumbing fixtures, trim, tile, and finished metal surfaces) and repair any damage caused by such cleaning operations.

3.9 CLEANING

A. During and upon completion of Work, the CONTRACTOR shall promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave areas affected by the Work in a clean condition in accordance with Section 01700.

B. Clean adjacent structures and facilities of dust, dirt, and debris caused by demolition and return adjacent areas to condition existing prior to start of work.

C. The CONTRACTOR shall clean and sweep the affected portions of roads, streets, sidewalks and passageways daily.

*** END OF SECTION ***

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes site preparation, clearing and grubbing. The CONTRACTOR shall furnish all materials, equipment, and labor necessary to prepare the site including clearing, grubbing and stripping.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01530 Protection of Existing Facilities

2. Section 01550 Site Access and Storage

3. Section 02050 Demolition

4. Section 02140 Dewatering

5. Section 02200 Earthwork

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments.

1.4 DEFINITIONS

A. The following definitions apply to the Work of this Section:

1. Clearing is defined as cutting trees, removing fences and posts, removing curbs and other improvements to prepare the site for grubbing and stripping.

2. Grubbing is defined as the below grade part of clearing to remove roots, small piping, irrigation systems, etc., to prepare the site for stripping.

3. Stripping is defined as removing a surface layer of soil and organic material, sod, top-soil, and other unsuitable material as defined in Section 02200, to a depth that earthwork can proceed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Existing Conditions: The site shall be examined, and the CONSTRUCTION MANAGER notified of any conditions which affect the Work of this Section.

B. Utility Interference: Where existing utilities interfere with the Work of this Section, the CONSTRUCTION MANAGER shall be notified of interferences, and notifications to the relevant departments and utilities shall be provided in accordance with SSPWC Section 402.

3.2 CLEARING, GRUBBING, AND STRIPPING

A. Clearing, grubbing, and stripping shall comply with the requirements of SSPWC Subsection 300-1 and the following:

1. All construction areas shall be cleared of grass and weeds to at least a depth of 6 inches and cleared of structures, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction, as directed by the CONSTRUCTION MANAGER.

2. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material.

3. Unless otherwise indicated, native trees larger than 3 inches in diameter at the base shall not be removed without the CONSTRUCTION MANAGER's approval. The removal of any trees, shrubs, fences, or other improvements outside of rights-of-way as deemed necessary, shall be arranged with the property owner and be removed and replaced at no increased cost to the OWNER.

4. Except in areas to be excavated, stump holes and other holes resulting from the Work shall be backfilled with suitable material in accordance with Section 02200.

5. Removal and disposal of all waste materials shall be as indicated in SSPWC Section 401. Unless otherwise indicated, all merchantable timber shall become the property of the CONTRACTOR.

6. Project site maintenance shall conform to SSPWC Section 3-12.

*** END OF SECTION ***

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall perform site dewatering necessary to lower and control groundwater levels and hydrostatic pressures to allow excavation and construction to be performed properly under dry conditions. This Section includes materials, installation, maintenance, operation, and removal of temporary dewatering systems. All dewatering equipment is temporary and shall be installed and removed in accordance with local, State, and Federal laws and regulations.

B. Dewatering operations shall be adequate to ensure the integrity of the finished project. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the CONTRACTOR. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the CONTRACTOR.

D. CONTRACTOR shall be responsible for providing all dewatering activities as necessary to facilitate the work at no additional cost to the OWNER.

E. The CONTRACTOR shall make its own assessment of the geologic conditions and impact of the geologic conditions on construction activities. The CONTRACTOR may perform additional subsurface explorations if deemed necessary to complete the work. Additional explorations shall be performed at no cost to the OWNER and shall comply with all applicable permit requirements. Copies of additional subsurface reports obtained by the CONTRACTOR shall be provided to the CONSTRUCTION MANAGER.

1.2 RELATED SECTIONS

A. The Work of the following Section applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 02200 Earthwork

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments, as specified in Section 01090.

B. The CONTRACTOR shall comply with California Regional Water Quality Control Board General Waste Discharge Requirements for Groundwater Extraction and Similar Waste Discharges, and City of San Diego Policy for Groundwater Discharges to Sewer and requirements of the Industrial Users Discharge Permit, as applicable.

1.4 CONTRACTOR SUBMITTALS

A. The following shall be submitted in compliance with Section 01300 - Submittals:

1. Prior to commencement of excavation, a detailed plan and schedule, with description, for dewatering of excavations. The plan shall include: the proposed type of dewatering system; the arrangement, location, and depths of system components; a complete description of the equipment and instrumentation to be used, with installation, operation and maintenance procedures; a description of the CONTRACTOR's means and methods for measuring groundwater levels and piezometric water levels; calculations showing the quantities to be dewatered; and the methods for treatment and disposal of dewatering effluent.

2. Demonstration of proposed system and verification that adequate personnel, materials and equipment are readily available.

3. Before starting excavation, the CONTRACTOR shall submit copies of its Regional Water Quality Control Board permit for dewatering discharges to the environment or permit for dewatering discharges to the Metropolitan Sewer System, as applicable.

4. Before starting excavation, the CONTRACTOR shall submit copies of well installation permits, as applicable.

5. The CONTRACTOR shall submit copies of well drilling and closure permits, as applicable. The CONTRACTOR shall construct and abandon wells per the County of San Diego Site Assessment and Mitigation Manual.

B. The CONTRACTOR shall submit a daily report that includes the following information:

1. Groundwater levels and piezometric water levels in observation wells (if any).

2. Changes in elevation of reference points as stated in section 1.5 to detect any settlement in adjacent structures.

3. The average dewatering flow rate.

4. Water quality testing results as required by the Regional Water Quality Control Board and City of San Diego Public Utilities Department, as applicable.

1.5 QUALITY ASSURANCE

A. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, the CONTRACTOR shall establish reference points and shall observe the reference points at frequent intervals to detect any settlement which may occur.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Dewatering, where indicated, includes well points, deep cased wells with submersible pumps, sump pumps, temporary pipelines for water disposal, rock or gravel placement, observation wells, and other means including standby pumping equipment maintained on the jobsite continuously.

B. The CONTRACTOR shall provide piezometers for monitoring groundwater levels. The CONTRACTOR shall provide other instruments and measuring devices as required.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Dewatering shall be performed in compliance with Section 3-12.6.4 and Section 306-5 of SSPWC and as specified herein.

B. The CONTRACTOR is responsible for obtaining a permit for temporary construction dewatering. A permit is required from the Regional Water Quality Control Board for any discharge of groundwater to the environment or from the San Diego Metropolitan Wastewater Department for any discharge of groundwater to the sanitary sewer. The CONTRACTOR shall comply with Regional Water Quality Control Board Waste Discharge requirements and City of San Diego Industrial Users Discharge Permit requirements, as applicable. Before starting dewatering operations, the CONTRACTOR shall obtain authorization, as required, for the disposal of groundwater. The CONTRACTOR shall comply with all applicable sampling, testing, monitoring, and reporting requirements.

C. The CONTRACTOR shall maintain adequate control to ensure that the stability of excavated and constructed slopes is not adversely affected by water, that erosion is controlled, and that flooding of excavations or damage to structures does not occur.

D. The CONTRACTOR shall maintain an adequate system to lower and control the groundwater to permit excavation, construction of structures, and placement of fill materials to be performed under dry conditions.

E. Sufficient dewatering equipment shall be installed to pre-drain the water-bearing strata below the bottom of foundations, drains, sewers, and other excavations.

F. The hydrostatic head in water-bearing strata below foundations, drains, sewers, water pipelines and trenches and other excavations shall be reduced to ensure that the water level and piezometric water levels are below the excavation surface at all times.

G. The piezometric water level shall be maintained at all times a minimum of 2-feet below the excavation surface.

H. The system shall be placed into operation before excavation below groundwater level is started. The system shall be operated continuously 24 hours a day, 7 days a week until pipelines, drains, sewers and structures have been constructed, structures have been waterproofed or dampproofed, fill and backfill materials have been placed, and dewatering is no longer required.

I. The site shall be graded to facilitate drainage and runoff shall be diverted from the excavations. Surface runoff shall be collected in shallow ditches around the perimeter of the excavations, drained to sumps, and pumped or drained by gravity away from the excavations.

J. Dewatering shall at all times be conducted to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

K. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock or approved materials at no additional cost to the OWNER.

L. Flotation of structures and facilities shall be prevented by maintaining a positive and continuous removal of water.

M. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sand packed and/or other means shall be used to prevent pumping of fine sands or silts from the subsurface. A continuous check shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

N. Water and debris shall be disposed of in a suitable manner in compliance with permit requirements and SSPWC Section 3, without damage to adjacent property. No water shall be drained into work built or under construction. Before disposal, water shall be treated in accordance with permit requirements. Before disposal, water shall be filtered to remove sand and fine-sized soil particles. The filtration system shall be submitted by the CONTRACTOR per the requirements of Paragraph 1.4, CONTRACTOR Submittals.

O. The release of groundwater to its original level shall be performed in a manner that avoids disturbance of natural foundation soils, prevents disturbance of compacted backfill, and prevents flotation or movement of structures and pipelines.

** END OF SECTION **

SECTION 02200

EARTHWORK

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes all earthwork required for construction of the WORK. Such earthwork shall include the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the WORK.

B. Fill material is defined as material used to raise the level of a portion of the site to the line and grade indicated. Backfill material is defined as material used to refill an excavation.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02140 Dewatering
2. Section 02600 Pipeline Construction

B. A soil report has been prepared for this project, titled "Geotechnical Evaluation Metropolitan Biosolids Center (MBC) Storm Drain Diversion Structure" Ninyo and Moore Project No. 104577001 dated 8/23/2002.

1. Update letter provided by Ninyo and Moore dated 4/24/2020

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 REGULATORY REQUIREMENTS

A. The WORK of this Section shall comply with current versions, with revisions, of the following:

1. Construction Safety Orders, Division of Industrial Safety, State of California.
2. California Department of Transportation Traffic Manual.

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. The CONTRACTOR shall comply with the provisions for "Shoring and Bracing Drawings in Section 6705 of the California Labor Code. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the OWNER and shall be in possession of the OWNER's written

acceptance of the CONTRACTOR's detailed plan shoring design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared by a civil or structural engineer licensed in the State of California.

2. Copy of the excavation permit issued by the California Department of Industrial Safety.

3. Samples of imported material. Samples shall be submitted in accordance with SSPWC, Subsection 306-1.3.5.

4. Such other samples of materials as the CONSTRUCTION MANAGER may require.

1.6 SOIL TESTING

A. General: All soils testing shall be done in accordance with SSPWC, Section 211, and by a testing laboratory of the OWNER's choice at the OWNER's expense.

B. Compaction Tests: Where soil material is required to be compacted to a percentage of maximum density, the maximum density shall be determined in accordance with the requirements of SSPWC, Subsection 211-2. In case the tests of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and shall be at the CONTRACTOR's expense.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

A. General: Fill and backfill material shall consist of select material obtained from the excavation, imported material, granular bedding material, or unclassified material. The CONTRACTOR shall import at his expense materials in excess of the approved material obtained from excavation as required to complete the fill, backfill, and grading WORK as indicated.

B. Select Material: Select material shall consist of primarily granular material encountered in the excavation which is free of vegetation, organic matter, debris, rocks larger than 4 inches in diameter and other unsuitable material, and shall have an expansion index less than 30 (less than 20 for footings and floor slabs) as determined by UBC Standard No. 29-2, plasticity index of 10 or less, a liquid limit of 30 or less and shall be approved as select material by the CONSTRUCTION MANAGER.

C. Imported Material: Imported material shall conform to the same specifications as select material defined above. In addition, the imported materials shall have a minimum sand equivalent of 15 as determined by California Test Method No. 217. Imported material placed in areas to be planted shall be able to support normal plant growth. Obtain approval by the CONSTRUCTION MANAGER prior to transporting imported material.

D. Bedding Material: Bedding material, defined as that material supporting, surrounding and extending to 1 foot above the top of a pipe, shall be in accordance with SSPWC, Subsection 306-1.2.1.

E. Unclassified Material: Unclassified material shall conform to SSPWC, Subsection 300-4.

2.2 ROCK PRODUCTS

A. Rock products, consisting of crushed rock, rock dust, gravel, sand, and stone for riprap shall be clean, hard, sound, durable, uniform in quality and free of disintegrated material, organic matter, oil alkali, or other deleterious substance, and shall, unless otherwise specified, conform with the requirements of SSPWC, Subsection 200-1.

2.3 DECOMPOSED GRANITE FOR ACCESS ROAD

A. Decomposed Granite shall conform to SSPWC, Subsection 200-2.7.

B. Decomposed Granite shall conform to the following requirements:

1. Resistance Value (R-Value) 73 Minimum

2. Sand Equivalent 30 Minimum

C. Decomposed Granite not used as base with hot mix A.C. shall conform to the following grading:

Percentage Composition on By Weight

Passing 1 ½" sieve	100%
Passing 1" sieve	90 – 100%
Passing a #4 sieve	50 – 100%
Passing a #3 sieve	25 – 55%
Passing a #200 sieve	5 – 18%

D. All Decomposed Granite shall be compacted to 95 percent relative compaction, as per ASTM D-1557.

E. Color shall be "California Gold" or as approved by OWNER.

2.4 UNTREATED BASE MATERIALS

A. Untreated base materials shall conform with the requirements of SSPWC Subsection 200-2.

B. Materials for use as untreated base or subbase shall be:

1. Crushed Aggregate Base

2. Decomposed Granite

2.5 TOPSOIL

A. Topsoil shall be designated as Class A (imported), Class B (selected), or Class C (unclassified), and shall conform with the requirements of SSPWC, Subsection 212-1.1. The CONSTRUCTION MANAGER shall determine the suitability of topsoil prior to use.

PART 3 -- EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall perform earthwork as necessary to complete the WORK as shown on the Contract Drawings and specified herein. The CONTRACTOR shall take the necessary precautionary measures to prevent dust or other nuisances which might be created by reason of his activities. The necessary precautionary measures shall conform to the requirements of SSPWC, Subsection 7-8. The requirements specified in Subsection 7-8 shall be extended to include paved surfaces.

B. All types of earthwork, including trench, structural and general excavation, fill, backfill and compaction, shall conform to applicable requirements of the SSPWC. Section 300, and to the requirements specified herein.

3.2 SITE PREPARATION

A. Areas to be excavated, filled, graded, and to be occupied by permanent construction or embankments shall be prepared by clearing and grubbing. Clearing and grubbing shall conform to the applicable requirements of SSPWC, Subsection 300-1.

3.3 EXCAVATION

A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. Unless otherwise directed, the removal of said materials shall conform to the lines and grades shown. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water as required by Section 02140. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the rules, orders, and regulations of the Division of Industrial Safety of the State of California.

B. Unclassified Excavation: Unclassified excavation shall consist of all excavation, including roadways, unless separately designated.

1. Unsuitable material shall be excavated and disposed of in accordance with the requirements of SSPWC, Subsection 300-2.2.

2. Wet material, if unsatisfactory for the specified use on the project solely because of high moisture content, may be processed to reduce the moisture content, or may be required to be removed and replaced with suitable material in accordance with the requirements of SSPWC, Subsection 300-2.2.2.

3. The removal and disposal of slide and slipout material shall be in accordance with SSPWC, Subsection 300-2.4.

4. Excavation slopes shall be finished in conformance with the lines and grades shown, and in accordance with SSPWC, Subsection 300-2.5.

5. Surplus material shall be disposed of off-site, and in accordance with SSPWC, Subsection 300-2.6.

C. Structure Excavation: Structure excavation shall consist of the removal of material for the construction of foundations for bridges, retaining walls, headwalls, culverts, buildings, or other structures, and shall be in accordance with SSPWC, Subsection 300-3.

1. Cofferdams for foundation construction shall be constructed in accordance with SSPWC, Subsection 300-3.2.

2. The treatment of foundation material shall be in accordance with SSPWC, Subsection 300-3.3.

D. Underground Conduit Excavation:

1. General: Excavation for underground conduits shall be in accordance with SSPWC, Subsection 306-1.1 and the requirements contained herein. Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches for mechanical compaction methods and 18 inches for water consolidation methods. The maximum width at the top of the pipe shall be equal to the outside diameter of the pipe plus 36 inches for pipe diameters 18 inches and larger and to the outside diameter of the pipe plus 24 inches for pipe diameters less than 18 inches.

2. Bracing Excavations: The manner of bracing excavations shall be as set forth in the rules, orders and regulations of the Division of Industrial Safety of the State of California, and in accordance with the requirements of SSPWC, Subsection 306-1.1.6.

3. Trench Bottom: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.

4. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived In cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights conforming to requirements set forth in the California Department of Transportation Traffic Manual shall be provided and maintained.

5. Trench Over-Excavation: Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth required, and then backfilled to the grade of the bottom of the pipe.

6. Where pipelines are to be installed in embankment fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

E. Over-Excavation Ordered by CONSTRUCTION MANAGER:

1. Trenches shall be over-excavated beyond the depth shown when required by the CONSTRUCTION MANAGER. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All work specified in this Section shall be performed by the CONTRACTOR at no additional cost to the OWNER when the over-excavation ordered by the CONSTRUCTION MANAGER is less than 6 inches below the limits shown. When the over-excavation ordered by the CONSTRUCTION IVIANAGER is 6 inches or greater below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the work which is located below said 6-inch distance.

F. Over-Excavation not Ordered or Indicated:

1. Any over-excavation carried below the grade ordered or indicated shall be backfilled to the required grade with the specified material and compacted. Such work shall be performed by the CONTRACTOR at no additional cost to OWNER.

G. Excavation in Lawn Areas:

1. Where excavation occurs in lawn areas, the sod shall be carefully removed and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn; provided, that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling [and testing of the pipeline], the sod shall be replaced in a manner so as to restore the lawn as near as possible to its original condition. CONTRACTOR shall provide new sod if removed sod has remained stockpiled for more than 72 hours.

2. The CONTRACTOR shall restore the lawn irrigation system removed or damaged due to excavation operations to a condition equal to the previous condition.

H. Excavation in Vicinity of Trees:

1. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without written permission of the CONSTRUCTION MANAGER. Trees shall be supported during excavation by means previously reviewed by the CONSTRUCTION MANAGER.

I. Rock Excavation:

1. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.

2. Said rock excavation shall be performed by the CONTRACTOR; provided, that should the quantity of rock excavation be affected by any change in the scope of the WORK, an appropriate adjustment of the contract price will be made.

3.4 FILL AND BACKFILL

A. General:

1. Fill and Backfill shall be placed in accordance with the applicable provisions of SSPWC, Section 300, and the requirements stated herein.

2. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has been properly cured in accordance with the requirements of Section 03300 and has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

3. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall not be placed until all water is removed from the excavation.

B. Placing and Spreading of Materials:

1. Materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment the layers shall be evenly spread so that when compacted each layer shall not exceed 8 inches in thickness. When compaction is achieved using flooding and jetting methods, each layer shall not exceed 3 feet in thickness after compaction.

2. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Bedding materials shall be brought up evenly around the pipe so that when compacted the material will provide unifonzi bearing and side support.

3. Where the material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

4. Where the material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

C. Compaction Requirements

1. Compaction tests shall be performed in accordance with SSPWC, Subsection 211-2.

2. The relative compaction of fill, backfill, and base material shall be in accordance with SSPWC, Section 300, with the following exceptions:

   a. Subgrade where trench has been overexcavated 95%

   b. One foot layer of crushed aggregate backfill in overexcavated trench. Where trench is overexcavated more than 2 feet, minimum of 2 layers shall be compacted: 95%

   c. Pipe zone for flexible and rigid pipe: 95%

   d. Fill beneath structures, including water containing structures: 95%

e. Backfill on underground structure roof: 90%

f. Decomposed granite driveway: 95%

D. Unclassified Fill:

1. All fill shall be of unclassified material unless separately designated. Construction of unclassified fill, including preparing me area on which fill is to be placed, and the depositing, conditioning, and compacting of fill material shall be in accordance with SSPWC, Subsection 300-4.

E. Structure Backfill:

1. Backfill at structure shall be select granular material placed in accordance with SSPWC, Subsections 300-3.5 and 300-4.5.

F. Underground Conduit Backfill:

1. Bedding around pipe shsll be bedding material placed in accordance with the requirements of SSPWC, Subsection 306-1.2.

2. Backfill above shall be considered as starting 1 foot above the pipe or conduit, or at the subgrade for cast-in-place structures such as manholes, transition structures, junction structures, vaults, and valve boxes.

3. Backfill at underground conduits shall be select material placed and densified according to SSPWC, Subsection 306-1.3.

3.5 PREPARATION OF SUBGRADE UNDER IMPROVEMENT

A. The preparation of subgrade for pavement, curbs and gutters, driveways, sidewalks and other roadway structures shall be in accordance with SSPWC, Subsection 301-1.

3.6 UNTREATED BASE

A. Spreading and Compacting:

1. Aggregate base material and decomposed granite driveway shall be spread and compacted in accordance with SSPWC, Subsection 301-2.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02600

PIPELINE CONSTRUCTION

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this section includes providing general requirements for pipelines, including pipe, joints, specials, and appurtenances complete and in place.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 01530 Protection of Existing Facilities

2. Section 02140 Dewatering

3. Section 02200 Earthwork

4. Section 02730 Sanitary Sewerage System Testing

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SHOP DRAWINGS AND SAMPLES

A. In addition to the requirements of Section 02200 and the pipe material specifications, the following shall be submitted in compliance with Section 01300.

1. Post-installation videotape and inspection reports.

2. Line layout and marking diagrams which indicate the specific number of each pipe and fitting and the location of each pipe and the direction of each fitting in the completed line. In addition, the line layouts shall include: the pipe station and invert elevation at all changes in grade or horizontal alignment; the station and invert elevation to which the bell end of each pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment; and the limits of each reach of retrained and/or welded joints, or of concrete encasement.

3. Shop drawings and design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.

4. Drawings and calculations for thrust blocks.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer. Materials delivered onsite without an approved submittal for verification shall be rejected and payment withheld.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

C. **Protection of Equipment:** Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment with anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings. Gears and bearings to be stored for extended periods shall be containerized suitable for export shipment.

1.6 FACTORY INSPECTION AND TESTING

A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for two OWNER-designated inspectors for the number of days indicated to complete such inspections or observations, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors. The CONTRACTOR shall comply with the requirements of Section 01400.

PART 2 - PRODUCTS

2.1 PIPE AND APPURTENANCES

A. Provide pipe materials, coatings and linings, and appurtenances of the sizes and types indicated on the Drawings and comply with Section 02617 - Reinforced Concrete Pipe, Section 02630 - Ductile Iron Pipe, Section 02644 - PVC Non-Pressure Pipe, Section 02646 - PVC Pressure Pipe.

2.2 DETECTABLE WARNING TAPE AND TRACER WIRE FOR BURIED PIPE

A. Provide Detectable Warning Tape for all buried piping:

1. Detectable Warning Tape shall be 3 inches wide, colored per ANSI Z535.1 (APWA Uniform Color Code for Marking Underground Utilities) and made of polyethylene or vinyl tape imprinted with black, bold letters approximately 2 inches high and shall read “CAUTION: _____ LINE BELOW” or similar as

approved by the Engineer. The blank shall be filled in with the applicable service.

2. Tape shall be capable of stretching to twice its original length and shall be as manufactured by W. H. Brady Co., Seton, Marking Services Inc., or equal.

B. Install tracer (locate) wire along the buried portion of pipe alignments for the following piping services: Storm Sewer

1. Direct burial rated, 12 gauge solid copper, 600-volt UF tracer wire with heavy-duty PVC insulation. Tracer wire insulation color-coded to match each utility service as designated in ANSI Z535.1 (APWA Uniform Color Code for Marking Underground Utilities).
2. SPLICES: Silicone-filled UL-Listed product specifically designed for waterproof direct bury splicing of tracer wire 3M DBR-6; or approve equal.
3. WIRE ACCESS BOXES: Cast iron valve box top piece frame and cover set within a concrete ring cast flush with grade, as appropriate for the location in which it will be installed and for the traffic loading it may be subject to, and in accordance with the applicable elements of the Standard Detail for valve box installations. Mark lids in raised or recessed lettering with the word "Test". Submit all wire access boxes proposed for use to the Construction Manager for review.

2.3 FILL AND BACKFILL MATERIAL

A. Fill and backfill materials shall be in accordance with Section 02200.

PART 3 - EXECUTION

3.1 PREPARATION

A. **Traffic:** Conform to requirements of Section 01550.

B. **Utility Relocation:** Notify the CONSTRUCTION MANAGER of property which must be relocated of existing public utilities and franchise holders which must be relocated and the reasonable time for doing so. The OWNER will contact the utility or franchise holder and request relocation. Relocation and protection of existing utilities which are the CONTRACTOR's responsibility shall be in accordance with Section 01530.

C. Before submitting joint shop drawings, where the proposed piping will connect to existing piping, the CONTRACTOR shall excavate the point of connection to verify size, layout, and depth. Prepare a sketch of the proposed point of connection for submittal with the joint shop drawings. The CONTRACTOR shall give the CONSTRUCTION MANAGER a minimum of two hours to inspect the existing piping before backfilling.

3.2 DEWATERING

A. Install and operate according to Section 02140 a continuous dewatering system capable of maintaining the ground water level 2 feet below the excavated trench bottom. Only well

points located on both sides of the trench shall be used for dewatering, unless otherwise approved by the CONSTRUCTION MANAGER.

B. Operate the dewatering system 7 days per week, 24 hours per day with water level as indicated above until backfilling is completed.

C. Field-determined departures from the dewatering plans may necessitate adjustments to the trench shoring and bracing methods to achieve soil stability. Adjustment shall be at no additional cost to the OWNER.

D. Dewatering shall prevent softening of the bottom of excavations or formation of "quick" conditions. Dewatering shall not remove native soils. All loose soil shall be removed and recompacted in accordance with Section 02200.

3.3 EXCAVATION

A. Unless indicated otherwise, excavation and overexcavation shall be in accordance with Section 02200.

B. Trench width shall be as indicated.

C. Stabilize the trench subgrade by compaction to 95 percent relative density. Where trench bottom has been over-excavated, compact the bedding to 95 percent in 1-foot thick layers.

3.4 LAYOUT AND HANDLING

A. **Handling of Pipe and Accessories:** Pipe shall be lifted in such a manner as to minimize bending and prevent damage to the pipe. During transport, pipe shall be supported to prevent distortion or damage to the pipe. When not being handled, pipe shall be stockpiled on timber cradles or properly prepared ground with all rocks larger than 3 inches eliminated. All pipe, fittings valves and accessories shall be carefully lowered into the trench in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. The CONTRACTOR shall smooth out any burrs, gouges, or weld splatter and repair other defects prior to laying the pipe. Any pipe section, including coatings and linings, that becomes damaged as a result of handling or stockpiling shall be replaced with a new unit or repaired at the discretion of the CONSTRUCTION MANAGER at no additional cost to the OWNER.

3.5 DIVERSION PUMPING

A. Where the proposed piping will connect to existing piping, which is in sewage service, install and operate bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow.

B. Design diversion piping, joints, and accessories to withstand 50 psi.

C. No sewage shall be diverted into any open area outside of a sanitary sewer.

D. In the event of spill or overflow, immediately stop the overflow and take action to clean up and disinfect the spillage area to original condition. Promptly notify the CONSTRUCTION MANAGER.

3.6 INSTALLATION

A. General: Pipe shall be installed in accordance with the pipe manufacturer's recommendations and the applicable provisions of SSPWC Section 306-1.2, and the requirements herein.

B. Interferences

1. CONTRACTOR shall protect and maintain all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the WORK in compliance with Section 01530. Where indicated that the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, or pipes, the obstruction shall be supported until it is relocated, removed, or reconstructed by the CONTRACTOR in cooperation with owners of such utility structures. Unless otherwise indicated, this WORK shall be performed at no additional cost to the OWNER.

2. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the CONSTRUCTION MANAGER may direct a change in the alignment or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount which will be detrimental to the strength and integrity of the finished joint.

C. Line and Grade Tolerance: Each section of pipe shall be laid in the order and position shown on the laying schedule. Unless indicated otherwise, the pipe shall be laid to the design line and grade, within approximately one inch plus or minus. No tolerance is permitted on pipes designed for zero slope.

D. Curved Alignments: Where curved alignments are indicated, deflecting the joints will be allowed only in accordance with the written instructions of the pipe manufacturer and these specifications. Where a smaller radius of curvature is required than can be accommodated by deflecting the joints, sections of pipe with beveled ends may be laid unless fabricated bends are indicated. Maximum joint deflection and maximum bevel for different pipe sizes and joint designs shall be in accordance with the pipe manufacturer's recommendations and these specifications.

E. Cutting and machining of the pipe shall only be in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe, produce ragged, uneven edges, or otherwise impair the condition of the pipe.

F. The CONTRACTOR shall install all pipe, fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials, bolts, nuts, gaskets, jointing materials, and all other appurtenances as indicated and as required to provide a complete

and workable installation. No pipe or appurtenance shall be installed when the interior or exterior surfaces show cracks or other defects that may be harmful as determined by the CONSTRUCTION MANAGER. Damaged interior and exterior surfaces shall be repaired to the satisfaction of the CONSTRUCTION MANAGER or a new undamaged pipe or appurtenance shall be provided.

G. Pipe laying operations shall be stopped, and dewatering operations shall be adjusted to prevent the pipe from floating due to water entering the trench from any source. The CONTRACTOR shall reinstall all affected pipe to its specified condition and grade.

H. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipeline shall be closed with watertight expandable type sewer plugs or PVC test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

I. Immediately before placing each section of pipe in final position for jointing, the bedding shall be checked for firmness and uniformity of surface.

J. Pipe shall be laid directly on the bedding material. No blocking will be permitted and the bedding shall form a continuous, solid bearing for the full length of the pipe. Excavate to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings and to facilitate placement of grout bands. Excavation shall be adequate to permit access to the joints for bonding operations and for application of coating on field joints.

K. Backfilling and compaction shall comply with Section 02200 and the pipe specifications.

L. Sheet piling used for shoring shall extend at least 2 feet below the bottom of the trench. After completion of the pipe, it may be removed by cutting at least 12 inches above the top of the pipe. No vibratory methods for pile removal will be accepted, and piling lower than 12 inches above the top of the pipe shall be left in place.

M. Lay section of pipe with the bell end upgrade.

N. Except for short runs which may be permitted by the CONSTRUCTION MANAGER, sections of pipe shall be laid in a sequence moving in an upgrade direction on grades exceeding 10 percent. Pipe which is laid in a downgrade direction shall be blocked and held in place until sufficient support is furnished by the following pipes to prevent movement.

O. Where indicated, concrete thrust blocks shall be provided.

3.7 FIELD TESTING

A. Field testing shall be in accordance with Section 02200.

3.8 SITE RESTORATION

A. Backfill and compact soil in accordance with Section 02200.

B. Place subgrade and base materials in accordance with Section 02200.

C. Replace damaged pavement, curbs, gutters, and sidewalks, shrubs, and trees as indicated in SSPWC Section 303-5.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02601

PRECAST MANHOLES

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes the precast reinforced concrete manholes.

1.2 MANUFACTURER

A. The precast concrete manholes shall be provided by a supplier in the manufacture of products required for this project.

B. Precast Producer shall be a National Precast Concrete Association (NPCA) certified plant.

C. Precast Producer shall be certified to International Organization for Standardization (ISO) standards.

1.3 RELATED SECTIONS

A. This section contains specific references to the following related specification sections. Additional related sections may apply that are not specifically listed below.

1. Section 02200 Earthwork
2. Section 02600 Pipeline Construction

1.4 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1. ASTM C 443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
2. ASTM C 478 Specification for Precast Reinforced Concrete Manhole Sections
3. ASTM C 497 Test Methods for Concrete Pipe, Manhole Sections, or Tile
4. ASTM C 877 Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections
5. ASTM C 923 Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
6. ASTM C 990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
7. ASTM C 1244 Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
8. AASHTO M 199M/M 199-05 Precast Reinforced Concrete Manhole Sections
9. AASHTO T 280 Concrete Pipe, Manhole Sections, or Tile

10. CSA A257.4 Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings.

11. CSA A257.3 Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections , and Fittings using rubber Gaskets

1.5 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300:

1. Detailed drawings of the precast manholes

a. System configuration with dimensions

b. Design loading: live loads, vertical and lateral earth loads used in design

c. Data sheets and installation instructions for lifting inserts and anchors

d. Data sheets and installation instructions for accessory items, such as sealants, gaskets, pipe entry connectors, steps, racks, and other items installed after delivery shall be included with the submittal package.

2. Provide certifications as listed in Part 1.2B and 1.2C

PART 2 -- PRODUCTS

All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.1 PRECAST CONCRETE

A. Precast elements shall be manufactured with concrete having a minimum 28-day compressive strength, f'c equal to 4000 psi.

B. Reinforcement:

1. Deformed Wire Reinforcing WWR – Per ASTM A1064

2. Reinforcing Bars – Per ASTM A615, Grade 60.

C. The manholes and all lids/vaults openings shall be capable of withstanding American Association of State Highway Transportation Officials (AASHTO) H-20 loading.

2.2 PIPE CONNECTIONS

A. For a cored or drilled opening, provide a flexible and watertight connection that meets or exceeds ASTM C923.

B. For a knockout opening, provide a watertight connection meeting the material requirements of ASTM C923 that is securely attached to the pipe with stainless steel bands or other means.

C. For grout openings in walls with non-shrink grout, pour a concrete collar around the pipe and outside the manhole opening. Provide flexible pipe joints or flexible connectors within 2 feet (0.6 m) of collar.

D. A flexible and watertight gasket per ASTM C923 shall be cast integrally with riser section(s) for all precast structures.

E. Grout internal joint space with non-shrink grout.

2.3 DAMPPROOFING

A. Dampproofing shall be applied by manufacturer per Section 07100.

PART 3 -- EXECUTION

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the structures and appurtenances in accordance with the drawings and these specifications.

3.1 INSTALLATION AND BACKFILL

A. Storage of precast concrete sewer manholes at the project site shall be in a manner to prevent physical damage and arranged so identification markings are visible

B. Contractor shall be responsible for locating and protecting all existing utilities, structures, etc., whether indicated or not, which may be affected by the construction process

C. All backfill shall be accomplished using approved material. Such material shall be free of debris, large stones, organic material, and other deleterious substances

D. Precast elements shall be installed in accordance with the contract plans and approved shop drawings

E. Lift and support precast sewer manholes only at lifting and/or support points designated by the manufacturer.

F. All construction activities shall conform to applicable OSHA standards for safety.

3.2 FIELD QUALITY CONTROL

A. Site tests – if owner requires testing for sanitary manholes, water testing shall be performed according to contract documents, ASTM C969 and precast concrete producer's recommendations.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02617

REINFORCED CONCRETE PIPE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing reinforced concrete pipe (tongue and groove joint) intended to be used for the construction of storm drains, and related structures.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02140 Dewatering

2. Section 02200 Earthwork

3. Section 02730 Sanitary Sewerage System Testing

4. Section 03300 Cast-in-Place Structural Concrete

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings showing dimensions and details of pipe joints, fittings, fitting specials, valves and appurtenances.

2. Detailed layout, spool or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings, and pipe supports.

3. Manufacturer's product data.

4. Manufacturer's installation instructions.

5. Manufacturer's certification of compliance.

1.5 FACTORY TESTING

A. **Product Testing:** Pipe shall be tested at the factory for D-load bearing strength in compliance with SSPWC Section 207-2.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserve the right to witness factory tests.

1.6 FIELD TESTING

A. **Testing:** Pipeline shall be field tested for leakage in compliance with SSPWC Section 207-2.

PART 2 - PRODUCTS

2.1 GENERAL

A. The size, type and D-load of the reinforced concrete pipe shall conform to SSPWC Section 207-2.

2.2 JOINT DESIGN

A. Joints shall be designed so as to be self-centering. Unless otherwise specified, joints in reinforced concrete pipe shall be of the tongue and groove mortar type of joint.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Reinforced concrete pipe shall be installed in accordance with the requirements of SSPWC Section 306.

** END OF SECTION **

SECTION 02630

DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing ductile iron pipe and all appurtenant work with Fusion bonded epoxy coating and lining material, which shall be furnished only by an OWNER-approved manufacturer.

B. The WORK requires that one pipe manufacturer accept responsibility for furnishing the coated and lined pipe without altering or modifying the CONTRACTOR's responsibilities under the Contract Documents.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02140 Dewatering

2. Section 02200 Earthwork

3. Section 02600 Pipeline Construction

4. Section 09800 Protective Coating

5. Section 15000 Piping Components

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. AWWA C110/ANSI A21.10 Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids

2. AWWA C150Thickness Design of Ductile-Iron Pipe

3. AWWA C151 Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids

4. AWWA C153 Ductile-Iron Compact Fittings, 3 in. through 24 inches and 54 through 64 inches for Water Service

5. ANSI/AWWA C203 Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

6. ANSI/AWWA C213 Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Certified dimensional drawings of all valves, fittings, and appurtenances.

2. For pipe 24 inches in diameter and larger, line layout and marking diagrams which indicate the specific number of each fitting and the location and the direction of each fitting in the completed line.

3. Certification from the polyurethane manufacturer that the proposed material meets all the indicated requirements.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. A certified affidavit of compliance for pipe and other products or materials with the requirements of this Section.

1.7 FACTORY INSPECTION AND TESTS

A. **Inspection:** All pipe shall be subject to inspection at the place of manufacture and place of coating and lining application in accordance with the provisions of the referenced standards, as supplemented by the requirements herein. The CONTRACTOR shall notify the CONSTRUCTION MANAGER in writing of the manufacturing starting date not less than 14 calendar days prior to the start of the pipe manufacture and coating application.

B. During the manufacture of the pipe, the CONSTRUCTION MANAGER shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

C. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

D. The CONTRACTOR shall perform said material tests at no additional cost to the OWNER. The CONSTRUCTION MANAGER will witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR'S schedule is not delayed for the convenience of the CONSTRUCTION MANAGER.

E. In addition to those tests specifically required, the CONSTRUCTION MANAGER may request additional samples of any material including lining and coating samples for testing by the OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

1.8 MARKING, HANDLING, AND STORAGE

A. **Markings:** All pipes shall be factory marked indicating size and class. Legibly mark specials 24 inches in diameter and larger in accordance with the laying schedule and marking diagram. Mark the surface of each fitting and special that is intended to be at the top when the fitting or special is placed in the trench.

PART 2 - PRODUCTS

2.1 GENERAL

A. **Pipe And Fittings:** Ductile iron pipe and fittings shall be in accordance with SSPWC, Section 209-1.1 and the requirements contained herein. The pipe shall be of the diameter indicated on the drawings.

2.2 PIPE JOINTS

A. Ductile iron pipe joints shall comply with the requirements of SSPWC, Section 209-1.1.2 and shall be of the type indicated.

B. Restrained joints shall be an approved type provided by the pipe manufacturer.

2.3 MATERIALS

A. **Ductile Iron Pipe:** Pipe materials shall have a minimum pressure rating of 250 psi.

2.4 SPECIAL FITTINGS

A. Fittings of the compact type for ductile iron pipe shall conform to the requirements of AWWA C153 and shall have a minimum pressure rating of 250 psi.

B. Fittings shall be of the diameter and class shown in the Specifications or the Plans. Compact type fittings shall only be used where expressly specified.

2.5 COATING AND LINING FOR DUCTILE IRON PIPE

A. **General:** Buried ductile iron pipe, fittings, and specials shall be lined with fusion bond epoxy and coated per System M-1 in Section 09800. Unless otherwise noted, exposed ductile iron pipe shall be lined with fusion bonded epoxy and coated per System EU-1 in Section 09800. Submerged ductile iron pipe shall be coated and lined with fusion-bonded epoxy. Except as described below, the material system for the exterior and interior of ductile iron pipe and fittings installed underground or underwater shall be in accordance with AWWA C213.

B. **Minimum Pipe Diameter:** The minimum pipe diameter for application of an internal lining shall be 4 inches.

C. **Maximum Temperature:** This material shall be able to withstand a maximum service temperature of 1900 F.

D. **Thickness:** The powder shall be applied to the preheated pipe at a uniform cured thickness. The minimum uniform cured thickness of the applied material shall be as follows:

1. Interior 16 mils

2. Exterior 14 mils

3. Maximum thickness shall be determined by the applicator based on the roughness of the pipe so as to obtain a holiday free product. Lining and coating thickness for pipe joints shall be compatible with the pipe dimensional tolerances.

E. Degassifying: The pipe and fittings shall be heated to between 425º F and 475º F and held at that temperature for 60 minutes or until total outgassing is achieved.

F. Blast Cleaning: The pipe surfaces to be covered in the plant shall be blast-cleaned with steel grit to achieve a near white surface conforming to SSPC SP10 or NACE TM-01-70 grade NACE No. 1, as applicable to ductile iron pipe.

G. Coating Repair and Field Touch-Up: Exothermic weld connections required for the installation of bond cables across joints of the pipeline for cathodic protection shall be repaired and touched-up with 3M-312 coating material or equal.

H. Fusion Bond Epoxy Manufacturers:

1. 3M Inc.

2. or equal

I. Qualifications, Approval, and Documentation of Fusion Bond Epoxy Manufacturers:

1. Qualifications: The fusion bond epoxy manufacturer shall have a record of at least one application of the proposed coating/lining material on a successfully performing ductile iron piping installation of comparable size and complexity constructed in the recent past.

2. Approval:

a. Bidders shall submit the name and documented qualifications of the manufacturer proposed for the fusion bond epoxy material. The OWNER will review and approve the proposed selection.

b. Documentation to be submitted by CONTRACTOR

1) Documentation of at least one ductile iron pipe project constructed in the recent past and successfully performing under similar service conditions.

(2) The name, telephone number, and address of the owner and completion date and location for the project listed above.

(3) The name, telephone number, and address of the firm which applied the fusion bond epoxy in the project listed above.

(4) Descriptive literature, including Material Safety Data Sheet, for the proposed material.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE

A. Ductile iron pipe shall be installed in accordance with the applicable provisions of SSPWC Section 306-8.2.2, Section 02600, and the recommendations of the manufacturer.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02644

PVC NONPRESSURE PIPE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing underground PVC nonpressure pipe for gravity flow and all appurtenant work, complete in place.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 01530 Protection of Existing Facilities

2. Section 02140 Dewatering

3. Section 02200 Earthwork

4. Section 02600 Pipeline Construction

5. Section 02730 Sanitary Sewerage System Testing

6. Section 03310 Cast-in-Place Sitework Concrete

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. ASTM D3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings

2. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Samples of all the materials proposed for use on the WORK. The samples shall be clearly marked to show the manufacturer's name and product identification and shall be submitted along with the manufacturer's technical data and installation instructions.

2. Shoring and bracing drawings in accordance with the requirements of Section 02200.

3. Shop drawings and laying diagrams of all pipe, joints, bends, special fittings, and piping appurtenances.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

B. Manufacturer's certificates of compliance indicating that all materials furnished under this Section meet the requirements of the Contract Documents.

1.7 FACTORY TESTS

A. The manufacturer shall perform all tests and submit the test results data and certification in compliance with SSPWC Section 207-17.4.

PART 2 - PRODUCTS

2.1 GENERAL

A. PVC pipe, fittings, couplings and appurtenances shall comply with SSPWC Section 207-17.

B. The pipe shall be marked per City of San Diego Whitebook 207-17.6.4.

C. All PVC pipe shall be suitable for joining by compression joints unless otherwise shown or indicated.

2.2 BEDDING AND BACKFILL MATERIALS

A. Unless otherwise indicated, all material used for pipe bedding shall conform to the requirements of SSPWC Section 217-2.4. Trench backfill shall conform to the requirements of SSPWC Section 217-2.

PART 3 - EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the CONSTRUCTION MANAGER, and shall be subject to his approval before acceptance

B. Installation shall conform to the recommendations of pipe manufacturer, the requirements of ASTM D 2321, SSPWC Section 306-2, Section 02600, and as indicated herein.

3.2 TRENCHING

A. Trench excavation shall conform to the requirements of Sections 02200 and 02600.

B. The minimum depth of cover over the top of the pipe shall be 36 inches unless otherwise shown. The width of the trenches shall be as indicated on the Drawings.

3.3 FIELD JOINTING

A. Pipe shall be jointed in compliance with manufacturer's printed instructions.

3.4 COMPACTION OF PIPE BEDDING AND BACKFILL

A. Compaction of pipe bedding and backfill material shall conform to the requirements of Sections 02200 and 02600.

3.5 TESTING

A. Field testing of gravity sewer pipe shall conform to the requirements of Section 02730.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02646

PVC PRESSURE PIPE

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The CONTRACTOR shall provide underground polyvinyl chloride (PVC) pressure pipe and all appurtenant work, complete in place.

1.2 RELATED SECTIONS

A. The Work of the following Sections applies to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01530 Protection of Existing Facilities
2. Section 02140 Dewatering
3. Section 02200 Earthwork
4. Section 02600 Pipeline Construction

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Except as otherwise indicated in this Section, the CONTRACTOR shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC) together with the latest adopted editions of the Regional and City of San Diego Supplement Amendments and as specified in Section 01090 - REFERENCE STANDARDS.

B. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. AWWA C104/A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings
3. AWWA C111/A21. 11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
4. AWWA C600 Installation of Ductile-Iron Mains and Appurtenances
5. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-in Through 60-in
6. ASTM D2584 Test Method for Ignition Loss of Cured Reinforced Resins
7. PPI Technical Report TR 3/4 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
8. AWWA Manual M23 PVC Pipe - Design and Installation

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300 - Contractor Submittals:

1. Shop drawings and laying diagrams of all pipe, joints, bends, special fittings, and piping appurtenances.

2. Shoring and bracing drawings in accordance with Section 02200.

3. Manufacturer's technical data and installation instructions plus samples of all materials proposed for use on the WORK. Samples shsll be clearly marked to show the manufacturer's name and product identification.

4. Test Reports from:

a. Hydrostatic proof testing

b. Sustained pressure testing

c. Burst strength testing

1.5 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's certificates of compliance indicating that all materials provided under this Section meet the requirements of the Contract Documents.

1.6 FACTORY INSPECTION AND TESTING

A. Inspection: All pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein. The CONTRACTOR shall notify the CONSTRUCTION MANAGER in writing of the manufacturing starting date not less than 14 calendar days prior to the start of any phase of the pipe manufacture.

B. During the manufacture of the pipe, the CONSTRUCTION MANAGER shall be given access to all areas where manufacturing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

C. Tests: Except as modified herein, pipe shall be tested in accordance with the requirements of this Section and AWWA C900.

D. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The CONSTRUCTION MANAGER will witness all testing conducted by the CONTRACTOR; provided, that the CONTRACTOR'S schedule will not be delayed for the convenience of the CONSTRUCTION MANAGER.

E. All expenses incurred in obtaining samples for testing shall be borne by the CONTRACTOR at no increased cost to the OWNER.

F. In addition to those tests specifically required, the CONSTRUCTION MANAGER may request additional samples of any material for testing by me OWNER. The additional samples shall be furnished at no additional cost to the OWNER.

PART 2 -- PRODUCTS

2.1 GENERAL

A. PVC pressure pipe shall conform to the applicable requirements of AWWA C900

2.2 PIPE

A. The pipe shall be of the diameter and pressure class or pressure rating indicated, shall be provided complete with rubber gaskets, and all specials and fittings shall be provided as required in the Contract Documents. The dimensions and pressure classes for Dimension Ratios shall conform to the requirements of AWWA C900 or AWWA C905, as appropriate.

B. Additives and Fillers: Unless otherwise required in alternate qualification procedures of PPI-TR3, compounds which have a Hydrostatic Design Basis (HDB) of 4000 psi at 73.4 degrees F for water shall not contain additives and fillers that exceed the recommended values in Table 1, Part Y of PPI-TR3 (e.g., allowable content range for calcium carbonate is 0.0-5.0 parts per hundred of resin). If requested by the CONSTRUCTION MANAGER, the additive and filler content shall be determined using the pyrolysis method as specified in ASTM D 2584.

C. Joints: As indicated, all joints for the pipe shall be either an integral bell manufactured on the pipe or a restrained joint employing a harness, coupling, or gland type restraint. The bell and coupling shall be the same thickness as of the pipe barrel, or greater thickness. The sealing ring groove in the coupling shall be of the same design as the groove in cast iron fittings and valves available from local water works supply distributors.

D. Joint Deflection: Deflection at the joint shall not exceed 1.5 degrees or one-half the maximum deflection recommended by the manufacturer, whichever is less. No deflection of the joint shall be allowed for joints which are over-belied or not belted to the stop mark.

2.3 FITTINGS

A. Fittings shall be ductile iron and shall conform to the requirements of AWWA C110, Class 350. Fittings shall have mechanically restrained joints. Restrained joints shall be an approved type (e.g., EBAA Iron PV 2000 or approved equal) provided and recommended by the pipe manufacturer.

2.4 MARKING

A. Pipe shall be identified in conformance with AWWA C900
B. PVC pipe used for sewer shall be colored green by the manufacturer.
C. Delivered pipe markings shall include, as a minimum, the following:

1. Nominal size.
2. PVC.
3. Dimension Ratio, Standard Dimension Ratio or Schedule.
4. Extrusion production-record code.
5. Trademark or trade name.
6. Cell Classification.
7. ASTM D3034 or ASTM F679.

2.5 DETECTABLE WARNING TAPE

A. Per section 02600 Pipeline Construction

PART 3 -- EXECUTION

3.1 GENERAL

A. All laying, jointing, and testing for defects and for leakage shall be performed in the presence of the CONSTRUCTION MANAGER and shall be subject to approval before acceptance.

B. Installation shall conform to the requirements of AWWA M23, instructions furnished by the pipe manufacturer, ASTM D 2321, SSPWC Section 306-1.2.13 and Supplement Amendments, and to the supplementary requirements or modifications specified herein. Wherever the requirements of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 PIPE STORAGE

A. Storage: Pipe should be stored at the job site in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe shall be stored in such a way as to prevent sagging or bending and shall be protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets should be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

3.3 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to the requirement of Sections 02000 and 02600 and as specified herein.

3.4 INSTALLATION OF BENDS, TEES, AND REDUCERS

A. Ductile iron fittings shall be installed utilizing standard installation procedures. Fittings shall be lowered into the trench by means of rope, cable, chain, or other acceptable means without damage to the fittings or linings or coating. Cable, rope, or other devices used for lowering fittings into trench shall be attached around the exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the interior for handling. Fittings shall be carefully connected to the pipe or other facility, and joints shall be checked to insure a sound and proper joint. Recoat damaged coatings.

3.5 COMPACTION OF PIPE BEDDING AND BACKFILL

A. Compaction of pipe bedding and backfill material shall conform to the requirements of Sections 02200 and 02600.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02730

SANITARY SEWERAGE SYSTEM TESTING

PART 1 – GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes testing of sanitary sewerage and storm sewer systems.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02617 Reinforced Concrete Pipe
2. Section 02630 Ductile Iron Pipe
3. Section 02644 PVC Nonpressure Pipe
4. Section 02646 PVC Pressure Pipe

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplement:

1. Uniform Plumbing Code

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. ANSI/ASTM C 828 Standard Test Method For Low-Pressure Air Test of Vitrified Clay Pipe Lines.

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Proposed plans for testing, and for water conveyance, control, and disposal, design and manufacture data for the mandrel (if proposed) and minimum 48- hour advance written notice of proposed testing schedule, for review by the CONSTRUCTION MANAGER.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. The WORK of this Section includes temporary valves, plugs, bulkheads, and other air pressure testing and water control equipment and materials. No materials shall be used which would be injurious to piping systems and future function. Air test gages shall be laboratory-calibrated prior to the leakage test.

PART 3 -- EXECUTION

3.1 GENERAL

A. Except as otherwise indicated, water for testing will be furnished by the CONTRACTOR and the OWNER is not responsible for conveying the water to the points of use.

B. Release of water from pipelines, after testing has been completed, shall be performed in the presence of the CONSTRUCTION MANAGER.

C. Testing shall be performed in the presence of the CONSTRUCTION MANAGER.

3.2 TESTING OF PIPE FOR LEAKAGE

A. General: Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. The CONTRACTOR shall test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the tine slowly with water. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Sewer pipes shall be tested for leakage in compliance with SSPWC Section 306-7.8 except as modified herein. Testing shall be completed prior to resurfacing. When leakage exceeds the indicated limits, piping shall be repaired or replaced and leakage shall be reduced to the indicated limits.

B. Gravity Sewer Pipeline

1. Water Exfiltration Test: The water exfiltration test shall comply with SSPWC Section 306-7.8.2.2.
2. Water infiltration Test: The water infiltration test shall comply with SSPWC Section 306-7.8.2.3.
3. Air Pressure Test: The air test shall comply with SSPWC Section 306-7.8.2.4.

C. Hydrostatic Testing for Storm Sewer Forcemains:

1. General: Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to

piping and equipment. The CONTRACTOR shall provide sufficient temporary air tappings in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. After completion of the test, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.

2. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the CONSTRUCTION MANAGER shall be taken.

3. The test pressure for storm sewer forcemains shall be 120 percent of the maximum operating pressure. Maximum operating pressure is **69 feet (30 psi).**

3.3 TELEVISING SEWER MAINS

A. Gravity sewer systems where a bypass system is not available shall be inspected by closed circuit televising in compliance with Section 306-18 of the SSPWC.

B. All defects as determined by CONSTRUCTION MANAGER shall be reconstructed prior to placing pavement or permanent trench resurfacing.

3.4 DEFLECTION TEST

A. Flexible and semi-rigid main line pipe shall be tested for deflection, joint displacement, and other obstructions by mandrel test in compliance with Section 306-7.8.3 of the City of San Diego Supplement Amendments to SSPWC.

B. The test shall be performed not less than 30 days after completion of the bench backfill, but prior to permanent resurfacing.

3.5 TESTING OF MANHOLES

A. Manholes shall be hydrostatically tested for leakage after installation, but prior to being backfilled. Prior to hydrostatic testing, manholes shall be visually inspected for leaks. Leaks or cracks shall be repaired prior to hydrostatic testing. Pipes entering the manhole shall be sealed at a point outside the manhole walls so as to include testing of the pipe/manhole joints. The manhole shall be filled with water to a level 2 inches below the top of the frame. Safety lines shall be secured to all plugs. After a period of at least one hour and when the water level has stabilized, the manhole shall be refilled and the water level shall be checked. The water level shall again be checked after a period of 4 hours. If the water level is reduced by more than ¼-inch, the leakage shall be considered excessive, and the manhole shall be repaired and retested. The exterior of the manhole shall be inspected during this period for visible evidence of leakage. Moisture, sweating, or beads of water on the exterior of the manhole shall not be considered leakage, but any water running across the surface will be considered leakage and the manhole shall be repaired.

** END OF SECTION **

SECTION 02740

STORMWATER STORAGE

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes the underground precast stormwater storage structures used to temporarily collect site stormwater and releasing it at a specified rate.

1.2 MANUFACTURER

A. The MANUFACTURER of the underground precast stormwater structures shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff, and which has a history of successful production, acceptable to the engineer of record.

1.3 RELATED SECTIONS

A. This section contains specific references to the following related specification sections. Additional related sections may apply that are not specifically listed below.

1. Section 02140 Dewatering
2. Section 02200 Earthwork
3. Section 02600 Pipeline Construction

1.4 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.5 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300:

1. Detailed drawings of the stormwater storage system and all components required and the sequence for installation, including:

a. System configuration with pertinent dimensions to the satisfaction of the engineer of record
b. RIM elevations
c. Invert elevations of all pipe penetrations
d. Access configuration
e. Ventilation
f. Interior components
g. Design loading: live loads, vertical and lateral earth loads used in design
h. Maximum and minimum depth of cover
i. Inspection and maintenance documentation

j. Professional Engineer stamped and signed drawings
k. Data sheets and installation instructions for lifting inserts and anchors
l. Data sheets and installation instructions for accessory items, such as sealants, gaskets, pipe entry connectors, steps, racks, vents, and other items installed after delivery shall be included with the submittal package.

PART 2 -- PRODUCTS

All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.1 PRECAST UNITS

A. The precast stormwater storage structures shall be designed and produced by an experienced and acceptable concrete manufacturer.
   1. Acceptable manufacturers: Oldcastle Infrastructure or equal

B. The structures shall be capable of storing 234,000 gallons (31,283 cubic feet) of stormwater.

C. The precast stormwater storage structures shall fit within the allotted area and depth as shown on the construction documents.

D. Ventilation shall be provided to provide release of air when system is full of water. Ventilation shall be provided through manhole lids. If unable to incorporate ventilation through manhole lids, vents shall be routed on site out of vehicular accessways.

E. The access manholes as shown on plans shall be able to withstand H-20 loading.

F. Precast structures shall be designed to withstand design conditions as noted on plans or in project geotechnical report: installation depth, vehicular loading, and geotechnical constraints per field geotechnical engineer, in accordance with the applicable industry design standards. Design must also consider stresses induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads for precast concrete modules shall be indicated on the submittal drawings and designed by a licensed professional engineer.

G. The type and configuration of joints and sealants between adjacent structures shall be shown on the submittal drawings and shall be watertight.

H. Concrete shall have a 28-day compressive strength of 5,000 psi minimum.

I. Concrete shall be leak resistant and shall have a water-cement ratio of 0.48 or less.

2.2 PIPE CONNECTIONS

A. For a cored or drilled opening, provide a flexible and watertight connection that meets or exceeds ASTM C923.

B. For a knockout opening, provide a watertight connection meeting the material requirements of ASTM C923 that is securely attached to the pipe with stainless steel bands or other means.

C. For grout openings in walls with non-shrink grout, pour a concrete collar around the pipe and outside the manhole opening. Provide flexible pipe joints or flexible connectors within 2 feet (0.6 m) of collar.

D. A flexible and watertight gasket per ASTM C923 shall be cast integrally with riser section(s) for all precast structures.

E. Grout internal joint space with non-shrink grout.

2.3 DAMPPROOFING

A. Dampproofing shall be applied by manufacturer and per Section 07100 Dampproofing and Waterproofing.

2.4 ACCESSORIES

A. Joint Wrap – Minimum 6" wide, self-adhesive, flexible joint sealant. Product as recommended by manufacturer

B. Geotextile – Non-woven, 180 lb. tensile strength, minimum 7.0 ounce per square yard typical weight. US 180NW US Fabrics Inc or equal

C. When water table is higher than bottom elevation of storage structures, a membrane liner for watertight applications is required. The liner shall be placed in between an inner and outer layer of geotextile fabric. Liner shall be double-scrim reinforced containment liner with high puncture resistance, UV resistance, and burst strength of 1,250 psi. Recommended BTL 40 or approved equal. Geotextile fabric of equal area shall be placed on both the interior and exterior faces of the membrane liner to prevent punctures. Pipe boots supplied by liner manufacturer required for all pipe penetrations. Liner size or shape may require a liner manufacturer's representative be present for field installations. Liner to be approved by Engineer of Record.

PART 3 -- EXECUTION

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the structures and appurtenances in accordance with the drawings and these specifications.

3.1 GRADING AND EXCAVATION

A. Site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the Contractor to contact local utility companies to check for underground utilities. All grading permits, if applicable, shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and

handled per governing agencies standards. It is the responsibility of the Contractor to install and maintain proper erosion control measures during grading and excavation operations.

3.2 JOINT WRAP

A. Seal exterior vertical and horizontal seams with joint wrap in accordance with ASTM C 891. Prepare surfaces and install joint wrap in accordance with manufacturer's instructions.

3.3 FIELD MODIFICATIONS

A. Field modifications to the structures will invalidate the product warranty and are strictly prohibited without prior written consent from Manufacturer.

3.4 BACKFILL

A. Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures. Deposit backfill equally around all sides of modules at the same time and same elevation. Prevent wedging action against modules by stepping or serrating slopes.

3.5 COMPACTION

A. All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of the structures. Compact in even lifts. Do not disrupt or damage joint wrap during backfilling and compaction.

3.6 CONCRETE STRUCTURES

A. After backfill has been inspected by the governing agency and approved, the concrete structures shall be lifted and placed in proper position per plans.

3.7 INSPECTION

A. After installation, the Contractor shall demonstrate that the structures have been properly installed at the correct location(s), elevations, and with appropriate components. The Contractor shall demonstrate that the structures have been installed per the manufacturer's specifications and recommendations.

3.8 MAINTENANCE

A. All components shall be inspected by a qualified person once at least once per year and results of inspection shall be kept in an inspection log. The manufacturer recommends cleaning and debris removal maintenance of at least once a year or as site conditions require. The maintenance shall be performed by qualified personnel.

B. Material Disposal - All debris, trash, organics, and sediments removed from the storage units shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

3.9 QUALITY ASSURANCE

A. Warranty - The Manufacturer shall guarantee the storage structures against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the job site. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 02742

HYDRODYNAMIC SEPARATOR

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes the hydrodynamic separator used to capture sediments, floatables, particulate-bound nutrients and metals, oils and other debris from stormwater runoff, dry weather flows, and other contaminated water sources.

1.2 MANUFACTURER

A. The MANUFACTURER of the filtration structure shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff, and which has a history of successful production, acceptable to the engineer of record.

1.3 RELATED SECTIONS

A. This section contains specific references to the following related specification sections. Additional related sections may apply that are not specifically listed below.

1. Section 02140 Dewatering
2. Section 02200 Earthwork
3. Section 02600 Pipeline Construction

1.4 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1. ASTM D422-63 Standard Test Method for Particle-Size Analysis of Soils
2. ASTM D3977-97 Standard Test Methods for Determining Sediment Concentrations in Water Samples

1.5 SUBMITTALS

A. The following shall be submitted in compliance with Section 01300:

1. Detailed drawings of the filtration structure and all components required and the sequence for installation, including:

a. System configuration with outer dimensions
b. Interior components with dimensions
c. Any accessory equipment called out on construction drawings
d. RIM elevations
e. Invert elevations of all pipe penetrations

f. Access configuration (i.e. risers, hatches, manholes)
g. Design loading: live loads, vertical and lateral earth loads used in design
h. Maximum and minimum depth of cover
i. Inspection and maintenance documentation

PART 2 -- PRODUCTS

All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.1 CONCRETE STRUCTURE

A. The filtration structure and all of its components shall be self-contained within a concrete structure constructed with a minimum 28-day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports a minimum H-20 loading as indicated by AASHTO. All seams and connection points shall be sealed watertight with non-shrink grout in accordance with manufactures recommendations.

B. The access manholes shall be able to withstand H-20 loading.

C. The concrete structure shall be designed to withstand design conditions in accordance with the applicable industry design standards. Design must also consider stresses induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads shall be indicated on the submittal drawings and designed by a licensed professional engineer.

2.2 MOUNTING HARDWARE

A. Internal components shall be fastened to the concrete structure using stainless steel hardware Grade 316

2.3 SEALANT

A. Internal components fastened to the concrete structure shall of any gaps filled with silicone sealant to ensure no leakage. All surfaces in which the internal components make contact with a concrete surface must be fully filled with sealant and made completely watertight. Sealant must have a movement capability of 50% (ASTM C-719), a tensile strength of 190 psi (ASTM D-412) and an elongation percentage of 650 (ASTM D-412).

2.4 PIPE CONNECTIONS

A. For a cored or drilled opening, provide a flexible connection that meets or exceeds ASTM C923.

B. For a knock-out opening, provide a connection meeting the material requirements of ASTM C923 that is securely attached to the pipe with stainless steel bands or other means.

C. For grout openings in walls with non-shrink grout, pour a concrete collar around the pipe and outside the manhole opening. Provide flexible pipe joints or flexible connectors within 2 feet (0.6 m) of collar.

D. Grout internal joint space with non-shrink grout

2.5 FUNCTION

A. The filtration structure shall be a pre-engineered, inline, hydrodynamic separation system composed of an oils/floatables baffle, outlet weir and sump chamber designed to capture sediments, floatables, particulate bound nutrients and metals, oils and other debris.

2.6 REMOVAL EFFICIENCIES

A. The filtration structure shall be capable of achieving at least 60% Annualized weighted TSS removal efficiency (of the size fractions typical for urban runoff) up to 100% of its manufacture treatment flow rate (MTFR). The SWTD shall be capable of capturing and retaining 98% of oils and grease up to 100% of its manufacture treatment flow rate.

2.7 HYDRAULIC CAPACITY

A. The filtration structure shall be capable of conveying 4.4 cubic feet per second

B. The filtration unit shall be capable of holding trash and floatables within the unit when the water surface elevation exceeds (4) feet higher than the outlet invert elevation.

PART 3 -- EXECUTION

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the structures and appurtenances in accordance with the drawings and these specifications.

3.1 GRADING AND EXCAVATION

A. Site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies to check for underground utilities. All grading permits, if applicable, shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

3.2 COMPACTION

A. All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of the structure. Compact in even lifts. Do not disrupt or damage joint wrap during backfilling and compaction.

B. Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures. Deposit backfill equally around all sides of modules at the same time and same elevation. Prevent wedging action against modules by stepping or serrating slopes. After backfill has been inspected by the governing agency and approved, the concrete structures shall be lifted and placed in proper position per plans.

C. Field modifications to the structures will invalidate the product warranty and are strictly prohibited without prior written consent from Manufacturer.

3.3 SHIPPING

A. The filtration structure shall be shipped to the contractor's address or job site and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

3.4 STORAGE AND HANDLING

A. The contractor shall exercise care in the storage and handling of the structures and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor. The filtration structure(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The filtration structure(s) shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

3.5 INSPECTION

A. After installation, the contractor shall demonstrate that the structures have been properly installed at the correct location(s), elevations, and with appropriate components. The contractor shall demonstrate that the structures have been installed per the manufacturer's specifications and recommendations.

3.6 MAINTENANCE

A. All components shall be inspected by a qualified person once at least once per year and results of inspection shall be kept in an inspection log. The manufacturer recommends cleaning and debris removal maintenance of at least once a year or as site conditions require. The maintenance shall be performed by qualified personnel.

3.7 MATERIAL DISPOSAL

A. All debris, trash, organics, and sediments removed from the filtration structure(s) shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

3.8 QUALITY ASSURANCE

A. Warranty - The Manufacturer shall guarantee the filtration structure(s) against all manufacturing defects in materials and workmanship for a period of (1) year from the date of delivery to the job site. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period.

** END OF SECTION **

SECTION 03100

CONCRETE FORMING

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Formwork requirements for concrete construction.

1.2 QUALITY ASSURANCE

A. References

1. The references listed below are part of this section. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict, the requirements of this section shall prevail.

Reference	Title
ACI 117	Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.5	Specifications for Environmental Concrete Structures
National Institute of Standards - PS1	Construction and Industrial Plywood

B. Design – General

1. When developing procedures, schedules, and structural calculations; consider the structural system that exists, effects of imposed loads, and the strength of concrete at each stage of construction.

C. Design Criteria

1. Design formwork in accordance with ACI 301 and ACI 318 for building structures and ACI 350 and 350.5 for environmental structures to provide concrete finishes as specified in Section 03300.

1.3 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300.
2. Manufacturer's product data with installation instructions:
   a. Form materials.

B. Informational Submittals:

1. Procedures: Section 01300.

PART 2 -- PRODUCTS

2.1 FORMS

A. Wood Forms:

1. Provide new and unused exterior grade plywood panels manufactured in accordance with American Plywood Association (APA) and bearing the trademark of that group.
   a. Forms for concrete surfaces exposed to view: use APA High Density Overlay (HDO) Plyform Class I Exterior 48" X 96" X 3/4".
   b. Forms for other concrete surfaces: use APA Douglas Fir B-B Plyform Class I Exterior 48” X 96” X 3/4-inch.

2. When approved, plywood may be reused.

B. Metal Forms:

1. Do not use aluminum. Provide forms free of rust and straight without dents to provide members of uniform thickness.

PART 3 -- EXECUTION

3.1 PREPARATION

A. Cover surface of forms with form release compound prior to form installation in accordance with manufacturer’s recommendations.

B. Do not permit excess form coating material to stand in puddles on forms or hardened concrete surfaces against which fresh concrete is to be placed.

C. Clean surfaces of forms, reinforcing steel and other embedded items of accumulated mortar, grout, or other foreign materials from previous concreting or construction activities before concrete is placed.

3.2 FORMWORK CONSTRUCTION

A. Form vertical surfaces of cast-in-place concrete including sides of footings.

B. Construct and place forms so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings. Brace or tie forms together to maintain position and shape under the load of freshly placed concrete.

C. Tighten forms to prevent leakage.

D. Place a 3/4-inch chamfer strip at exposed to view corners of formed surfaces.

E. At construction joints, overlap hardened concrete surface by at least 1 inch. Brace forms against hardened concrete to prevent movement, offsets, or loss of mortar at construction

joint and to maintain a true surface. Where possible, locate juncture of built-in-place forms at architectural lines, control joints, or at other inconspicuous lines.

3.3 TOLERANCES

A. Install formwork with tolerances in accordance with ACI 117 and the following (the more stringent requirement controls):

1. Install formwork in accordance with manufacturer's written instructions.
2. Vertical surface tolerance from plumb; walls, columns, piers, and risers: ± 1/2 inch for entire ± 1/4 inch in any 10 feet of height
3. Vertical surface tolerance from plumb; exposed wall corners, end columns, control-joint grooves, and other exposed to view vertical lines: ± 1/2 inch for entire height ± 1/4 inch in any 20 feet of height
4. Horizontal variation from level or from grade; top of slabs, slab soffits, ceilings, and beam soffits, measured before removal of supporting shores: ± 3/4 inch for entire length ± 3/8 inch for any bay or 20 foot length ± 1/4 inch in any 10 feet of length
5. Horizontal variation from level or from grade; exposed lintels, sills, parapets, horizontal grooves, and other exposed-to-view horizontal lines: ± 1/2 inch for entire length ± 1/4 inch in any 20 feet of length.
6. Plan position variation; columns, walls, and partitions: ± 3/4 inch for entire length ± 3/8 inch for any bay or 20 foot length
7. Plan location and size; sleeves, floor openings, walls, wall openings, beams, and columns: ± 1/2 inch
8. Cross sectional dimensions; columns and beams and thickness of slabs and walls: ± 3/8 inch
9. Plan dimensions; footings and foundations: minus 1/2 inch + 2 inches
10. Misplacement or eccentricity; footings and foundations: 2 percent of footing width in direction of misplacement not more than 2 inches
11. Thickness; footings and foundations: minus 5 percent no limit on the maximum increase except that which may interfere with other construction.
12. Step variance in flight of stairs: Rise ± 1/16 inch Tread from level ± 1/8 inch

B. Use control points and benchmarks for reference purposes to check tolerances. Establish and maintain reference points in an undisturbed condition until final completion and acceptance of the work.

C. Regardless of tolerances listed, no portion of a structure shall extend beyond the legal boundary of work site.

D. Camber formwork to compensate for anticipated deflections in formwork under wet load of concrete. Adjust camber to maintain above specified tolerances in hardened concrete after forms and shoring are removed.

3.4 REMOVAL OF FORMS

A. Do not impose construction loads or remove shoring from any part of the structure until that portion of the structure in combination with remaining forming and shoring systems has sufficient strength to safely support its weight and loads placed thereon.

B. If forms are loosened and not removed, proceed same day with wet curing operations to soak surfaces of concrete where forms are loosened. When wet curing is not practical or not planned, loosen, remove, and start approved curing procedures on the same day.

C. When required for concrete curing in hot weather, required for repair of surface defects, or when required for finishing at an early age; remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.

D. Remove top forms on sloping surfaces as soon as concrete has attained sufficient stiffness to prevent sagging. Make repairs or finishing treatment on such sloping surfaces immediately after form removal.

E. Remove wood forms for wall openings as soon as this can be accomplished without damage to concrete.

F. Remove formwork from columns, walls, sides of beams, and other parts not supporting weight of concrete as soon as concrete has hardened sufficiently to resist damage from removal.

G. When shores and supports are so arranged such that non-load-carrying form facing material can be removed without loosening or disturbing other shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

H. In all cases, proceed with curing same day as form removal.

I. Where no reshoring is planned, forms and shoring used to support weight of concrete shall be left in place until concrete has attained its specified 28-day compressive strength.

** END OF SECTION **

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 SUMMARY

A. Section includes: Cast-in-place concrete, which consists of providing material, mixing, transporting equipment, and labor for the proportioning, mixing, transporting, placing, consolidating, finishing, curing, and protection of concrete in the structure.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related specification sections. Additional related sections may apply that are not specifically listed below.

1. Section 03600 Grouting
2. Section 07905 Joint Fillers
3. Section 07900 Joint Sealants

1.3 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 214R	Guide to Evaluation of Strength Test Results in Concrete
ACI 301	Specifications for Structural Concrete
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ACI 350.1	Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures
ACI 503.7	Specification for Crack Repair by Epoxy Injection
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C117	Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

Reference	Title
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C157	Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C192	Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C511	Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
ASTM C595	Blended Hydraulic Cements
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989	Slag Cement for use in Concrete and Mortars
ASTM C1059	Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1077	Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1240	Silica Fume Used in Cementitious Mixtures
ASTM C1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1315	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
ASTM C1567	Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D75	Sampling Aggregates
ASTM D2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
CRD-C572	U.S. Corps of Engineer's Specifications for Polyvinylchloride Waterstop
CBC	California Building Code with local amendments

1.4 SUBMITTALS

A. Action Submittals

1. Procedures: Section 01300.

2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

3. Check-marks (□) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined

signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.

4. Each proposed mix design showing:
    a. Expected strength at 7 and 28-days
    b. Slump, before and after introduction of high-range water-reducing admixture
    c. Water/cement ratio
    d. Weights and test results, certifications, and mill reports of the ingredients
    e. Chemical analysis report and report of other specified test analyses for supplementary cementitious material
    f. Aggregate gradation and documentation of test results classifying aggregate as non-potentially reactive
    g. Test results of mix design prepared by an independent testing laboratory
    h. Other physical properties necessary to review each mix design for conformance with these specifications
5. Mix designs proposed shall be sealed by a Professional Engineer registered in the state of California.
6. Product literature and technical data for aggregates, cement, and pozzolan.
7. Product literature, technical data, and dosage of proposed admixtures including, but not limited to, air entraining, water reducing, retarding, shrinkage reducing, etc.
8. Anticipated average delivery time from batch plant to site. If this time exceeds the limit specified in Part 3, include proposed method to extend set time without deleterious effects on final product. Owner's Representative reserves the right to accept or reject such proposed methods.
9. Curing program description in sufficient detail to demonstrate that the Contractor will provide acceptable strength, finish, and crack control within the completed structure. Detailed plan for curing and protection of concrete in cold and hot weather.
10. Product literature and technical data for waterstops, curing and sealing compounds, bonding compounds, epoxy and chemical grout for crack injection, and bearing pads,.
11. Sample panels at least 12-inches by 12-inches by three inches thick to demonstrate formed wall surface finishes as specified in Part 3.

12. Samples of concrete floor and slab for each finish specified in Part 3 approximately four feet square and a minimum of four inches thick, with one construction joint and one expansion joint, if used.

13. Concrete delivery truck tickets showing the information listed in ASTM C94, section 14.

1.5 QUALITY ASSURANCE

A. Quality Control By Owner

1. Special Inspection of concrete work shall be performed by the Special Inspector under contract with the Owner and in conformance with the CBC Chapter 17. Special Inspection of concrete is in addition to, not replacing, other inspections and quality control requirements specified herein. Where sampling and testing specified herein conforms to Special Inspection standards, such sampling and testing need not be duplicated.

2. All structural concrete work shall receive Special Inspection in accordance with CBC Chapter 17. Structural concrete includes elements which resist code-defined loads and whose failure would impact life safety. Non-structural site work concrete does not require Special Inspection. Anchor bolts and anchors installed in hardened concrete require Special Inspection.

B. Quality Control By Contractor

1. Where required to demonstrate conformance with the specified requirements for cast-in-place concrete, the Contractor shall provide the services of an independent testing laboratory which complies with the requirements of ASTM E329 and ASTM C1077. The testing laboratory shall sample and test concrete materials as specified in this section. Costs of testing laboratory services shall be borne by the Contractor.

2. Concrete testing laboratory personnel shall be certified in accordance with the ACI Concrete Laboratory Testing Technician – Level 1 Certification Program or the ACI Concrete Strength Testing Technician Certification Program, or an equivalent program.

3. Refer to Section 01400 Contractor Quality Control.

C. Basis For Quality:

1. Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified herein.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Cement

1. Portland cement shall be ASTM C150, Type II or Type V, low alkali, containing less than 0.60 percent alkalis. In addition to standard requirements, cement shall satisfy optional chemical and physical requirements of ASTM C150, Tables 2 and 4, respectively.

2. If low alkali portland cement is not available, test results shall be submitted showing aggregates meet the alkali-silica reactivity criteria in 2.01.D.1.b below.

3. Portland-pozzolan cement shall be ASTM C595, Type IP (MS), interground, low alkali.

4. Portland blast-furnace slag cement shall be ASTM C595, Type IS (MS), interground, low alkali.

5. Use cementitious materials that are of the same brand and type and from the same plant of manufacture as the cementitious materials used in the concrete represented by the submitted field test records or used in the trial mixtures. See Change of Materials paragraph below.

B. Ground granulated blast-furnace slag (GGBFS), if used in conjunction with portland cement, shall be per ASTM C989, Grade 100 or Grade 120, limited to 50 percent of the weight of cementitious materials. If GGBFS is combined with pozzolans and/or silica fume, the total weight of GGBFS, pozzolans, and silica fume shall not exceed 50 percent of the weight of cementitious materials.

C. Silica fume, if used in conjunction with Portland cement, shall be per ASTM C1240, limited to 10 percent of the weight of cementitious materials. Silica fume shall be used with a high-range water-reducing admixture.

D. Aggregates

1. General

a. Except as modified herein, fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates are regarded as separate ingredients. Aggregates shall be non-reactive and washed before use.

b. Check aggregates for alkali-silica reactivity to meet the following criteria. Aggregates or combinations of cementitious materials and aggregates shall have less than 0.10% expansion at 16 days when tested in accordance with ASTM C1260 or ASTM C1567. Alternatively, aggregate tested independently in accordance with ASTM C1293 shall have less than 0.04% expansion at one-year, or combinations of aggregate and cementitious materials tested in accordance with ASTM C1293 shall have less than 0.04% expansion at two years. Test results shall be no older than two years.

c. Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes to produce a concrete that has

optimum workability and consolidation characteristics. Establish the final combined aggregate gradation during mix design.

d. Aggregates used in the project production concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by the submitted historical data or trial mixtures. See Change of Materials paragraph below.

2. Fine Aggregate

a. Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33. For classes of concrete which will be used in liquid retaining structures, fine aggregate shall not exceed 40 percent by weight of combined aggregate total, except for concrete with coarse aggregate of less than maximum size 1/2 inch.

b. Variations from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below:

U.S. standard sieve size	Permissible variation in individual tests, percent
30 and coarser	2
50 and finer	0.5

c. Other tests shall be in accordance with the following specifications:

Test	Test method	Requirements
Amount of material	ASTM C117	3 percent passing No. 200 sieve maximum by weight
Sand equivalent	ASTM D2419	Minimum 70 percent

3. Coarse Aggregate

a. Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other deleterious substances shall not exceed the limits listed in ASTM C33, Table 4 for Class Designation 4S. Gradation of each coarse aggregate size specified shall conform to ASTM C33, Table 3.

b. Variations from the specified gradations will be acceptable in individual tests if the average of three consecutive tests is within the specified limits.

E. Pozzolan

1. Pozzolan shall be Class N, natural pozzolan, or Class F fly ash conforming to ASTM C618. Class C fly ash is not allowed. Pozzolan supplied during the life of the project shall have been formed at the same single source. See Change of Materials paragraph below.

2. The pozzolan color shall not substantially alter the resulting concrete from the normal gray color and appearance.

3. Use pozzolan materials that are of the same brand and type and from the same plant of manufacture as the materials used in the concrete represented by the submitted field test records or used in the trial mixtures.

4. The loss on ignition shall be a maximum of four percent.

5. The maximum percent of sulfur trioxide (SO3) shall be 4.0.

F. Admixtures

1. General: Admixtures shall be compatible with the concrete and with each other. Calcium chloride or admixtures containing calcium chloride are not acceptable. Use admixtures in accordance with the manufacturer's recommendations and add separately to the concrete mix. Water reducing retarders and admixtures shall reduce the water required by at least 11 percent for a given concrete consistency and shall comply with the water/cement ratio standards of ACI 211.1. Retarder dosage shall result in set time consistent with requirements specified in Part 3.

2. Water Reducing Admixtures: Conform to ASTM C494, Type A. Acceptable products include: BASF Corporation “MasterPozzolith Series”; SIKA Chemical Corp. “Plastocrete 161”; Euclid Chemical Co. “Eucon WR 91”; or approved equal.

3. Water Reducing and Retarding Admixtures: Conform to ASTM C494, Type D. Acceptable products include: BASF Corporation “MasterSet R Series”; Sika Chemical Corp. “Plastiment”; Euclid Chemical Co. “Eucon Retarder 75”; or approved equal.

4. High Range Water Reducing (Superplasticizing) Admixtures: Conform to ASTM C494, Type F. Acceptable products include: BASF Corporation “MasterGlenium” Series; Sika Chemical Corp. “Viscocrete 2100” or “Viscocrete 2110” (Hot Weather) or “Viscocrete 6100” (Cold Weather); Euclid Chemical Co. “Eucon 37”; GCP Applied Technologies “ADVA 195”; or approved equal.

5. High Range Water Reducing And Retarding Admixtures: Conform to ASTM C494, Type G. Acceptable products include: GCP Applied Technologies “Daracem 100”; Sika Chemical Corp. “Sikaplast 200” ; Euclid Chemical Co. “Eucon 537”; or approved equal.

6. Air Entraining Agent: Conform to ASTM C260 and produce air entrained concrete as specified in the Mix Proportioning table below. Acceptable products include: BASF Corporation “MasterAir Series”; Sika Chemical Corp. “Sika AEA-14” or “Sika AIR” ; Euclid Chemical Co. “Eucon AEA-92”; or approved equal.

G. Water: For washing aggregate, mixing, and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials; comply with the requirements of ASTM C1602. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.

H. Change of Materials: After each concrete mix design is approved, no changes of any sort or source will be allowed without prior written approval from the Engineer. When brand, type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed, new field data, data from new trial mixtures, or evidence that indicates that the change will not affect adversely the relevant properties of the concrete shall be submitted for approval by the Engineer before use in concrete.

2.2 CONCRETE CHARACTERISTICS

A. Mix Proportioning

1. Concrete shall be normal weight concrete composed of cement, pozzolan, admixtures, aggregates, and water; proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. It is acceptable to substitute interground Portland-pozzolan cement conforming to ASTM C595, containing the specified amount of pozzolan in lieu of Portland cement and pozzolan. Water-cementitious material (w/cm) ratio is based on the combined contents of cement and pozzolan.

2. Provide concrete mix designs in accordance with the following guidelines:

Concrete class	Minimum[a] 28-day compressive strength, psi	ASTM coarse aggregate size	Maximum water-cementitious materials (w/cm) ratio	Minimum cementitious materials content (pounds/CY)	Pozzolan, percent by weight of cementitious materials	Air content (percent)	Slump range[f] (inches)
B	3000	57 or 67	0.45	560	15-25[d]	4-6	3-5
C-1	4500	57 or 67	0.40	560	15-25 [d]	4-6	3-5
C-2	5000	57 or 67	0.42	560	15-25[d]	4-6	3-5
E[c]	2000	57	--	-	15-25[d]	Not Required	4-8

[a] *Determine compressive strength at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39.*

[b] *Compressive strength of Class A concrete may be determined at 56 days.*

[c] *Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.*

[d] *Pozzolan use is optional for this class of concrete.*

[e] *Minimum 28-day compressive strength shall be 500 psi and maximum 28-day compressive strength shall be 1,000 psi.*

[f] *Slump before addition of high range water reducing admixture (superplasticizer). Maximum slump after addition of high range water reducing admixture shall be 8".*

B. Use

1. Provide concrete by class for the uses listed below:

Concrete class	Type of use
B	Non-structural concrete (sidewalks, curbs, pavers, etc.)
C-1	Typical cast-in-place structural concrete
C-2	Precast concrete
E[a]	Pipe bedding and encasement, electrical conduit encasement (duct banks) and concrete fill

a *Contractor's option to use the same concrete mix for pipe encasement as the concrete slab above.*

C. Control Tests

1. General: Select and adjust proportions of ingredients in accordance with ACI 211.1. Verification of mix characteristics for submittal may be achieved using either the Trial Mix Design method or Field Experience Data method. Do not place concrete prior to submittal and acceptance of proposed mix.

2. Trial Mix Design

a. Mixes verified by this method shall have the samples produced for testing, manufactured at the batch plant which will supply concrete to the project, using materials proposed for the Work and material combinations listed above. Testing, data, and reporting shall conform to ACI 318 and the following:

1) Required compressive strength used as the basis for selecting concrete proportions (f'cr) shall be the specified concrete strength (f'c) + 1000 psi for specified concrete strengths less than 3,000 psi and f'c + 1200 psi for specified concrete strengths between 3000 psi and 5000 psi.
2) Make at least three different trial mixtures for each class of concrete qualified by the Trial Mix Design. Each trial mixture shall have a different w/cm ratio or different cementitious materials content that will produce a range of compressive strengths encompassing f'cr.
3) Design trial mixtures to produce a slump within ¾ inch of the maximum specified and an air content within 0.5 percent of the maximum specified.
4) For each w/cm ratio or cementitious materials content, cast and cure at least twelve standard test cylinders in accordance with ASTM C192. Four cylinders from each batch tested at age 7-days, 14-days, and 28-days or as required to comply with ACI 318.
5) From results of the cylinder tests, plot a curve showing the relationship between w/cm ratio and compressive strength.

6) From the curve of w/cm ratio versus compressive strength, select the w/cm ratio that will produce f'cr. This is the maximum w/cm ratio to be used unless a lower w/cm ratio is specified above.

3. Field Experience Data

a. When sufficient test data for a particular mix design is available which is identical or substantially similar to that proposed for use, Contractor may substitute use of this data in lieu of a trial mix design. Field data, reports, and analysis shall conform to ACI 318, except as modified herein.

1) Historical mix design proportions for which data are submitted may vary from the specified mix within the following limits:

a) f'c as specified or up to 500 psi above

b) w/cm ratio as specified or lower

c) pozzolan content within 5 percent of that specified

d) maximum coarse aggregate size may not vary smaller, but gradation of coarse aggregate may vary

e) slump after introduction of admixtures +0/-1 inch.

b. Use of historical Field Experience Data does not allow modification of the project mix specifications herein without review and acceptance by the Engineer.

2.3 WATERSTOPS

A. Expanding (Hydrophilic) Waterstops

1. Bentonite-free, made from unvulcanized rubber. Acceptable products include: Adeka Corporation "Ultra Seal MC-2010MN with P-201 adhesive/sealant"; Greenstreak Group, Inc. "Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive/sealant"; or approved equal. These are allowable for use only where indicated on the drawings or accepted in writing by Engineer. Provide adhesive/sealant approved by manufacturer plus concrete nails and fender washers to secure waterstop material in-place during concrete placement. The waterstop MUST be placed with minimum 3-inches concrete cover.

2. For limited cover applications or where only one mat or curtain of reinforcement is present, use Adeka Corporation "Ultra Seal KBA-1510FP"or approved equal.

B. Non-expanding Waterstops: Acceptable products include: Henry Company "SF302 Synko-Flex Waterstop with primer" or approved equal.

2.4 SEALANTS AND JOINT FILLERS

A. Sealants and preformed joint fillers are specified in Sections 07900 and 07905.

2.5 BONDING COMPOUNDS

A. Epoxy resin bonding compounds for use in wet areas shall conform to ASTM C881 Types IV or V, Class A, B, or C depending on temperature at use. Acceptable products include: BASF Corporation “MasterEmaco ADH 327RS”; Sika Chemical Corporation “Sikadur 32”; or approved equal.

B. Non-epoxy bonding compounds for use in dry areas for non-structural bonding or as noted on the drawings shall conform to ASTM C1059 Type II. Acceptable products include: Penetron Specialty Products “Acrylic Bondcrete”; ChemMasters “Cretelox”; or approved equal.

C. Apply bonding compounds in accordance with the manufacturer’s instructions.

2.6 EPOXY FOR CRACK INJECTION

A. Use a two component, moisture insensitive, high modulus, injection grade, 100 percent solids, epoxy-resin blend. Consistency as required to achieve complete penetration into cracks. Material shall conform to ASTM C881 Type 1 Grade 1. Acceptable products include: Sika Corporation “Sikadur 52”; Adhesives Technology Corporation “Crackbond SLV302”; or approved equal.

B. Use epoxy injection for structural crack repairs except as noted below for non-structural cracks in liquid-containing concrete structures. The Engineer shall determine whether a crack is classified as structural or non-structural.

2.7 CHEMICAL GROUT FOR CRACK INJECTION

A. Use hydrophobic polyurethane grout at the Engineer's discretion as an alternative for sealing non-structural cracks in concrete structures intended to be watertight. Acceptable products for sealing hairline cracks include: GCP Applied Technologies "DE NEEF Flex SLV PURe” (must be used with DE NEEF Flex Cat PURe); or Sika Corporation “SikaFix HH LV” as appropriate for crack width; or approved equal. Coordinate with product supplier to verify and select appropriate product for crack widths to be injected.

2.8 CURING AND SEALING COMPOUNDS

A. Acceptable products include: BASF Corporation “MasterKure CC 250SB”; Dayton Superior “Cure & Seal 25% J22UV”; or approved equal, conforming to ASTM C1315.

B. Compound shall be clear and applied in accordance with the manufacturer’s instructions.

C. Curing and sealing compound shall be certified compliant with final finish system if applicable, including compatibility with floor hardeners in areas where floor hardeners are specified to be used.

2.9 NEOPRENE BEARING, SEAL PADS, AND RODS

A. Use 100 percent chloroprene (neoprene), 50 Durometer A, conforming to AASHTO Standard Specifications for Highway Bridges. Pads and rods shall conform to geometry as shown on the drawings. Products shall be one-piece as manufactured, or factory spliced; using a process proven gas-tight in repeated similar applications. Do not use glues and adhesives to bond pieces together.

B. Deliver to job site in protective containers or packaging and maintain the integrity of the pad/rod through construction.

PART 3 -- EXECUTION

3.1 GENERAL

A. Use only truck-mixed, ready-mixed concrete conforming to ASTM C94. Proportion materials by weighing.

B. Introduce pozzolan into the mixer with cement and other components of the concrete mix; do not introduce pozzolan into a wet mixer ahead of other materials or with mixing water.

C. Introduce water at the time of charging the mixer; additional water may be introduced within 45 minutes from charging the mixer, provided the specified w/c ration and slump is not exceeded and the maximum total water per the approved mix design is not exceeded.

D. Arrange with the testing laboratory for inspection as required to comply with these specifications.

E. Deliver concrete to the site and complete discharge within 90 minutes after introduction of water to the mixture. Extension of allowable time beyond this limit requires a Contractor proposed remedial action plan to be reviewed and accepted by the Owner's Representative.

3.2 CONVEYING AND PLACING CONCRETE

A. Convey concrete from the mixer to the forms in accordance with ACI 301. Remove concrete that has segregated in conveying from the site of the work.

B. Placing Concrete

1. General: Place concrete in accordance with ACI 301. Do not permit concrete to drop freely more than 4-ft (6-ft when superplasticizer is used).

2. Placing Concrete By Pumping:

a. Concrete placed by pumping is at Contractor's discretion and shall not be the cause to change or relax specified mix design characteristics. Concrete shall possess the specified characteristics at the point of placement.

b. Measure slump at the hose discharge, except as follows: Initial slump testing in each placement shall occur at both the pumping unit inlet hopper and hose discharge. Slump loss in pumping, measured between the inlet

hopper and the hose discharge, shall not exceed 1 inch. After these criteria have been satisfied, slump may be measured at the inlet hopper with allowable slump increased by the earlier measured difference, not to exceed 1 inch.

c. Before starting each pumping operation, prime the pump and line with a cement slurry to lubricate the system. Waste cement slurry outside the forms. Equip hose tip with a safety chain for recovery in case of hose blowout during pumping. Hose or accessories shall not remain in the freshly placed concrete.

d. Use tremie placing techniques and equipment for pump placed concrete. Pump discharge system shall remain full of concrete from pump to discharge point at all times. Concrete pumping shall not occur until Owner's Representative has verified equipment including the tremie plug. Should the discharge line become open, with zones empty of concrete, cease pumping and re-primed with tremie plug installed before continuing.

3. Placing Concrete In Hot Weather: In temperatures above 80 degrees F, place concrete in accordance with ACI 305.1.

4. Placing Concrete In Cold Weather: In temperatures below 40 degrees F, place concrete in accordance with ACI 306.1.

3.3 CONSOLIDATING CONCRETE

A. Consolidate concrete in accordance with ACI 301. If evidence of inadequate consolidation is observed, concrete placement will be suspended until Contractor provides a revised plan to achieve proper consolidation.

3.4 CURING AND SEALING

A. General

1. Cure concrete using water (including form curing and use of moister retaining covers), a clear membrane curing compound, or by a combination of both methods. Coordinate repairs or treatment of concrete surfaces so that interruption of curing will not be necessary.

2. Maintain concrete surface temperature between 50 degrees F and 80 degrees F for at least 5 days. Cure concrete in hot weather (above 80 degrees F) in accordance with ACI 305.1. Cure concrete in cold weather (below 45 degrees F) in accordance with ACI 306.1.

B. Water Curing

1. Keep concrete continuously wet for a minimum of 10-days after placement (14 days after placement for sections over 3-feet thick). Absorptive mats or fabric may be used to retain moisture during the curing period. Absorptive covers shall

comply with AASHTO M182, Class 3, and moisture retaining covers shall comply with ASTM C171.

2. Use water curing in hot weather for liquid containment structures. Cover forms and keep moist. Loosen forms as soon as possible without damage to the concrete, and make provisions for curing water to run down inside them. During form removal, take care to provide continuously wet cover to newly exposed surfaces.

C. Curing Compound

1. When curing compound is allowed, apply it as soon as the concrete has set sufficiently so as not to be marred by the application or apply it immediately following form removal for vertical and other formed surfaces. Preparation of surfaces, application procedures, and installation precautions shall follow manufacturer's instructions. For liquid containing structures, apply curing compound at twice the manufacturer's recommended dosage rate, applied in two coats perpendicular to each other.

2. Do not use curing compound on concrete surfaces to be coated, waterproofed, moisture-proofed, tiled, roofed, or where other coverings are to be bonded. In these cases, use water curing unless the curing compound is first removed or is compatible with the final finish covering.

3.5 PROTECTION

A. Protect concrete from injurious action by sun, rain, wind, flowing water, frost, excessive vibration and mechanical means.

B. Loading green concrete is not permitted. Green concrete is defined as concrete with less than 100 percent of the specified strength.

C. Backfill shall not be placed against concrete walls until the concrete has reached the specified strength, connecting slabs and beams have been cast and have also reached the specified strength, and watertightness testing and repairs have been completed for liquid containing structures to the satisfaction of the Owner's Representative.

D. Arrangements for covering, insulating, heating, and protecting concrete in cold weather shall be in accordance with ACI 306.1.

3.6 INSERTS AND EMBEDMENTS

A. Inserts

1. Where pipes, castings, or conduits are to pass through structures, position in forms before placing concrete; or where shown on Drawings or approved by the Owner's Representative, provide openings in the concrete for subsequent insertion of such pipes, castings, or conduits. Provide waterstops and a slight flare in the form to facilitate grouting and permit the escape of entrained air during grouting.

2. Provide additional reinforcement around openings. Use non-shrink grout to infill around inserts.

3. Place horizontal conduits and pipes, in slabs and beams, between the top and bottom layers of reinforcement. Spacing and size limitations shall conform to ACI 318.

4. Conduits and pipes shall not run directly beneath a column or base plate.

5. Position conduit, pipe, and other ferrous items such that there will be a minimum of 2-inches clearance between said item and concrete reinforcement. Welding inserts to reinforcement is not permitted.

6. The outside diameter of conduit or pipe shall not exceed one-fourth the slab or beam thickness.

B. Embedments

1. Gate frames, gate thimbles, special castings, channels, grating frames, or other miscellaneous metal parts to be embedded in concrete shall be secured in the forms prior to concrete placement.

2. Embed anchor bolts and inserts in concrete as shown. Provide inserts, anchors, or other bolts necessary for the attachment of piping, valves, metal parts, and equipment.

3. Provide nailing blocks, plugs, strips, and the like necessary for the attachment of trim, finish, and similar work. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent entry of concrete. Do not use continuous anchor slots or strips in concrete intended to be watertight.

4. Position operators or sleeves for gate or valve stems to clear reinforcing steel, conduit, and other embedments, and to align accurately with equipment.

3.7 WATERSTOPS

A. Waterstops shall conform to ACI 301. Tie waterstops in position prior to placement of concrete to prevent movement and deformation.

B. Provide waterstops in construction and expansion joints as follows:

1. Joints in parts of structures exposed to ground or water on one side and occupied by non-submerged equipment or by personnel on the other.

2. Wall and slab joints of tanks and channels subject to water pressure.

3. Waterstops shall be provided for the full height of the walls.

4. Provide at other locations shown on the Drawings.

C. Field splices shall be at straight sections using heat fused welded, butt splices only. Lapping of splices or joining by means other than heat fused welding is not allowed.

D. Install hydrophilic waterstops according to manufacturer's recommendations. Surfaces of concrete shall be prepared level/plumb and to the smoothness required by manufacturer. Grind surface as necessary. Provide bonding adhesive and concrete nails with fender washers to hold waterstop in position during concrete placement.

3.8 SLAB FINISHES

A. General

1. The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Do not use dry cement on new concrete surfaces to absorb excess moisture. Round edges to a radius of 1/2 inch.

2. Slope floors to drain uniformly within a room or space. Unless otherwise specified, slope shall be a minimum of 1/8 inch per foot toward nearest drain. Restrict use of floor drains with only locally depressed slabs to locations specifically noted.

3. Immediately after final finish is applied, the surface shall be cured and protected as specified in Curing, Sealing, and Protection paragraphs above.

4. Where finish is not specified, floor slabs shall receive a Steel Trowel Finish.

B. Float Finish

1. Perform floating with a hand or power-driven float in accordance with ACI 301. Begin floating when the bleed water sheen has disappeared and the surface has stiffened sufficiently. Float as required to meet tolerance requirements of ACI 117 for a conventional surface.

2. Floating shall close cracks and checks plus compact and smooth the surface. Refloat the slab to a uniform texture.

3. Apply float finish to surfaces of channels, tank bottom slabs, exterior below grade horizontal surfaces, including tops of footings, and surfaces to receive insulation or roofing.

C. Broom Finish

1. Float the concrete surface as indicated above, then immediately give the concrete a coarse transverse scored texture by drawing a broom or burlap belt across the surface in accordance with ACI 301.

2. Provide a Broom Finish for steps and ramps, exterior exposed horizontal surfaces, and where otherwise indicated.

D. Samples Of Concrete Slab Finishes

1. Provide a sample concrete slab, minimum 4 feet by 4 feet, representative of workmanship and each specified finish.

2. Samples shall be approved by the Owner's Representative prior to the start of production work. The samples shall be on display at the job site, and finished surfaces shall match samples.

3.9 RELATED SURFACES

A. Finishing of Unformed Surfaces

1. Adjacent Unformed Surfaces

a. Tops of walls, buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be Float Finished to a texture reasonably consistent with that of the adjacent formed surface.

b. Continue final treatment of formed surface uniformly across the top of the unformed surface.

2. Pavements and Sidewalks

a. The surface of the concrete shall be screeded to grade and sloped to drain. After screeding, the surface shall be Float Finished followed by a Broom Finish.

b. Round edges and expansion joints to a radius of 1/2 inch. Control joints shall be grooved or sawcut to a minimum depth of 1/4 the slab thickness.

3.10 FIELD SAMPLING AND TESTS

A. General

1. Field sampling and tests shall be performed by an independent testing laboratory. Samples of aggregates and concrete will be obtained at such times to represent the quality of the materials and work throughout the project.

2. The laboratory shall provide necessary labor, materials and facilities for sampling aggregate and for casting, handling, and initially storing the concrete samples at the work site.

3. The minimum number of samples and tests are specified in Testing paragraph below.

B. Sampling

1. Aggregates

a. General

1) Sample fine and coarse aggregates in accordance with ASTM D75 not less than 30 days prior to the use of such aggregates in the work.

2) Take samples at the discharge gates of the bins feeding the weigh hopper. Repeat sampling when the source of material is changed or when unacceptable deficiencies or variations from the specified requirements of materials are found.

3) Aggregate samples shall be tagged and their sources identified.

b. Coarse Aggregate

1) Take a sample weighing between 50 and 60 pounds after the batch plant is brought up to full operation.

2) Take samples to obtain a uniform cross section, accurately representing the materials on the belt or in the bins for sieve analysis.

c. Fine Aggregate

1) Take samples as specified for coarse aggregate.

2) Take samples of sand when the sand is moist for sieve analysis and specific gravity tests.

2. Concrete

a. Take samples of plastic concrete in accordance with ASTM C172.

b. Take samples at the hopper of mixing equipment or transit mix truck, except as noted in the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

C. Testing

1. Aggregate

a. A minimum of one test of coarse aggregate per 400 cubic yards of concrete used and a minimum of one test of fine aggregate per 200 cubic yards of concrete used shall be made to confirm continuing conformance with specifications for gradation, cleanliness and sand equivalent.

b. A maximum of one test per day of each aggregate is required.

c. Repeat of the entire concrete mix design test program is required before source changes will be accepted.

2. Concrete

a. Strength Tests

1) The strengths specified for the design mix shall be verified by the independent testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site. Cylinders shall be 4 by 8 inch or 6 x 12 inch.

2) Concrete samples shall represent the concrete placed in the forms. One set of six standard 6 x 12 inch (or nine 4 x 8 inch)

cylinders shall be cast of each class of concrete for each 100 cubic yards or less, or for each 5,000 square feet of slab or wall surface area placed per day. Provide additional cylinders when an error in batching is suspected. Each set of cylinders are cast from material taken from a single load of concrete.

3) Casting, handling and curing of cylinders shall be in accordance with ASTM C31. For the first 24 hours after casting, keep cylinders moist in a storage box constructed and located so that its interior air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the testing laboratory will transport the cylinders to their laboratory.

4) Testing of specimens for compressive strength shall be in accordance with ASTM C39. Each test shall consist of two 6 x 12 inch (or three 4 x 8 inch) test cylinders from each group of six (or nine) specimens. Test at the end of 7 days and at the end of 28 days. The remaining cylinders shall be tested at the end of 56 days if the 28-day strength reports below specification.

5) A strength test shall consist of the average strength of two 6 x 12 inch (or three 4 x 8). If one cylinder shows evidence of low strength due to improper sampling, casting, handling, or curing, the result of the remaining cylinders may be used if approved by the Owner's Representative.

6) The average of any three consecutive 28-day strength test results of the cylinders representing each class of concrete for each structure shall be equal to or greater than the specified strength. Not more than 10 percent of the individual strength test results shall have values less than the specified 28-day strength for the total job concrete. No individual strength test result shall be less than the specified strength by more than 500 pounds per square inch.

7) Provide certified reports of the test results directly to the Owner's Representative and the Engineer. Test reports shall include sufficient information to identify the mix used, the stationing or location of the concrete placement, and the quantity placed. Slump, water/cement ratio, air content, temperature of concrete, and ambient temperature shall be noted.

8) The 28-day strength test results shall be evaluated in accordance with ACI 214R. Quality control charts showing field test results

shall be included with the test results for each class of concrete in each major structure. Charts shall be prepared in accordance with ACI 214R. Quality control charts shall be maintained throughout the entire project and shall be available for the Owner's Representative's inspection at any time.

9) If the 28-day test results fall below the specified compressive strength for the class of concrete required for any portion of the work, adjustment in the proportions, water content, or both, shall be made as necessary at the Contractor's expense. Report changes and adjustments in writing to the Owner's Representative.

10) If compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other analyses or load tests acceptable to the Engineer. Costs of such tests and/or analysis shall be borne by the Contractor.

b. Tests for Consistency of Concrete

1) Measure slump in accordance with ASTM C143. Take samples for slump determination from concrete during placement. Tests shall be made at the beginning of concrete placement operation, whenever test cylinders are cast, and at subsequent intervals to ensure that the specification requirements are met.

2) For pumped concrete, measure slump in accordance with the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

3) When high range water reducer is added at the site, slump tests shall be taken before and after addition of the admixture.

c. Tests for Temperature and Air Content

1) Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Perform temperature tests whenever test cylinders are cast.

2) Measure air content in accordance with ASTM C231 whenever test cylinders are cast. For pumped concrete, measure air content

in accordance with the Placing Concrete by Pumping subparagraph of the Conveying and Placing article above.

D. Final Laboratory Report

1. The testing laboratory shall provide a final report at the completion of all concreting. This report shall summarize the findings concerning concrete used in the project and provide totals of concrete used by class and structure.

2. Include final quality control charts for compressive strength tests for classes of concrete specified in each major structure. Also include the concrete batch plant's coefficient of variation and standard deviation results for each class of concrete.

3.11 REPAIR OF DAMAGED AND CRACKED CONCRETE

A. Acceptance Of Concrete

1. Completed cast-in-place concrete work shall conform to the applicable requirements of ACI 301 and the Contract Documents. Concrete work that fails to meet these requirements shall be repaired, as approved by the Engineer, to bring the concrete into compliance. Repair methods shall be in accordance with ACI standards, including ACI 503.7, and are subject to the approval of the Engineer.

2. Concrete that cannot be brought into compliance by approved repair methods will be rejected. Remove and replace rejected concrete work.

3. The cost of repairs and replacement of defective concrete shall be borne by the Contractor.

B. Repair Methods

1. Damaged/defective concrete or concrete with crack widths exceeding 0.004 inches at liquid-containing and conveying structures or crack widths exceeding 0.006 inches for other structures shall be repaired by one of the following methods (only the Engineer may determine that a defect or crack does not require repair):

a. Perform watertightness testing and repair as needed to meet leakage criteria in this specification even when liquid-containing and conveying structures meet the crack width criteria defined above.

b. Damaged or defective concrete includes surface defects, honeycomb, rock pockets, indentations greater than 3/16 inch, spalls, chips, air bubbles greater than 1/2 inch diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins, projections, form pop outs, texture irregularities, and stains or other color variation that cannot be removed by cleaning.

1) Damaged or defective concrete is repaired according to procedures outlined above under finish requirements, Repair of Surface Defects.

2. Crack Repair Method 1

   a. Fill the joint or crack by drilling holes to the affected area (following the product manufacturer's details), install injection ports, and force epoxy or chemical grout (expanding urethane) into the joint under pressure.

   b. Material type and repair procedures shall be approved by Engineer.

   c. After injection and curing; ports, sealing mix, and surface shall be cleaned and worked to match the adjacent specified finish.

3. Crack Repair Method 2

   a. Fill cracks with low viscosity epoxy, applied by pouring/flooding crack zone until cracks are filled. Prepare surface, install, and cure according to manufacturer's recommendations.

   b. At a minimum, prepare surface to be clean and dry with no visible detrimental material in cracks to be filled. Conform to temperature limitations of epoxy. Clean and refinish to match adjacent surfaces.

4. Crack Repair Method 3

   a. Cut a bevel groove 3/8 to 1/2 inch in width and depth, use backer rod or tape, and fill with sealant in accordance with manufacturer's instructions.

   b. This repair method is only used where approved by Engineer.

   c. Groove and sealant shall be applied on wet or hydrostatic pressure side of surface.

C. Repair Method Use

1. Repair Method 1: For cracks in walls, surfaces sloped 1:1 or greater, beams, columns, structural slabs, overhead surfaces, and liquid retaining surfaces. Need for repair depends upon crack width, location, and leakage.

2. Epoxy grout is used for repair of structural cracks and chemical grout (expanding urethane) for repair of non-structural cracks at liquid-containing structures. The Engineer shall determine whether a crack is classified as structural or non-structural.

3. Repair Method 2: Utilized in lieu of Method 1 for slabs when approved by Owner's Representative. Final finish shall match adjacent surfaces.

4. Repair Method 3: Limited to dry-surface slabs, walls subject to less than three feet of liquid pressure, or as approved by Engineer. Repair Method 3 is not an equivalent repair method to Repair Methods 1 or 2, which shall be considered the standards.

3.12 BEARING AND SEAL PADS

A. General

1. Seal pads are intended to result in a gas-tight and liquid tight seal between surfaces and may also serve as bearing pads. Bearing pads are intended primarily to transmit structural loads between two structural elements.

2. A seal pad is intended to seal by dead load compressive force or mechanical clamping force as detailed. The seal pad may be bonded to one or both surfaces to maintain uniformly tight contact with the pieces contacting it. Neoprene materials may not be compatible with coatings applied later, and the Contractor shall verify that the particular coating(s) proposed for use are:

   a. contact compatible without neoprene breakdown; or

   b. mask off neoprene which may be exposed to the coating to prevent contact.

B. Concrete Contact

1. Neoprene pads shall bear against clean, smooth concrete. Clean concrete with high-pressure hydro-blast (3,500 psi) equipment. Epoxy grout cracks as specified above. Repair surfaces with irregularities greater than 1/16 inch. Create a 1/4-inch amplitude surface roughness and patch using an epoxy bonding agent followed by either polymer modified repair concrete or profiling mortar. Cure patch material before installing pad.

2. Bond seal pad, as indicated, to concrete prepared as above. Bonding agent shall be as recommended by the pad manufacturer to not allow shear sliding of the pad either with or without load normal to its surface.

C. Metal Surface Contact

1. Neoprene pads with metal-to-metal or metal-to-concrete contact shall be 1/4 inch minimum thickness or as shown on the drawings.

2. Contact surfaces shall be clean, smooth, and without evidence of harmful sharp edges or chemicals.

3. Compression is achieved by tightening connection bolts to specified torque, determined by:

   a. the equipment manufacturer; or

   b. structural specifications on the drawings; or

   c. minimum 1/16 turn past “snug tight” as defined by AISC Steel Construction Manual.

4. Tighten bolts in multiple steps, proceeding around the joint to result in a uniform compression of the pad.

5. Certain pieces of equipment may have gasket specifications particular to that piece of equipment. Refer to those Sections of the specifications for requirements.

3.13 CLEANUP

A. Upon completion of the work and prior to final inspection, clean all concrete surfaces as follows: Sweep with a broom to remove loose dirt, then mop and/or flush with clean water. Scrub by hand or machine as required to remove and blend stains or discolored areas .

B. Clean floors that have curing and sealing compound as stated above, followed by the final application of curing and sealing compound.

** END OF SECTION **

SECTION 03600

GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes: Grout for column base plates, other structural supports, equipment bases, reinforcing bar dowels, surface repair, grout toppings, patching of fresh concrete, and uses other than masonry. Adhesive anchor bolt grouting is specified in Section 05502. Topping concrete over precast elements in Section 03300.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 03300 Cast-In-Place Concrete
2. Section 05502 Anchor Bolts
3. Section 11002 Rigid Equipment Mounts

1.3 REFERENCES:

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens)
ASTM C230	Flow Table for Use in Tests of Hydraulic Cement
ASTM C307	Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
ASTM C939	Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C531	Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings and Polymer Concretes
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C942	Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory

Reference	Title
ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM E329	Agencies Engaged in Construction Inspection, Testing, or Special Inspection
COE CRD-C611	Flow of Grout for Preplaced Aggregate Concrete
COE CRD-C621	Non-shrink Grout
IBC	International Building Code

1.4 SUBMITTALS

A. Action Submittals

1. Procedure: Section 01300:
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Complete product literature, including mixing, handling and placement instructions for the following: Cementitious non-shrink grout, epoxy grout, adhesive for reinforcing bar dowel grouting, concrete repair mortar, and prepackaged cement grout products to be used on the project.
5. Mix design for cement grout that is not prepackaged, including product data for aggregates and cement in accordance with Section 03300.
6. Current ICC Evaluation Service reports for adhesives used for reinforcing dowels.
7. Installer certification in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.
8. Certified test results verifying the compressive strength, shrinkage and expansion requirements specified herein.

1.5 QUALITY ASSURANCE

A. Quality Control by Owner

1. The Owner will provide the services of a qualified Special Inspector.

2. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.

   a. The Special Inspector shall furnish a report to the Engineer, Owner's Representative and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).

B. Quality Control by Contractor: Provide the services of an independent testing laboratory which complies with the requirements of ASTM E329 if a product other than those listed below is proposed and test data is not available from the supplier to demonstrate equivalence to the specified grout. The testing laboratory shall sample and test the proposed grout materials. Costs of testing laboratory services shall be borne by the Contractor.

C. Certifications: Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined reinforcing bar dowels grouted using adhesive.

D. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications.

1. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days and any other time period as appropriate.
2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.

E. Manufacturer Qualifications

1. Manufacturer shall have experience of producing products substantially similar to that required.
2. When required, provide services of manufacturer's full-time employee, factory-trained in handling, use, and installing the products required

PART 2 - PRODUCTS

2.1 CEMENTITIOUS NON-SHRINK GROUT

A. The grout material shall be an approved ready to use mixture requiring only water for use at the job site. The 2-inch cubes shall have a minimum compressive strength of 3,000 psi at 7 days and 7,000 psi at 28 days.

B. Cementitious non-shrink non-metallic aggregate grout shall be:

3. BASF, Masterflow 928

4. Euclid Chemical Company, Hi-Flow Grout
5. Five Star Products, Inc., Five Star Grout
6. Sika Corporation, SikaGrout 212
7. Approved Equal

C. Non-shrink grout shall conform to CRD-C 621 and ASTM C1107, Grade B or C when tested at a maximum fluid consistency of 30 seconds per ASTM C939 at temperature extremes of 45 degrees Fahrenheit and 90 degrees Fahrenheit and an extended working time of 15 minutes.

D. Fluid grout shall pass through the flow cone, with continuous flow, one hour after mixing.

2.2 EPOXY GROUT FOR EQUIPMENT MOUNTING:

A. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system.

B. Epoxy grout for equipment mounting shall be a non-cementitious, resin based, multi-component formulation. Epoxy grout shall be flowable, with shrinkage minimized to achieve minimum 98% effective bearing area. Epoxy grout shall be:

1. BASF, Masterflow 648
2. Euclid Chemical Company, E3-G
3. Sika Corporation, Sikadur 42
4. Approved Equal.

C. The following properties shall be attained with the minimum quantity of aggregate allowed by epoxy grout manufacturer.

1. Length change after hardening shall be less than 0.0006-inch per inch and coefficient of thermal expansion shall be less than 0.00003-inch per inch per degree F when tested in accordance with ASTM C531.
2. Compressive creep at one year shall be less than 0.001-inch per inch when tested under a 400-psi constant load at 140 degrees F in accordance with ASTM C1181.
3. Minimum seven-day compressive strength shall be 14,000 psi when tested in accordance with ASTM C579
4. Grout shall be capable of maintaining at least a flowable consistency for minimum of 30 minutes at 70 degrees F.
5. Shear bond strength to portland cement concrete shall be greater than shear strength of concrete when tested in accordance with ASTM C882/C882M.

2.3 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

A. Adhesive for setting dowels in concrete shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report. Adhesive shall be:

1. Hilti, HIT-RE 500v3
2. Simpson Strong Tie, SET XP

3. Approved Equal (equivalent product must have ICC approval for use in cracked concrete in areas with high seismic risk).

B. Adhesive for setting dowels in concrete masonry shall be an injectable two-component epoxy adhesive. Adhesive shall be approved for the intended use per the product ICC Report or IAPMO Report. Adhesive shall be:

1. Hilti, HIT-HY 70
2. Simpson Strong Tie, SET XP
3. Approved Equal acceptable per ICC Report or IAPMO Report for resisting earthquake loads

2.4 CONCRETE REPAIR MORTAR

A. Horizontal Applications: Repair mortars shall be:

4. BASF, MasterEmaco S 466CI
5. Sika Corporation, SikaTop 111 Plus
6. Approved Equal

B. Vertical and Overhead Applications: Repair mortars shall be:

7. BASF, MasterEmaco 1500HCR Vertical Overhead
8. Sika Corporation, SikaTop 123 Plus
9. Approved Equal

2.5 CEMENT GROUT

A. Cement grout shall be comprised of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed in accordance with this Section.

1. Minimum Compressive Strength: 4,500 psi at 28 days.
2. Maximum Water Cement Ratio: 0.42 by weight.
3. Coarse Aggregate: ASTM C33/C33M, No. 8 size.
4. Fine Aggregate: ASTM C33/C33M, approximately 60 percent by weight of total aggregate.
5. Air Content: Five percent (plus or minus one percent).
6. Minimum Cement Content: 564 pounds per cubic yard.
7. Slump for grout fill shall be adjusted to match placing and finishing conditions, and shall not exceed four inches.

PART 2 EXECUTION

3.1 EXAMINATION

A. Examine and accept existing conditions before beginning work.

3.2 CEMENTITIOUS NONSHRINK GROUT

A. Non-shrink, cementitious, nonmetallic aggregate grout shall be used for column base plates, structural bearing plates, and all locations where the general term “non-shrink grout” is indicated on the Drawings. Use of this grout to support the bearing surfaces of machinery shall be as specified in Section 11002 or as detailed on the Drawings for specific locations or pieces of equipment. If guidance is not provided in locations noted above, use of non-shrink grout for equipment mounting shall be limited to equipment less than 25 horsepower or 750 pounds. Grout shall be placed and cured in accordance with the manufacturer's instructions.

B. Non-shrink cementitious grout shall not be used as a surface patch or topping. Non-shrink cementitious grout must be used in confined applications only.

3.3 EPOXY GROUT FOR EQUIPMENT MOUNTING

A. Prepare concrete surfaces of equipment pads as indicated in details on the Drawings and as required by the epoxy grout manufacturer. Epoxy grout for equipment mounting shall be placed and cured in accordance with the requirements of Section 11002, details on the Drawings, and in conformance with manufacturer’s recommendations.

3.4 ADHESIVE FOR GROUTING REINFORCING BAR DOWELS

A. Follow manufacturer’s instructions.

3.5 CONCRETE REPAIR MORTAR

A. Concrete repair materials and procedures shall be submitted for review to the Owner’s Representative and shall be accepted prior to commencement of the repair work.

B. Follow all manufacturer's instructions, including those for minimum and maximum application thickness, surface preparation and curing. Add aggregate as required per manufacturer's recommendations. Any deviations from the manufacturer's instructions shall be submitted for review to the Owner’s Representative and shall be accepted prior to commencement of the work.

3.6 CEMENT GROUT

A. Cement grout shall be used for grout toppings less than four inches thick and for patching of fresh concrete.

B. Grouting shall comply with temperature and weather limitations in Section 03300, Cast-In-Place Concrete.

C. Cure grout in accordance with grout manufacturer’s instructions for prepackaged grout and Section 03300, Cast-In-Place Concrete, for non-prepackaged cement grout.

** END OF SECTION **

SECTION 05502

ANCHOR BOLTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Bolts and all-thread rods used to attach structural elements and equipment to concrete. Included are cast-in-place and post-installed anchors (adhesive systems and wedge type expansion anchors), nuts and washers.

B. Cast-in-place and post-installed anchors shall be Type 316 stainless steel unless noted otherwise.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 01734 Design Requirements for Nonstructural Components and Nonbuilding Structures
2. Section 03300 Cast-In-Place Concrete
3. Section 03600 Grouting
4. Section 11002 Rigid Equipment Mounts

1.3 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ACI 318	Building Code Requirements for Structural Concrete
ASTM A193	Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A320	Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A563	Carbon and Alloy Steel Nuts
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
ASTM F844	Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	Anchor Bolts, Steel, 36, 55, 105-ksi Yield Strength
CBC	California Building Code with local amendments

1.4 SUBMITTALS

A. Action Submittals

1. Procedures: Section 01300.
2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. Anchor bolt placement plans.
5. Anchor bolt, nut, and washer material information, including material certifications.
6. Record copy of design calculations and details showing the required diameter, length, embedment, edge distance, confinement, anchor reinforcement, anchor bolt sleeves, connection redesign, and other conditions, stamped and signed by a Professional Engineer currently registered in the state of California. Calculations shall comply with the provisions of ACI 318-14, Chapter 17. Base anchor capacity determination on cracked concrete condition and compressive strength of new concrete per Section 03300. Assume compressive strength of existing concrete is 3,000 psi unless otherwise noted.
7. Submit record copy of proof loading test results within five days after test.
8. Product Data:
    a. ICC Evaluation Service Reports for post-installed adhesive type anchors and expansion (wedge type) anchors when allowed. Products shall be ICC approved for use in cracked concrete in high seismic areas (Seismic Design Category D, E and F).
    b. Product data indicating load capacity charts/calculations.
    c. Chemical resistance.
    d. Temperature limitations.
    e. Manufacturers written installation instructions.
9. Installer certification for horizontal or upwardly inclined adhesive anchors in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program.

1.5 QUALITY ASSURANCE

A. Quality Assurance By Owner

1. Special inspection of anchor bolts shall be performed by the Special Inspector under contract with the Owner and in accordance with IBC Chapter 17.

2. A five percent sample of installed post-installed anchors shall be proof-loaded by an independent laboratory contracted by the Contractor. The quantity of samples and locations shall be coordinated with the Owner's Representative.

3. Adhesive anchors installed in horizontal or upwardly inclined orientations to resist sustained tension loads shall be continuously inspected during installation by a Special Inspector.

4. The Special Inspector shall furnish a report to the Engineer, Owner's Representative, and Building Official that the work covered by the report has been performed and that the materials used and the installation procedures used conform with the approved Project Manual and the Manufacturer's Printed Installation Instructions (MPII).

B. Certifications

1. Installer certification shall be in accordance with ACI/CRSI Adhesive Anchor Installer Certification Program for installers of horizontal or upwardly inclined adhesive anchors.

PART 2 - PRODUCTS

2.1 GENERAL

A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 1/4 inch. Minimum anchor bolt diameter shall be 1/2 inch. Anchor bolts for equipment mounting and vibration isolation systems shall be provided as specified in Sections 43 05 13 and 43 05 18, respectively.

B. Tapered washers shall be provided where mating surface is not square with the nut.

C. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings. Substitution of post-installed anchors will not be permitted unless specifically requested by the Contractor and approved by the Engineer.

2.2 PERFORMANCE/DESIGN CRITERIA

A. Anchor bolts for equipment shall be designed by the equipment manufacturer to include equipment operational loads combined with seismic and wind forces when applicable. Design criteria provided in Section 01 73 24.

B. Design anchor bolts for support and bracing of non-structural components and non-building structures for loading specified in Section 01 73 24.

2.3 MATERIALS

A. Anchor bolt materials shall be as specified in the following table:

Material	Specification
Stainless Steel Anchor Bolts	ASTM A193 or A320, Type 316
Stainless Steel Threaded Rods	ASTM F593, Type 316

Material	Specification
Stainless Steel Nuts	ASTM A194 Heavy Hex Nuts, Type 316 ASTM F594 Heavy Hex Nuts at Adhesive Anchors, Type 316
Stainless Steel Washers	Type 316 to match bolt material
Carbon Steel Anchor Bolts	ASTM F1554, Grade 36, Hot Dip Galvanized
High-Strength Carbon Steel Anchor Bolts	ASTM F1554, Grade 55, Weldable per Supplementary Requirement S1, Hot Dip Galvanized
Carbon Steel Nuts and Washers	ASTM A563 and F844, Heavy Hex, Hot-Dip Galvanized
Concrete Adhesive Anchors	Hilti “HIT-RE 500v3”, Simpson Strong-Tie “SET-XP”, or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Adhesive Anchors	Hilti "HIT-HY 70", Simpson Strong-Tie “SET-XP”, or approved equal, with Type 316 Stainless Steel threaded rods
Concrete Masonry Expansion (wedge) Anchors*	Hilti "KWIK BOLT 3", or approved equal, Type 316 Stainless Steel
Concrete Expansion (wedge) Anchors *	Hilti “KWIK BOLT TZ”, or approved equal, Type 316 Stainless Steel

**Post installed anchors shall always be an adhesive type anchor system except where noted otherwise or when Contractor makes a request for a specific application and Engineer approves.*

2.4 STAINLESS STEEL FASTENER LUBRICANT (ANTI-SEIZING)

A. Anti-seizing Lubricant for Stainless Steel Threaded Connections:

1. Formulated to resist washout.
2. Acceptable manufacturers are Bostik, Saf-T-Eze, or equal.

2.5 ANCHOR BOLT SLEEVES

A. Provide anchor bolt sleeves as shown on design drawings and as required by equipment manufacturer’s design.
1. Provide high density polyethylene plastic sleeves of single unit construction with deformed sidewalls such that the concrete and grout lock in place.
2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
3. Acceptable manufacturers are Contec, Wilson, or equal.

PART 3 - EXECUTION

3.1 GENERAL

B. Anchor bolts shall be cast-in-place anchors unless post-installed anchors are specified or shown on the Drawings.

C. Grouting of anchor bolts using plastic sleeves with non-shrink or epoxy grout, where specified, shall be in accordance with Section 03 60 00.

D. The threaded end of anchor bolts and all-thread rods shall be long enough to project through the entire depth of the nut and if too long, shall be cut off at ½-inch beyond top of nut and ground smooth.

3.2 CAST-IN-PLACE ANCHOR BOLTS

A. Anchor bolts to be embedded in concrete shall be placed accurately and held in correct position using templates while the concrete is placed.

B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

3.3 ADHESIVE ANCHOR BOLTS

A. Note that adhesive anchors shall not be substituted for cast-in-place anchor bolts unless the adhesive anchors have been specified or shown on the Drawings, or approval has been obtained from the Engineer that substitution of adhesive anchors is acceptable for the specific use and location. Use of adhesive anchors shall be subject to the following conditions:

1. Limit to locations where intermittent or continuous exposure to the following is extremely unlikely:
   a. Acid concentrations higher than 10 percent
   b. Chlorine gas
   c. Machine or diesel oils
2. Limit to applications where exposure to the following is extremely unlikely:
   a. Fire
   b. Concrete or rod temperature above 120 degrees F
3. Overhead applications (such as pipe supports) shall not be allowed unless approved by the Engineer and installation is by an Installer specially certified for overhead applications.
4. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
5. Anchor diameter and material shall be per Contract Documents or equipment manufacturer's specifications. Anchor shall be threaded or deformed the full length of embedment and shall be free of rust, scale, grease, and oils.
6. Embedment depth shall be as specified or as required by the equipment manufacturer.
7. Follow the anchor system manufacturer's installation instructions.
8. Holes shall have rough surfaces created by using a hammer drill with carbide bit. Core drilled holes are not allowed.
9. Holes shall be blown clean with oil-free compressed air and be free of dust or standing water prior to installation. Follow additional requirements of the adhesive manufacturer.
10. Concrete and air temperature shall be compatible with curing requirements of adhesives per adhesive manufacturer's instructions. Anchors shall not be placed in concrete when the temperature is below 25 degrees F.

11. Anchors shall be left undisturbed and unloaded for full adhesive curing period, which is based on temperature of the concrete.

3.4 EXPANSION ANCHORS

A. Expansion (wedge type) anchors shall not be substituted for cast-in-place anchor bolts or adhesive anchors unless approved by the Engineer for a specific application. Use of expansion anchors shall be subject to conditions 4 through 9 as specified above for adhesive anchors. Expansion anchors shall not be used in a submerged condition or in mounting of equipment subject to vibration or cyclic motion.

3.5 REINFORCING STEEL CONFLICTS WITH POST-INSTALLED ANCHOR INSTALLATION

A. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction and provide beveled washer to match angle of anchor. Drill shall not be slanted more than 10 degrees.

B. Where slanting the drill does not resolve the conflict, notify the Owner's Representative and resolve the conflict to the satisfaction of the Owner's Representative in consultation with the Engineer.

C. Abandoned post-installed anchor holes shall be cleaned and filled with non-shrink grout and struck off flush with adjacent surface.

D. The costs of determining and executing the resolution shall be borne by the Contractor. The determination and execution of the resolution shall not result in additional cost to the Owner.

E. Reinforcing steel in masonry shall not be damaged.

F. In order to avoid or resolve a conflict, locate embedded reinforcing steel using non-destructive methods and/or redesign the attachment.

1. Redesign shall be done by the Contractor's Professional Engineer currently registered in the state of California.
2. Calculations and details for redesign shall be submitted.

** END OF SECTION **

SECTION 07100

DAMPPROOFING AND WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Dampproofing and waterproofing coatings and membranes for concrete surfaces.

1. Plastic Lining is not covered by this specification.

2. Refer to Section 09900 for protective concrete coatings.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 03300 Cast-In-Place Concrete.

2. Section 09900 Painting and Coating.

1.3 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C109	Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)
ASTM C321	Bond Strength of Chemical-Resistant Mortars
ASTM C348	Flexural Strength of Hydraulic-Cement Mortar
COE CRD-C48	Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete

1.4 DEFINITIONS

A. SM – Coating or Membrane - System Manufacturer

B. TR – Coating or Membrane System Manufacturer's - Technical Representative

1.5 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300.

2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. System Manufacturer's (SM) current printed recommendations and product data sheets for proposed systems including:

    a. Volatile organic compound (VOC) data.

    b. Surface preparation recommendations.

    c. Allowable substrate moisture content.

    d. Primer type, coverage rate, and drying time; where required.

    e. Maximum dry and wet-mil thickness per coat.

    f. Product(s) shelf life.

    g. Minimum and maximum curing time between coats.

    h. Atmospheric condition requirements during application and curing.

    i. Curing time before submergence in liquid.

    j. Thinner to be used.

    k. Ventilation requirements.

    l. Allowable application methods.

    m. Corner, joint, and wall penetration details.

    n. Backfill procedure recommendations including termination bar if required.

5. Affidavits signed and sealed by an officer of the SM's corporation, attesting to compliance of each system component with federal, state, and local air pollution control regulations and requirements.

6. SM's detailed, written instructions for system installation including graphic details for terminations, pipe penetrations, metal embedments, gate frames, concrete joints, and other terminations as coordinated by Contractor.

7. Schedule of all surfaces where dampproofing, waterproofing coating, and sheet membrane waterproofing will be applied.

B. Informational Submittals:

1. Material Safety Data Sheets (MSDS) for materials to be delivered to the job site, including coating system materials, solvents, and abrasive blast media.

2. List of cleaning and thinner solutions allowed by the SMs.

3. Storage and handling requirements including temperature, humidity, and ventilation for system materials as recommended by the SMs.

4. The Contractor and SM shall each provide five project references with contact name, address, and telephone number where similar coating work has been performed by their companies.

1.6 QUALITY ASSURANCE

A. General:

1. Materials in each system shall be the products of a single SM.

2. Installation of each system shall be by a single installation Contractor, approved by the SM.

B. Quality Control:

1. The Contractor is responsible for the workmanship and quality of the system installation. Inspections by the Owner's Representative or the System Manufacturer's Technical Representative (TR) will not relieve or limit the Contractor's responsibilities.

2. Installation methods shall conform to requirements of this specification. Changes in the system installation requirements will be allowed only with the written acceptance of the Owner's Representative before work commences.

3. Only personnel who are trained by the TR specifically for the system or who are approved by the SM specifically for the system are allowed to perform the system installation specified in this Section.

4. For repairs, provide the same products, or products recommended by the SM, as used for the original installation.

5. Identify the points of access for inspection by the Owner's Representative. Provide ventilation, ingress and egress, and other means necessary for the Owner's Representatives to safely access the work areas.

6. Conduct and inspect the work so that the system is installed as specified. Work that does not conform to the specifications shall be corrected.

1.7 SPECIAL WARRANTY

A. Waterproofing coating and sheet membrane waterproofing SM and the installation Contractor agree to repair or replace components of the waterproofing system that fail in materials or workmanship within 5 years from the date of completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Dampproofing Coating:

1. W.R. Meadows, Sealtight Sealmastic Emulsion.

2. ChemMasters, MasterGard 400.

3. Euclid Chemical Company, Dehydratine 75.

B. Epoxy Waterproofing Coating:

1. Tnemec Series 69.

2. Ameron Amercoat 385.

3. International Protective Coatings Intergard 670 HS.

2.2 MATERIALS

A. Dampproofing Coating:

1. Cold applied, asphalt emulsion.

B. Epoxy Waterproofing Coating:

1. Polyamidoamine epoxy resin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine and accept existing conditions before beginning work.

3.2 DAMPPROOFING COATING

A. Location:

1. Apply to the earth side of concrete walls which are below grade at the following locations or as indicated on the Drawings:

a. Walls at unoccupied crawl spaces.

b. Wall areas above the water table and the waterproofing membrane or coating at walls common with rooms, tunnels or galleries to be occupied by equipment, piping or personnel.

c. Walls of concrete channels, basins and tank walls (above and below ground water table).

2. Do not apply to walls that are to be provided with waterproofing sheet membrane with protection board or to walls that are placed directly against an excavated surface.

3. Dampproofing is not a substitute for waterproofing.

B. Surface Preparation:

1. New concrete shall have cured at least 28 days. Remove loose concrete and laitance from new concrete surfaces by abrasive blasting. Repair voids and cracks as specified in Section 03 30 00. Pre-dampen the surface as recommended by the product manufacturer.

2. Do not proceed with dampproofing Work until all projections through the concrete surface are installed.

C. Application: Apply one or more coats at the manufacturer's recommended dry film thickness for optimum performance. Surfaces to be coated must be kept damp during the application procedure. Drying time between coats: as recommended by the manufacturer.

3.3 EPOXY WATERPROOFING COATING

A. Location: Except where sheet membrane waterproofing is indicated at the earth side of walls and slabs on the Drawings, apply epoxy waterproofing coating to the process liquid and earth side of walls and elevated slabs which are common with rooms, tunnels or galleries to be occupied by equipment, piping, conduit, or personnel, or as indicated on the Drawings.

B. Surface Preparation: New concrete shall have cured at least 28 days and allowed to dry to a moisture content recommended by the coating manufacturer. Remove loose concrete and laitance by abrasive blasting. Repair voids and cracks as specified in Section 03 30 00.

C. Application:

1. Total dry film thickness: minimum 16 mils.

2. Apply two or more coats at the manufacturer's recommended dry film thickness.

3. Drying time between coats: as recommended by the manufacturer.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07900

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies sealants.

1.2 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
FEDSPEC TT-S-00230C	Sealing Compound: Elastomeric Type, Single Component
FEDSPEC TT-S-00227E	Sealing Compound: Elastomeric Type, Multi-Component

PART 2 - PRODUCTS

2.1 POLYURETHANE SEALANT

A. Acceptable Products: Acceptable products shall be Sikaflex by Sika Chemical Corporation, Vulkem by Mameco International, U-Seal Joint Sealant by Burke Company, or Rubber Calk by Products Research and Chemical Corporation.

B. General:

1. Polyurethane sealants shall conform to FEDSPEC TT-S-0230C for one-component systems and FEDSPEC TT-S-00227E for two-component systems. Polyurethane sealant shall be one of the following two types.
    a. Self-Leveling: Self-leveling polyurethane sealant shall be Type I, Class A as specified by the FEDSPECs referenced above.
    b. Nonsag: Nonsag polyurethane shall be Type II, Class A as specified by the FEDSPECs referenced above.

C. Primer: Primer shall be as recommended by the sealant manufacturer.

D. Backer Rod or Backer Tape: Backer rod shall be open cell polyethylene or polyurethane foam. Rod shall be cylindrical unless otherwise specified. Backer tape shall be polyethylene or polyurethane with adhesive on one side.

2.2 MASTIC SEALANT

A. General: Mastic joint sealant shall consist of a blend of refined asphalts, resins and plasticizing compounds, reinforced with fiber. Sealant shall be compatible with joint fillers and shall be pressure grade.

B. Primer: Primer shall be as recommended by the mastic sealant manufacturer.

2.3 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Manufacturer's product data showing conformance to the specified products.

2. Manufacturer's recommendations for storage, handling and application of sealants and primers.

PART 3 - EXECUTION

3.1 GENERAL

A. Sealants and primers shall be applied according to the sealant manufacturer's recommendations. Polyurethane sealants shall be used on all expansion joints and specified construction joints.

B. Joints and spaces to be sealed shall be clean, dry and free of dust, loose mortar, concrete and plaster. Additional preparation of joints and spaces shall be provided in accordance with manufacturer's recommendations. Primer shall be applied only to the surfaces that will be covered by the sealant.

3.2 POLYURETHANE SEALANTS

A. General: Nonsag polyurethane sealants shall be used on vertical joints. Self-leveling polyurethane sealants shall be used on horizontal joints.

B. Joint Dimensions: Unless otherwise specified, joints and spaces to be filled shall be constructed to the following criteria. Joints and spaces shall have a minimum width of 1/4 inch and a maximum width of 1 inch. The depth of the sealant shall be one-half the width of the joint, but in no case less than 1/4 inch deep. Sealant depth shall be measured at the point of smallest cross section. When joints exceed the depth requirements, backing rod shall be inserted to provide the joint depth specified. If the joint sealant depth is within the specified tolerances, backer tape shall be placed in the bottom of the joint.

3.3 MASTIC SEALANT

A. Joint Dimensions: Joints to be sealed shall be 2 inches deep, 1 inch wide at the top, and 3/4-inch-wide at the base.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 07905

JOINT FILLERS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. This section specifies preformed joint fillers.

1.2 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D994	Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

PART 2 -- PRODUCTS

2.1 PREFORMED ASPHALT FIBERBOARD

A. Preformed asphalt fiberboard joint filler shall be in accordance with ASTM D994 and shall be 1/2 inch thick unless otherwise specified.

2.2 PREFORMED RESIN-BONDED CORK

A. Preformed resin-bonded cork joint filler shall be in accordance with ASTM D1752, Type II. Cork joint filler thickness shall match the specified joint width.

2.3 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Manufacturer's recommendations for handling and installation of the material.

PART 3 -- EXECUTION

3.1 GENERAL

A. Preformed joint fillers shall be placed into position before the concrete is poured. Where it is necessary for the filler to be fixed to existing concrete or other building materials, a suitable adhesive recommended by the filler manufacturer shall be used. Filler surfaces shall be clean and dry prior to the placement of the concrete.

3.2 PREFORMED ASPHALT FIBERBOARD

A. Preformed asphalt fiberboard joint fillers shall be used for expansion joints in concrete sidewalks, curbs, and roadways.

3.3 PREFORMED RESIN-BONDED CORK

A. Preformed resin-bonded cork joint filler shall be used for expansion joints in concrete structures. The expansion joint shall be sealed with backer rod and sealant as specified in Section 07900.

** END OF SECTION **

SECTION 08305

FLOOR ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Factory-fabricated double leaf aluminum floor access doors and frames with water drainage, along with safety chain.

1.2 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B632	Aluminum-Alloy Rolled Tread Plate
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
AASHTO	American Association of State Highway and Transportation Officials
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration

1.3 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300

2. 1.3.1.2 A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

3. Check-marks (✓) shall denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Statement of experience for both manufacturer and installer.

5. Fabrication drawings showing layouts, connections to structure, and anchoring details.

6. Erection and installation drawings showing construction details, reinforcement, anchorage, and installation with relation to the building construction.

B. Informational Submittals

1. Manufacturer's product data showing conformance to the specification.

2. Structural calculations for the floor access door design provided by the manufacturer and sealed by a registered professional engineer registered in the State of California

3 Instructions for the storage, handling, installation, and operation.

4 Manufacturer’s warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer: Shall have experience manufacturing similar products.

B. Installer: Shall have experience installing similar products.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s original packaging, stored in a dry, protected, well-vented area. Inspect product upon receipt and report damage to carrier and manufacturer.

1.6 SPECIAL WARRANTY

A. Materials shall be free of defects in material and workmanship for a period of 5 years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. The following manufacturers are acceptable. The manufacturer’s standard product may require modification to conform to specified requirements.

1. The Bilco Company.

2 Babcock Davis.

3 Halliday Products.

4 East Jordan Iron Works (EJ).
5 Approved Equal.

2.2 PERFORMANCE/DESIGN CRITERIA

A. Door leafs shall be reinforced to support a minimum live load of 300 psf or AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span. See Floor Access Door Schedule at the end of this section, which indicates loading criteria required at each location.

B. Nominal opening sizes and hinge opening side shall be as noted on the Drawings and in the Floor Access Door Schedule.

2.3 MATERIALS

A. Access doors, single or double leaf: 1/4 inch minimum aluminum with diamond tread pattern; ASTM B632, 6061-T6.

B. Channel frame shall be 1/4 inch minimum extruded aluminum with bent down anchor tabs around the perimeter: ASTM B221, 6061-T6.

C. Hardware: ASTM A240 Type 316 stainless steel throughout.

D. Fasteners:

1. Bolts: ASTM F593

2. Nuts: ASTM F594

2.4 COMPONENTS/FEATURES

A. Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled door leaf operation throughout the entire arc of opening; and to act as a check in retarding downward motion of the cover when closing.

B. Spring tubes shall be constructed of a reinforced nylon 6/6-based engineered composite material. The upper tube shall prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4 inch gusset support plate.

C. Door leafs shall be equipped with a hold-open arm which automatically locks the door in the open position. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the door and the latch release shall be protected by a flush, gasketed, removable screw plug. A stainless steel snap lock with fixed handle shall be mounted on the underside of the door.

D. Provide heavy forged aluminum hinges with 1/4 inch minimum diameter stainless steel pins.

1. Hinges must operate in such a manner to prevent the door leafs from protruding into the channel frame.
2 Design hinges specifically for horizontal installation.

3 Hinges shall be through-bolted to the cover with tamperproof stainless steel lock bolts and through-bolted to the frame with stainless steel bolts and locknuts.

E. A continuous ethylene propylene diene monomer (EPDM) gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover and significantly reduce the amount of dirt and debris that may enter the channel frame.

F. A channel drain shall be provided along the perimeter of the door leafs.

G. Provide safety chain made of non-corrosive material that will span across the corners of double leaf access doors when open.

2.5 FINISHES

A. Door and frame: Mill finish aluminum with heavy bituminous coating where in contact with concrete.

B. Springs: Electro-coated acrylic finish.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation shall conform to the manufacturer's recommendations.

B. Frame shall be accurately cast in place and securely anchored to concrete. Installation of access doors after concrete is placed is not allowed.

C. Set frame level, plumb and in proper alignment with adjacent work.

D. Contractor shall field route a 1.5 inch Schedule 80 PVC drain pipe from the 1.5 inch drain coupling on all access doors to the water or floor level below. Place drain pipe clear of the access area below the door and as approved by the Owner's Representative.

3.3 REPAIR/RESTORATION

A. Repair finishes damaged during installation.

B. Remove and replace doors that are warped, bowed, or otherwise damaged.

3.4 ADJUSTING

A. Adjust doors and hardware after installation for proper operation.

3.5 CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer that will not damage finish.

3.6. FLORR ACCESS DOOR SCHEDULE

Mark	Location/Room Number	Clear Opening Size (north/south x east/west) [1]	Leafs	Loading	Comments
H001	Pump Station Wet Well	3'-6" x 3'-0"	Double	H-20	Orientate leafs per mechanical plans
H002	Pump Station Wet Well	3'-6" x 3'-0"	Double	H-20	Orientate leafs per mechanical plans

Note:

Clear opening is defined as the opening dimension in the wet well lid in which the access door frame will be installed.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 09800

PROTECTIVE COATING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section specifies coating systems, surface preparations, and application requirements for coating systems.

B. Definitions:

1. Specific coating terminology used in this Section is in accordance with definitions contained in ASTM D16, ASTM D3960, and the following definitions.

a. Definitions:

1) Abrasive: Material used for blast cleaning, such as sand, grit or shot.
2) Abrasive Blast Cleaning: Cleaning/surface preparation by abrasive propelled at high speed.
3) Anchor Pattern: Profile or texture of prepared surface(s).
4) ANSI: American National Standards Institute.
5) Bug Holes: Small cavities, usually not exceeding 15 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.
6) Coating/Paint/Lining Thickness: The total thickness of primer, intermediate and/or finish coats.
7) Coating System Applicator (CSA): A generic reference to the specialty subcontractor or subcontractors retained by the Contractor to install the coating systems specified in this Section.
8) Coating System Manufacturer (CSM): Refers to the acceptable coating system manufacturer, abbreviated as the CSM.
9) Coating System Manufacturer's Technical Representative(s) (CTR): Refers to the technical representative(s) of the acceptable Coating System Manufacturer and is abbreviated as CTR.
10) Dew point: Temperature of a given air/water vapor mixture at which condensation starts.
11) Dry Film Thickness (DFT): Depth of cured film, usually expressed in mils (0.001 inch). Use this definition as opposed to existing definition.
12) Drying Time: Time interval between application and curing of material.

13) Dry to Recoat: Time interval between application of material and ability to receive next coat.

14) Dry to Touch: Time interval between application of material and ability to touch lightly without damage.

15) Feather Edging: Reducing the thickness of the edge of paint.

16) Feathering: Operation of tapering off the edge of a point with a comparatively dry brush.

17) Field Coat: The application or the completion of application of the coating system after installation of the surface at the site of the work.

18) Hold Point: A defined point, specified in this Section, at which work shall be halted for inspection.

19) Holiday: a discontinuity, skip, or void in coating or coating system film that exposes the substrate.

20) Honeycomb: Segregated condition of hardened concrete due to non-consolidation.

21) ICRI: International Concrete Repair Institute.

22) Incompatibility: Inability of a coating to perform well over another coating because of bleeding, poor bonding, or lifting of old coating; inability of a coating to perform well on a substrate.

23) Laitance: A layer of weak, non-durable concrete containing cement fines that is brought to the surface through bleed water because of concrete finishing and/or over-finishing.

24) Mil: 0.001 inch.

25) NACE: National Association of Corrosion Engineers.

26) Overspray: Dry spray, particularly such paint that failed to strike the intended surface.

27) Pinhole: A small diameter discontinuity in a coating or coating system film that is typically created by outgassing of air from a void in a concrete substrate resulting in exposure of the substrate or a void between coats.

28) Pot Life: Time interval after mixing of components during which the coating can be satisfactorily applied.

29) Resurfacer/Resurfacing Material: A layer of cementitious and/or resin-base material used to fill or otherwise restore surface continuity to worn or damaged concrete surfaces.

30) Shelf Life: Maximum storage time for which a material may be stored without losing its usefulness.

31) Shop Coat: One or more coats applied in a shop or plant prior to shipment to the site of the work, where the field or finishing coat is applied.

32) Spreading Rate: Area covered by a unit volume of paint at a specific thickness.

33) SSPC: The Society for Protective Coatings.

34) Stripe Coat: A separate coat of paint applied to all weld seems, pits, nuts/bolts/washers and edges by brush. This coat shall not

be applied until any previous coat(s) have cured and, once applied, shall be allowed to cure prior to the application of the subsequent coat(s).

35) Surface Saturated Dry (SSD): Refers to concrete surface condition where the surface is saturated (damp) without the presence of standing water.

36) Tie Coat: An intermediate coat used to bond different types of paint coats. Coatings used to improve the adhesion of a succeeding coat.

37) Touch-Up Painting: The application of paint on areas of painted surfaces to repair marks, scratches, and areas where the coating has deteriorated to restore the coating film to an unbroken condition.

38) TPC: Technical Practice Committee.

39) Volatile Organic Compound (VOC) Content: The portion of the coating that is a compound of carbon, is photochemically reactive, and evaporates during drying or curing, expressed in grams per liter (g/l) or pounds per gallon (lb/gal).

40) Immersion: Refers to a service condition in which the substrate is below the waterline or submerged in water or wastewater at least intermittently if not constantly.

41) Weld Splatter: Beads of metal scattered near seam during welding.

42) Wet Film Thickness (WFT): The primer or coating film's thickness immediately following application. Wet film thickness is measured in mils or thousandths of an inch (0.001 inch) and is abbreviated WFT.

C. The following surfaces shall not be protective coated hereunder unless indicated.

1. Stainless steel
2. Machined surfaces
3. Grease fittings
4. Glass
5. Equipment nameplates
6. Platform gratings, stair treads, door thresholds, and other walk surfaces

D. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coatings systems, or to clarify or show details for application of the coating systems.

1.2 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under

this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ANSI/ASC 29.4 Exhaust Systems	Abrasive Blasting Operations – Ventilation and Safe Practice
ANSI/NSF 61	Drinking Water System Components Health Effects
ANSI B74.18	Grading of Certain Abrasive Grain on Coated Abrasive Material
ASTM D16	Standard Terminology for Paint, Related Coatings, Materials, and Applications
ASTM D2200 (SSPC-VIS1)	Pictorial Surface Preparation Standards for Painting Steel Surfaces
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4262	Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages
ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM D4541	Standard Test Methods for Pull-Off Strength of Coatings On Metal Substrates Using Portable Adhesion Testers
ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
ASTM D5162	Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Adhesion Testers.
ASTM E337	Standard Test Method for Measuring Humidity With a Psychrometer
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
FS 595b	Federal Standard Colors
ICRI 03732	Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
NACE Publication 6D-163	A Manual for Painter Safety
NACE Publication 6F-163	Surface Preparation of Steel or Concrete Tank/Interiors
NACE Publication 6G-164 A	Surface Preparation Abrasives for Industrial Maintenance Painting
NACE Standards	January 1988 Edition of the National Association of Corrosion Engineers, TPC.
NACE Standard RP0188	Standard Recommended Practice – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE Standard RP0288	Standard Recommended Practice, Inspection of Linings on Steel and Concrete

Reference	Title
NACE Standard RP0892	Standard Recommended Practice, Linings Over Concrete in Immersion Service
NACE Publication TPC2	Coatings and Linings for Immersion Service
NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
NAPF 500-03-04	Abrasive Blast Cleaning for Ductile Iron Pipe
NAPF 500-03-05	Abrasive Blast Cleaning for Cast Ductile Iron Fittings
OSHA 1910.144	Safety Color Code for Marking Physical Hazards
OSHA 1915.35	Standards – 29CFR - Painting
SSPC	Paint Application Specification No. 1.
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-PA 1	Shop, Field, and Maintenance Painting of Steel
SSPC-PA 2	Measurement of Dry Coating Thickness with Magnetic Gages
SSPC-PA 9	Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages
SSPC-PA Guide 1	Guide for Illumination of Industrial Painting Project
SSPC-PA Guide 3	A Guide to Safety in Paint Application
SSPC-PA Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC-PA Guide 11	Guide for Coating Concrete
SSPC SP1	Solvent Cleaning
SSPC SP2	Hand Tool Cleaning
SSPC SP3	Power Tool Cleaning
SSPC SP5	White Metal Blast Cleaning
SSPC SP6	Commercial Blast Cleaning
SSPC SP7	Brush-Off Blast Cleaning
SSPC SP10	Near-White Blast Cleaning
SSPC SP11	Power Tool Cleaning to Bare Metal
SSPC SP12	Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultra-High Pressure Water Jetting Prior to Recoating
SSPC SP13	Surface Preparation of Concrete
SSPC-TR2	Wet Abrasive Blast Cleaning
SSPC-TU-3	Overcoating
SSPC-TU-4	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates.
SSPC V2	Systems and Specifications: Steel Structures Painting Manual, Volume 2
SSPC-VIS 1	Visual Standard for Abrasive Blast Cleaned Steel
SSPC-VIS 3	Visual Standard for Power and Hand – Tool Cleaned Steel
SSPC-VIS 4	Visual Standards (Waterjetting)
SSPC-VIS 5	Visual Standards (Wet Abrasive Blast Cleaning)
WPCF Manual of Practice No. 17	Paints and Protective Coatings for Wastewater Treatment Facilities. Guide and Paint Application Specifications.

B. Standardization:

1. Materials and supplies provided shall be the standard products of CSMs. Materials in each coating system shall be the products of a single CSM.
2. The standard products of CSMs other than those specified may be acceptable when it is demonstrated to the Construction Manager that they are equal in composition, durability, usefulness, and convenience for the purpose intended.

Requests for consideration of CSMs other than those specified in this Section will be considered, provided the following minimum conditions are met. Such requests are not a substitution for submittals after the alternative CSMs have been considered and accepted.

a. The proposed coating system shall use an equal or greater number of separate coats to achieve the required total dry film thickness.

b. The proposed coating system shall use coatings of the same generic type as that specified including curing agent type.

c. Requests for consideration of products from CSMs other than those specified in this Section shall include information listed in paragraph 1.04, demonstrating that the proposed CSM's product is equal to the specified coating system.

d. The Contractor and the proposed alternative CSM shall provide a list of references for the proposed product where the coating of the same generic type has been applied. The reference list shall include the project name, city, state, owner, phone number of owner; coating system reference and number from this Section 09800; type of facility in which it was used, generic type, and year coating was applied.

C. Quality Control Requirements:

1. The Contractor is responsible for the workmanship and quality of the coating system installation. Inspections by the Construction Manager or the CTR will not relieve or limit the Contractor's responsibilities.

2. The Contractor's methods shall conform to requirements of this specification and the standards referenced in this Section. Changes in the coating system installation requirements will be allowed only with the written acceptance of the Construction Manager before work commences.

3. Only personnel who are trained by the CTR specifically for this contract or who are approved by the CSM specifically for this contract shall be allowed to perform the coating system installation specified in this Section.

4. Contaminated, outdated, diluted materials, and/or materials from previously opened containers shall not be used.

5. For repairs, the Contractor shall provide the same products, or products recommended by the CSM, as used for the original coating.

6. The Contractor shall identify the points of access for inspection by the Owner or the Construction Manager. The Contractor shall provide ventilation, ingress and egress, and other means necessary for the Construction Manager's personnel to access safely the work areas.

7. The Contractor shall conduct the work so that the coating system is installed as specified and shall inspect the work continually to ensure that the coating system is installed as specified. Coating system work that does not conform to the specifications or is otherwise not acceptable shall be corrected as specified.

8. The Contractor shall complete the Coating System Inspection Checklist, Form 09800-A, included in Section 01300, for coating system installations. Follow the sequential steps required for proper coating system installation as specified and as listed in the Coating System Inspection Checklist. For each portion of the work, install the coating system and complete sign-offs as specified prior to proceeding with the next step. After completing each step as indicated on the

Coating System Inspection Checklist, the Contractor shall sign the checklist indicating that the work has been installed and inspected as specified.

9. The Contractor shall provide written daily reports that present, in summary form, test data, work progress, surfaces covered, ambient conditions, quality control inspection test findings, and other information pertinent to the coating system installation.

D. Inspection at Hold Points:

1. The Contractor shall conduct inspections at Hold Points during the coating system installation and record the results from those inspections on Form 09800-A. The Contractor shall coordinate such Hold Points with the Construction Manager such that the Construction Manager may observe Contractor's inspections on a scheduled basis. The Contractor shall provide the Construction Manager a minimum of two (2) hours of notice prior to conducting Hold Point Inspections. The Hold Points shall be as follows:

   a. Environment and Site Conditions. Prior to commencing an activity associated with coating system installation, the Contractor shall measure, record, and confirm acceptability of ambient air temperature and humidity as well as other conditions such as proper protective measures for surfaces not to be coated and safety requirements for personnel. The acceptability of the weather and/or environmental conditions within the structure shall be determined by the requirements specified by the CSM of the coating system being used.

   b. Conditions Prior to Surface Preparation. Prior to commencing surface preparation, the Contractor shall observe, record, and confirm that oil, grease, and/or soluble salts have been eliminated from the surface.

   c. Monitoring of Surface Preparation. Spot checking of degree of cleanliness, surface profile, and surface pH testing, where applicable. In addition, the compressed air used for surface preparation or blow down cleaning shall be checked to confirm it is free from oil and moisture.

   d. Post Surface Preparation – Upon completion of the surface preparation, the Contractor shall measure and inspect for proper degree of cleanliness and surface profile as specified in this Section 09800 and in the CSM's written instructions.

   e. Monitoring of Coatings Application – The Contractor shall inspect, measure, and record the wet film thickness and general film quality (visual inspection) for lack of runs, sags, pinholes, holidays, etc. as the application work proceeds.

   f. Post Application Inspection – The Contractor shall identify defects in application work including pinholes, holidays, excessive runs or sags, inadequate or excessive film thickness and other problems as may be observed.

   g. Post Cure Evaluation – The Contractor shall measure and inspect the overall dry film thickness. The Contractor shall conduct a DFT survey, as well as perform adhesion testing, holiday detection, or cure testing as required based on the type of project and the specific requirements in this Section 09800 and/or in the CSM's written instructions.

h. Follow-up to Corrective Actions and Final Inspection. The Contractor shall measure and reinspect corrective coating work performed to repair defects identified at prior Hold Points. This activity also includes final visual inspection along with follow-up tests such as holiday detection, adhesion tests, and DFT surveys.

1.3 DELIVERY AND STORAGE

A. General:

1. Materials shall be delivered to the job site in their original, unopened containers. Each container shall be properly labeled. Materials shall be handled and stored to prevent damage to or loss of label.
2. Labels on material containers shall show the following information:
   a. Name or title of product.
   b. CSM's batch number.
   c. CSM's name.
   d. Generic type of material.
   e. Application and mixing instructions.
   f. Hazardous material identification label.
   g. Shelf life expiration date.
3. Materials shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold in accordance with the CSM's recommendations. Flammable materials shall be stored in accordance with state and local requirements.
4. Containers shall be clearly marked indicating personnel safety hazards associated with the use of or exposure to the materials.
5. Material Safety Data Sheets (MSDS) for each material shall be provided to the Construction Manager.
6. The Contractor shall store and dispose of hazardous waste according to federal, state and local requirements. This requirement specifically addresses waste solvents and coatings.

1.4 SUBMITTALS:

A. General:

1. Provide in accordance with Section 01300:
   a. A copy of this specification section, with addendum updates included, and referenced and applicable sections, with addendum updates included, with each paragraph check-marked (□) to indicate specification compliance or marked to indicate requested deviations from specification requirements or those parts which are to be provided by the Contractor or others. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final

authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined shall signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for requested deviations to the specification requirements shall be cause for rejection of the entire submittal and no further submittal material will be reviewed.

b. CSM's current printed recommendations and product data sheets for coating systems including:
   1) Volatile organic compound (VOC) data.
   2) Surface preparation recommendations.
   3) Primer type, where required.
   4) Maximum dry and wet-mil thickness per coat.
   5) Minimum and maximum curing time between coats, including atmospheric conditions for each.
   6) Curing time before submergence in liquid.
   7) Thinner to be used with each coating.
   8) Ventilation requirements.
   9) Minimum atmospheric conditions during which the paint shall be applied.
   10) Allowable application methods.
   11) Maximum allowable moisture content.
   12) Maximum shelf life.

c. Affidavits signed and sealed by an officer of the CSM's corporation, attesting to full compliance of each coating system component with current and promulgated federal, state, and local air pollution control regulations and requirements.

d. Material Safety Data Sheets (MSDS) for materials to be delivered to the job site, including coating system materials, solvents, and abrasive blast media.

e. List of cleaning and thinner solutions allowed by the CSMs.

f. Storage requirements including temperature, humidity, and ventilation for Coating System Materials as recommended by the CSMs.

g. CSM's detailed, written instructions for coating system treatment and graphic details for coating system terminations in the structures to be coated including pipe penetrations, metal embedments, gate frames, and other terminations to be determined from the contract drawings. This information shall also include detail treatment for coating system at joints in concrete.

1.5 RESPONSIBILITIES OF THE CTR

A. General:

1. The Contractor shall retain or obtain the services of the CTR to be on site to perform the Contractor and/or CSA application training and to routinely inspect and verify in writing that the application personnel have successfully performed

surface preparation, filler/surface application, coating system application, and Quality Control Inspection in accordance with this Section 09800 and to warrantable level of quality. This must include checking the required degree of cleanliness, surface pH for concrete substrates, surface profile of substrates, proper mixing of coating materials, application (including checking the wet and dry film thickness of the coating systems), proper cure of the coating systems, and proper treatment of coating systems at terminations, transitions, and joints and cracks in substrates. Refer to paragraph 1.05 Coating System Installation Training. for further details on these CTR requirements. This inspection is in addition to the inspection performed by the Contractor in accordance with this Section 09800.

B. Coating System Installation Training:

1. Provide a minimum of 8 hours of classroom and off site training for application and supervisory personnel (both the Contractor's and CSA's). Provide training to a minimum of two supervisory personnel from the CSA and one supervisor from the Contractor. Alternatively, the CTR shall provide a written letter from the CSM stating that the application personnel (listed by name) who shall perform coating work are approved by the CSM without further or additional training.
2. One CTR can provide training for up to fourteen application personnel and three supervisory personnel at one time. The training shall include the following as a minimum:
    a. A detailed explanation of mixing, application, curing, and termination details.
    b. Hands-on demonstration of how to mix and apply the coating systems.
    c. A detailed explanation of the ambient condition requirements (temperature and humidity) and surface preparation requirements for application of the coating system as well as a detailed explanation of re-coat times, cure times, and related ambient condition requirements.
    d. When training is performed, the CTR shall provide a written letter stating that training was satisfactorily completed by the personnel listed by name in the letter.

C. Coating System Inspection:

1. While on site to routinely inspect and verify, the CTR shall perform the following activities to confirm acceptability and conformance with the specifications:
    a. Inspect ambient conditions during various coating system installation at hold points for conformance with the specified requirements.
    b. Inspect the surface preparation of the substrates where the coating system will terminate or will be applied for conformance to the specified application criteria.
    c. Inspect preparation and application of coating detail treatment (for example, terminations at joints, metal embedments in concrete, etc.).
    d. Inspect application of the filler/surface materials for concrete and masonry substrates.
    e. Inspect application of the primers and finish coats including wet and dry film thickness of the coatings.

f. Inspect coating systems for cure.

g. Review adhesion testing of the cured coating systems for conformance to specified criteria.

h. Review coating system continuity testing for conformance to specified criteria.

i. Inspect and record representative localized repairs made to discontinuities identified via continuity testing.

j. Conduct a final review of completed coating system installation for conformance to the specifications.

k. Prepare and submit a site visit report following each site visit that documents the acceptability of the coating work in accordance with the CSM's Recommendations.

D. Final Report:

1. Upon completion of coating work for the project, the CTR shall prepare a final report. That report shall summarize daily test data, observations, drawings, and photographs in a report to be submitted in accordance with paragraph 2.02. Include substrate conditions, ambient conditions, and application procedures, observed during the CTR's site visits. Include a statement that the completed work was performed in accordance with the requirements of this Section 09800 and the CSM's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL

1. Notwithstanding the listing of product names in this Section 09800, the Contractor shall provide affidavits, signed and sealed by an officer of the CSM's corporation, attesting to full compliance of each coating system component with current and promulgated federal, state, and local air pollution control regulations and requirements. No coatings shall be applied to a surface until the specified affidavits have been submitted and have been reviewed and accepted. Failure to comply with this requirement shall be cause for rejection and removal of such materials from the site.

2. The following list specifies the material requirements for coating systems. Coating systems are categorized by generic name followed by an identifying abbreviation. If an abbreviation has a suffix number, it is for identifying subgroups within the coating system.

Material Requirements for Coating Systems: All California Except SCAQMD

Coating System	CSM	First Coat(s)	Finish Coat(s)
Epoxy Coatings			
E-1	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI*	Devran 224 HS	Devran 224 HS

Material Requirements for Coating Systems: All California Except SCAQMD			
Coating System	**CSM**	**First Coat(s)**	**Finish Coat(s)**
	Sherwin Williams	Macropoxy 646 CA	Macropoxy 646 CA
	Tnemec	Series V69	Series V69
E-1-G	(NOT USED)		
E-2	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Sherwin Williams	Macropoxy 646-100	Macropoxy 646-100
	Tnemec	Series V69	Series V69
E-3	PPG PMC	Amerlock 2/400 Series	Amerlock 2/400 Series
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Sherwin Williams	Macropoxy 646	Macropoxy 646
	Tnemec	Series V69	Series V69
E-4	(NOT USED)		
E-5	(NOT USED)		
E6	(NOT USED)		
E7	PPG PMC	Amerlock 400	Amerlock 400
	Carboline	Sanitile 120	Sanitile 120
	International Paint/ICI	Bar-Rust 236	Bar-Rust 236
	Sherwin Williams	Macropoxy 646	Macropoxy 646
	Tnemec	Series V69	Series V69
E8	(NOT USED)		
E-9	(NOT USED)		
E-9-C	PPG PMC	Amercoat 253	Amercoat 253
	Carboline	Carboguard 890	Carboguard 890
	International Paint/ICI	Bar-Rust 231	Bar-Rust 231
	Sherwin Williams	CorCote HCR-FF	CorCote HCR-FF
	Tnemec	Series 104	Series 104
E-10	(NOT USED)		
Specialty Epoxy Linings			
EA-1	Carboline	Plasite 4550S	Plasite 4550S
	Sauereisen	Sewergard 210S	Sewergard 210S
	Tnemec	Series 435	Series 435
EA-2	(NOT USED)		
EA-3	(NOT USED)		
EA-4	(NOT USED)		
EA-5	(NOT USED)		
Epoxy Polyurethane			
EU-1	Ameron	Amerlock 400	Amershield VOC
	Carboline	Carboguard 890	Carbothane 134 VOC

Material Requirements for Coating Systems: All California Except SCAQMD			
Coating System	**CSM**	**First Coat(s)**	**Finish Coat(s)**
	Sherwin Williams	Macropoxy 646 100	Hi Solids Polyurethane 100
	Tnemec	Series V69	Series 1075
Grease			
G	Texaco	N/A	Rust Inhibitive Grease
	Chevron	N/A	E.P. Roller Grease
Latex Acrylic			
L-1	PPG PMC	Amercoat 148	Amercoat 220
	Carboline	Sanitile 120	Carbocrylic 3359 DTM
	International Paint/ICI	Prep and Prime Gripper	Ultrahide 250-1406
	Sherwin Williams	Loxon Acrylic Primer	Sher Cryl
	Tnemec	Series 1028 or 1029	Series 1028 or 1029
L-2	Carboline	Sanitile 120	Carbocrylic 3359 DTM
	International Paint/ICI	Prep & Prime 9116	UHDurus 2416
	Sherwin Williams	Loxon Acrylic Primer A24WA300	Metalatex
	Tnemec	Series 1028 or 1029	Series 1028 or 1029
L-3	(NOT USED)		
L-4	(NOT USED)		
Miscellaneous			
M-1	Carboline	Carbowrap Tape Paste	Carbowrap Petrolatum Tape
	Denso	Denso Paste	Densyl Tape
	Trenton	Waxtape Primer	#1 Wax Tape
M-2	(NOT USED)		
Penetrating Stain			
S-1	(NOT USED)		
S-2	(NOT USED)		
S-3	(NOT USED)		
S-4	(NOT USED)		

**See CSM's Product Data Sheets for acceptable thinners for VOC compliance or do not thin.*

2.2 PRODUCT DATA

A. General:

1. Prior to application of coatings, submit letter(s) from the CTR(s) identifying the application personnel who have satisfactorily completed training as specified in paragraph 1.05 or a letter from the CSM stating that personnel who shall perform the work are approved by the CSM without need for further or additional training.
2. Submit reports specified in paragraph 1.02 Quality Control Requirements and 1.05 Coating System Inspection when the work is underway.
3. Submit the Coating System Inspection Checklists, using Form 09800-A, included in Section 01300, for the coating work.
4. CTR final report in accordance with paragraph 1.05 Final Report.

PART 3 - EXECUTION

3.1 COATINGS

A. General:

1. Coating products shall not be used until the Construction Manager has accepted the affidavits specified in paragraphs 1.04 and 2.01, the Construction Manager has inspected the materials, and the CTR has trained the Contractor and CSA in the surface preparation, mixing and application of each coating system.
2. Erect and maintain protective enclosures as stipulated per SSPC-Guide 6 Guide for Containing Debris Generated During Paint Removal Operations.

B. Shop and Field Coats:

1. Shop Applied Prime Coat: Except as otherwise specified, prime coats may be shop-applied or field-applied. Shop-applied primer shall be compatible with the specified coating system and shall be applied at the minimum dry film thickness recommended by the CSM. Data sheets identifying the shop primer used shall be provided to the on-site coating application personnel. Adhesion tests shall be performed on the shop primer as specified in paragraph 3.01 Adhesion Confirmation. Damaged, deteriorated and poorly applied shop coatings that do not meet the requirements of this Section 09800 shall be removed and the surfaces recoated. If the shop primer coat meets the requirements of this Section 09800, the field coating may consist of touching up the shop prime coat and then applying the finish coats to achieve the specified film thickness and continuity.
2. Field Coats: Field coats shall consist of one or more prime coats and one or more finish coats to build up the coating to the specified dry film thickness. Unless otherwise specified, finish coats shall not be applied until other work in the area is complete and until previous coats have been inspected.
3. Adhesion Confirmation: The Contractor shall perform an adhesion test after proper cure in accordance with ASTM D3359 to demonstrate that (1) the shop applied prime coat adheres to the substrate, and (2) the specified field coatings adhere to the shop coat. Test results showing an adhesion rating of 5A on immersed surfaces and 4A or better on other surfaces shall be considered acceptable for coatings 5 mils or more in thickness (Method A). Test results showing an adhesion rating of 5B on immersed surfaces and 4B or better on other surfaces shall be considered acceptable for coating thicknesses less than 5 mils.

C. Application Location Requirements:

1. Equipment, Nonimmersed: Items of equipment, or parts of equipment that are not immersed in service, shall be shop primed and then finish coated in the field after installation with the specified or acceptable color. If the shop primer requires topcoating within a specified period, the equipment shall be finish coated in the shop and then touch-up painted after installation. If equipment removal and reinstallation is required for the project, touch-up coating work shall be performed in the field following installation.
2. Equipment, Immersed: Items of equipment, or parts and surfaces of equipment that are immersed when in service, with the exception of pumps and valves, shall

have surface preparation and coating work performed in the field. Coating systems applied to immersed equipment shall be pinhole free.

3. Steel Water Tanks: The interior surfaces of steel water tanks or reservoirs shall have surface preparation and coating work performed in the field.

3.2 PREPARATION

A. General:

1. Surface preparations for each type of surface shall be in accordance with the specific requirements of each coating specification sheet (COATSPEC) and the following. In the event of a conflict, the COATSPEC sheets shall take precedence.
2. Surfaces to be coated shall be clean and dry. Before applying coating or surface treatments, oil, grease, dirt, rust, loose mill scale, old weathered coatings, and other foreign substances shall be removed. Oil and grease shall be removed before mechanical cleaning is started. Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded and free from contaminants that might interfere with the adhesion of the coatings. The air used for blast cleaning shall be sufficiently free of oil and moisture so as not to cause detrimental contamination of the surfaces to be coated.
3. Where deemed necessary by the CONSTRUCTION MANAGER, a NACE International certified coatings inspector, provided by the CONSTRUCTION MANAGER, will inspect and approve surfaces to be coated before application of a coating. Surface defects identified by the inspector shall be corrected by the Contractor at no additional cost to the Owner.
4. Cleaning and painting shall be scheduled so that dust and spray from the cleaning process shall not fall on wet, newly coated surfaces. Hardware, hardware accessories, nameplates, data tags, machined surfaces, sprinkler heads, electrical fixtures, and similar uncoated items which are in contact with coated surfaces shall be removed or masked prior to surface preparation and painting operations. Following completion of coating, removed items shall be reinstalled. Equipment adjacent to walls shall be disconnected and moved to permit cleaning and painting of equipment and walls and, following painting, shall be replaced and reconnected.

B. Blast Cleaning:

1. When abrasive blast cleaning is required to achieve the specified surface preparation the following requirements for blast cleaning materials and equipment shall be met:
    a. Used or spent blast abrasive shall not be reused on this project.
    b. The compressed air used for blast cleaning shall be filtered and shall contain no condensed water and no oil. Moisture traps shall be cleaned at least once every four hours or more frequently as required to prevent moisture from entering the supply air to the abrasive blasting equipment.
    c. Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. These shall be checked on the same frequency as the moisture traps as defined above.

d. Regulators, gauges, filters, and separators shall be in use on compressor air lines to blasting nozzles times during this work.

e. An air dryer or desiccant filter drying unit shall be installed which dries the compressed air prior to blast pot connections. This dryer shall be used and maintained for the duration of surface preparation work.

f. The abrasive blast nozzles used shall be of the venturi or other high velocity type supplied with a minimum of 100 psig air pressure and sufficient volume to obtain the blast cleaning production rates and cleanliness/specified.

g. The Contractor shall provide ventilation for airborne particulate evacuation (meeting pertinent safety standards) to optimize visibility for both blast cleaning and inspection of the substrate during surface preparation work.

h. If, between final surface preparation work and coating system application, contamination of prepared and cleaned metallic substrates occurs, or if the prepared substrates' appearance darkens or changes color, recleaning by water blasting, reblasting and abrasive blast cleaning shall be required until the specified degree of cleanliness is reclaimed.

i. The Contractor is responsible for dust control and for protection of mechanical, electrical, and other equipment adjacent to and surrounding the work area.

C. Solvent Cleaning:

1. Any solvent wash, solvent wipe, or cleaner used, including but not limited to those used for surface preparation in accordance with SSPC SP-1 Solvent Cleaning and shall be of the emulsifying type which emits no more than 340 g/l VOCs for AIM regions, 250 g/l for CARB regions and 100 g/l for SCAQMD regions, contains no phosphates, is biodegradable, removes no zinc, and is compatible with the specified primer.

2. Clean white cloths and clean fluids shall be used in solvent cleaning.

D. Metallic Surfaces:

1. Metallic surfaces shall be prepared in accordance with applicable portions of surface preparation specifications of the Society for Protective Coatings (SSPC) specified for each coating system. See Coat Spec for each coating system in this Section 09800. The profile depth of the surface to be coated shall be in accordance with the COATSPEC requirements in this Section measured by Method C of ASTM D4417. Blast particle size shall be selected by the Contractor to produce the specified surface profile. The solvent in solvent cleaning operations shall be as recommended by the CSM.

2. Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS1-89 (ASTM D2200), and as described in the Coat Spec for each coating system. If dry abrasive blast cleaning is selected and to facilitate inspection, the Contractor shall, on the first day of cleaning operations, abrasive blast metal panels to the standards specified. Plates shall measure a minimum of 8-1/2 inches by 11 inches. Panels meeting the requirements of the specifications shall be initialed by the Contractor and the Construction Manager and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of

abrasive blasting and shall be used as the comparison standard throughout the project.

3. Blast cleaning requirements for steel, ductile iron and stainless steel substrates are as follows:
    a. Steel piping shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) and primed before installation. Ductile iron piping surfaces including fittings shall be prepared in accordance with NAPF 500-03, NAPF 500-03-04, and NAPF 500-03-05.
    b. Stainless steel surfaces shall be abrasive blast cleaned to leave a clean uniform appearance with a minimum surface profile of 1.5 to 2.5 mils that is uniform.
    c. Remove traces of grit, dust, dirt, rust scale, friable material, loose corrosion products or embedded abrasive from substrate by vacuum cleaning prior to coating application.
    d. Care must be taken to prevent contamination of the surface after blasting from worker's fingerprints, deleterious substances on workers' clothing, or from atmospheric conditions.
    e. Ambient environmental conditions in the enclosure must be constantly monitored and maintained to ensure the degree of cleanliness is held and no "rust back" occurs prior to coating material application.

E. Concrete Surfaces:
1. Inspection of concrete surfaces prior to surface preparation and surface preparation of concrete surfaces shall be performed in accordance with SSPC-SP13 (also called NACE 6).
2. Prepare substrate cracks, areas requiring resurfacing and perform detail treatment including but not limited to, terminating edges, per CSM recommendations. This shall precede surface preparation for degree of cleanliness and profile.
3. The surface profile for prepared concrete surfaces to be coated shall be evaluated by comparing the profile of the prepared concrete with the profile of graded abrasive paper, as described in ANSI B74.18 or by comparing the profile with the ICRI 03732 (surface profile replicas). Surface profile requirements shall be in accordance with the Coat Spec requirements and the CSM's recommendations.
4. Surface cleanliness of prepared concrete substrates shall be inspected after cleaning, preparation, and/or drying, but prior to making repairs or applying a coat in the coating system. If concrete surfaces are repaired, they shall be reinspected for surface cleanliness prior to application of the coating system.
5. Surface preparation of concrete substrates shall be accomplished using methods such as dry abrasive blast cleaning, high, or ultra high-pressure water blast cleaning in accordance with SSPC-SP-13. The selected cleaning method shall produce the requirements set forth below.
    a. A clean substrate that is free of calcium sulfate, loose coarse or fine aggregate, laitance, loose hydrated cement paste, and otherwise deleterious substances shall be achieved. Blast cleaning and other means necessary shall be used to open up air voids or bugholes to expose their complete perimeter. Leaving shelled over, hidden air voids beneath the exposed concrete surface is not acceptable. Concrete substrate must be dry prior to the application of filler/surface or coating system materials.

b. Acceptable surface preparation must produce a concrete surface with a minimum pH of 8.0 to be confirmed by surface pH testing. If after surface preparation, the surface pH remains below 8.0, perform additional water blasting, cleaning, or abrasive blast cleaning until additional pH testing indicates an acceptable pH level.

c. Following inspection by the Contractor of the concrete surface preparation, thoroughly vacuum clean concrete surfaces to be coated to remove loose dirt, and spent abrasive (if dry blast cleaning is used) leaving a dust free, sound concrete substrate. Debris produced by blast cleaning shall be removed from the structures to be coated and disposed of legally off site by the Contractor.

6. Should abrasive blast cleaning or high or ultrahigh pressure water blasting not remove degraded concrete, chipping or other abrading tools shall be used to remove the deteriorated concrete until a sound, clean substrate is achieved which is free of calcium sulfate, loose coarse or fine aggregate, laitance, loose hydrated cement paste, and otherwise deleterious substances. Concrete substrates must be dry prior to the application of filler/surfacers or coating system materials.

7. Surface cleanliness of prepared concrete substrates shall be inspected after cleaning, preparation, and/or drying, but prior to application of coating materials. If concrete surfaces are repaired, they shall be reinspected for surface cleanliness and required surface profile prior to application of the coating system.

8. Moisture content of concrete to be coated shall be tested in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method and ASTM F 1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride. The ASTM D4263 plastic sheet test shall be conducted at least once for every 500 sq. ft. of surface area to be coated. The presence of any moisture on plastic sheet following test period constitutes a non-acceptable test. For concrete surfaces to be coated which are on the negative or back side of concrete walls or structures exposed to soils (back filled) or immersed and waterproofed in accordance with Section 07100, perform calcium chloride tests in accordance with ASTM F-1869 once for each 500 sq. ft. of surface area to be coated. Comply with CSM's written recommendations regarding acceptance/non-acceptance of moisture vapor emissions.

F. Fiberglass Reinforced Plastic (FRP) Surfaces:

1. Prepare FRP surfaces by sanding to establish uniform surface roughness and to remove gloss from the resin in the FRP. Next, vacuum clean to remove loose FRP dust, dirt, and other materials. Next, solvent clean using clean white rags and allow solvent to evaporate completely before application of coating materials.

3.3 APPLICATION

A. Workmanship:

1. Coated surfaces shall be free from runs, drips, ridges, waves, laps, and brush marks. Coats shall be applied to produce an even film of uniform thickness completely coating corners and crevices.

2. The Contractor's equipment shall be designed for application of the materials specified. Compressors shall have suitable traps and filters to remove water and oils from the air. A paper blotter test shall be performed by the Contractor when requested by the Construction Manager to determine if the air is sufficiently free of oil and moisture so as not to produce deteriorating effects on the coating system. The amount of oil and moisture in spray air shall be less than the amount recommended by the CSM. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators, and spray nozzles of the proper sizes.
3. Each coat of coating material shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs, and other adjacent areas and installations shall be protected by taping, drop cloths, or other suitable measures.
4. Coating applications method shall be conventional or airless spray, brush or roller, or trowel as recommended by CSM.
5. Allow each coat to cure or dry thoroughly, according to CSM's printed instructions, prior to recoating.
6. Vary color for each successive coat for coating systems when possible.
7. When coating complex steel shapes, prior to overall coating system application, stripe coat welds, edges of structural steel shapes, metal cut-outs, pits in steel surfaces, or rough surfaces with the primer coat. This involves applying a separate coat using brushes or rollers to ensure proper coverage. Stripe coat via spray application is not permitted.

B. Coating Properties, Mixing and Thinning:

1. Coatings, when applied, shall provide a satisfactory film and smooth even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application and adhesion of subsequent coats. Coating materials shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings consisting of two or more components shall be mixed in accordance with the CSM's instructions. Where necessary to suit the conditions of the surface, temperature, weather and method of application, the coating may be thinned as recommended by the CSM immediately prior to use. The volatile organic content (VOC) of the coating as applied shall comply with prevailing air pollution control regulations. Unless otherwise specified, coatings shall not be reduced more than necessary to obtain the proper application characteristics. Thinner shall be as recommended by the CSM.

C. Atmospheric Conditions:

1. Coatings shall be applied only to surfaces that are dry, and only under conditions of evaporation rather than condensation. Coatings systems shall not be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation. During damp weather, when the temperature of the surface to be coated is within 10 degrees F of the dew point, forced dehumidification equipment may be used to maintain a temperature of minimum 40 degrees F and 10 degrees F above the dew point for the surfaces to be coated, the coated surface, and the atmosphere in contact with the surface. These conditions shall be maintained for a period of at least 8 hours or as recommended by the CSM. Where conditions causing condensation are severe, dehumidification equipment,

fans, and/or heaters shall be used inside enclosed areas to maintain the required atmospheric and surface temperature requirements for proper coating application and cure.

D. Concrete Substrate Temperatures and Detail Treatment:

1. When the surface temperatures of the concrete substrates to be coated are rising or when these substrates are in direct sunlight, outgassing of air from the concrete may result in bubbling, pinhole formations, and/or blistering in the coating system. The application of the filler/surface and the coating system will only be allowed during periods of falling temperature. This will require that application of the filler/surface and coating system shall only occur during the cooler evening hours. Contractor shall include any cost for working outside of normal hours in the bid.
2. Should bubbles, pinholes, or discontinuities form in the applied coating system material, they shall be repaired as recommended by the CSM. Should pinholes develop in the filler/surfacer material or in the first coat of the coating material, the pinholes shall be repaired in accordance with the CSM's recommendations prior to application of the next coat of material. Whenever pinholes occur, the air void behind or beneath the pinhole shall be opened up completely and then completely filled with the specified filler/surfacer material. Next, the coated area around the pinhole repair shall be abraded and the coating reapplied over that area.
3. Perform application detail work per CSM's current written recommendations and/or drawings.

E. Protection of Coated Surfaces:

1. Items that have been coated shall not be handled, worked on, or otherwise disturbed, until the coating is completely dry and hard. After delivery at the site, and upon permanent erection or installation, shop-coated metalwork shall be recoated or retouched with specified coating when it is necessary to maintain the integrity of the film.

F. Method of Coating Application:

1. Where two or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead, or lead compounds, which may be destroyed or affected by hydrogen sulfide or other corrosive gas, and/or chromium.
2. Mechanical equipment, on which the equipment manufacturer's coating is acceptable, shall be touch-up primed and coated with two coats of the specified coating system to match the color scheduled. Electrical and instrumentation equipment specified in Divisions 26 and 40 shall be coated as specified in paragraph 3.03 Electrical and Instrumentation Equipment and Materials.
3. Coatings shall not be applied to a surface until it has been prepared as specified. The primer or first coat shall be applied by brush to ferrous surfaces that are not blast-cleaned. Coats for blast-cleaned ferrous surfaces and subsequent coats for nonblast-cleaned ferrous surfaces may be either brush or spray applied. After the prime coat is dry, pinholes and holidays shall be marked, repaired in accordance with CSM's recommendations and retested before succeeding coats are applied.

Unless otherwise specified, coats for concrete and masonry shall be brushed, rolled, or troweled.

G. Film Thickness and Continuity:

1. WFT of the first coat of the coating system and subsequent coats shall be verified by the Contractor, following application of each coat.
2. The surface area covered per gallon of coating for various types of surfaces shall not exceed those recommended by the CSM. The first coat, referred to as the prime coat, on metal surfaces refers to the first full paint coat and not to solvent wash, grease emulsifiers or other pretreatment applications. Coatings shall be applied to the thickness specified, and in accordance with these specifications. Unless otherwise specified, the average total thickness (dry) of a completed protective coating system on exposed metal surfaces shall be not less than 1.25 mils per coat. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Unless otherwise specified, no less than two coats shall be applied.
3. In testing for continuity of coating about welds, projections (such as bolts and nuts), and crevices, the Construction Manager shall determine the minimum conductivity for smooth areas of like coating where the dry-mil thickness has been accepted. This conductivity shall be the minimum required for these rough or irregular areas. Pinholes and holidays shall be recoated to the required coverage.
4. The ability to obtain specified film thickness is generally compromised when brush or roller application methods are used and, therefore, more coats may need to be applied to achieve the specified dry film thickness.
5. For concrete substrates, the Contractor shall apply a complete skim coat of the specified filler/surfacer material over the entire substrate prior to application of the coating system. This material shall be applied such that all open air voids and bugholes in the concrete substrate are completely filled prior to coating application.

H. Special Requirements:

1. Before erection, the Contractor shall apply all but the final finish coat to interior surfaces of roof plates, roof rafters and supports, pipe hangers, piping in contact with hangers, and contact surfaces that are inaccessible after assembly. The final coat shall be applied after erection. Structural friction connections and high tensile bolts and nuts shall be coated after erection. Areas damaged during erection shall be hand-cleaned or power-tool cleaned and recoated with primer coat prior to the application of subsequent coats. Touch-up of surfaces shall be performed after installation. Surfaces to be coated shall be clean and dry at the time of application. Except for those to be filled with grout, the underside of equipment bases and supports that have not been galvanized shall be coated with at least two coats of primer specified for system E-2 prior to setting the equipment in place. Provide coating system terminations at leading edges and transitions to other substrates in accordance with the CSM's recommendations or detail drawings.

I. Electrical and Instrumentation Equipment and Materials:

1. Electrical and instrumentation equipment and materials shall be coated by the equipment manufacturer as specifie: Finish: Electrical equipment shall be treated with zinc phosphate, bonderized or otherwise given a rust-preventive treatment. Equipment shall be primed, coated with enamel, and baked. Minimum dry film thickness shall be 3 mils.

a. Unless otherwise specified, instrumentation panels shall be coated with system E-1 for indoor mounting and system EU-1 for outdoor mounting.

b. Before final acceptance, the Contractor shall touch up scratches on equipment with identical color coating. Finish shall be smooth, free of runs, and match existing finish. Prior to touching up scratches, Contractor shall fill them with an appropriate filler material approved by the CSM.

c. Color: Exterior color of electrical equipment shall be FS 26463 (ANSI/NSF 61) light gray. Interior shall be painted FS 27880 white. Nonmetallic electrical enclosures and equipment shall be the equipment manufacturer's standard grey color.

1) Exterior color of instrumentation panels and cabinets mounted indoors shall be FS 26463 light gray; unless otherwise specified, exterior color for cabinets mounted outdoors shall be FS 27722, white. Cabinet interiors shall be FS 27880, white.

J. Soluble Salt Contamination of Metallic Substrates:

1. Contractor shall test in accordance with SSPC-TU-4 metallic substrates to be coated that have been exposed to seawater or coastal air or to industrial fallout of particulate or other sources of soluble chlorides (such as wastewater exposure). If testing indicates detrimental levels of soluble salts, those in excess of 25 ppm, the Contractor shall clean and prepare these surfaces to remove the soluble salts.

3.4 CLEANUP

A. General:

1. Upon completion of coating, the Contractor shall remove surplus materials, protective coverings, and accumulated rubbish, and thoroughly clean surfaces and repair overspray or other coating-related damage.

3.5 COATING SYSTEM SPECIFICATION SHEETS (COATSPEC)

A. General:

1. Coating systems for different types of surfaces and general service conditions for which these systems are normally applied are specified on the following COATSPEC sheets. Surfaces shall be coated in accordance with the COATSPEC to the system thickness specified. Coating systems shall be as specified in paragraph 3.06. In case of conflict between the schedule and the COATSPECS, the requirements of the schedule shall prevail.

2. Coating Specification Sheets included in Table A are included this paragraph 3.05.

Table A Coating Specification Sheets

Coating System ID	Coating Material	Surface	Service Condition
E-1	Epoxy	Metal	Interior; exterior, covered, not exposed to direct sunlight, non-corrosive exposure.
E-2	Epoxy	Metal	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required.
E-3	Epoxy	Concrete or Masonry	Immersed, nonpotable; non-immersed, corrosive environment, color required.
E-7	Epoxy	Plastic	Interior; exterior covered, not exposed to direct sunlight.
E-9	(NOT USED)		
E-9-C	Epoxy	Concrete or masonry	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
E-10	(NOT USED)		
EA-1	Blended Amine Cured Epoxy	Metal	Immersed, nonpotable; non-immersed, corrosive environment, color not required especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
EA-2	(NOT USED)		
EA-3	(NOT USED)		
G	Grease	Metal	Ferrous Metal: Ferrous metal surfaces shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning.)
L-1	Latex	Concrete, masonry, plaster, gypsum board	Interior and Exterior including existing exterior coated concrete.
L-2	Latex	PVC and CPVC pipe	Exterior, direct sunlight exposure.
M-1	Petrolatum based mastic or wax based wrapping tapes	Metal	Below grade (buried) or where little to no surface preparation can be performed on piping or structural steel.
EU-1	Zinc-epoxy-polyurethane system	Ferrous Metal	Exterior, exposed to direct sunlight, moderately corrosive non-immersed.

Coating System Specification Sheets (COATSPEC)

A.	Coating System Identification: E-1	
1.	Coating Material:	Epoxy
2.	Surface:	Metal
3.	Service Condition:	Interior; exterior, covered, not exposed to direct sunlight, non-corrosive exposure.
4.	Surface Preparation:	
a.	General:	Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive and vacuum cleaning blasting prior to receiving finish coats.
b.	Ferrous Metal:	Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) to achieve a uniform, surface profile of 2.0 to 2.5 mils.
		Ferrous metal with rust bleeding shall be cleaned in accordance with SSPC SP-1 (Solvent Cleaning). Areas of rust penetration shall be spot blasted to SSPC SP-10 (Near White Blast) (to achieve the 2.0- to 2.5-mil surface profile) and spot primed with the specified primer. For ductile iron surfaces, refer to the requirements in paragraph 3.02 Metallic Surfaces.
c.	Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve uniform, minimum surface profile 1.0 to 1.5 mils.
5.	Application:	Field
a.	General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b.	Ferrous Metal:	Prime coats shall be an epoxy primer compatible with the specified finish coats and applied in accordance with the written instructions of the CSM.
c.	Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be cleaned prior to the application of the prime coat in accordance with SSPC SP-1 (Solvent Cleaning).
6.	System Thickness:	10 mils dry film.
7.	Coatings:	
a.	Primer:	One coat at CSM's recommended dry film thickness.
b.	Finish:	One or more coats at CSM's recommended dry film thickness per coat to achieve the specified system thickness.
B.	Coating System Identification: E-2	
1.	Coating Material:	Epoxy
2.	Surface:	Metal
3.	Service Condition:	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required.
4.	Surface Preparation:	
a.	Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils.
		Damaged shop coating shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) and vacuum cleaning and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive blasting or abrading prior to receiving finish coats if the maximum recoat time for the primer has been exceeded. This cleaning must produce a uniform 1.0- to 1.5-mil profile in the intact shop primer. For ductile iron surfaces, refer to the requirements in paragraph 3.02 Metallic Surfaces.
b.	Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve a uniform surface profile of 1.0 to 1.5 mils. Galvanized steel with this E-2 coating system shall not be used in immersion service in wastewater.
5.	Application:	Field

a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coat shall be an epoxy primer compatible with the specified finish coats.
c. Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal, non-immersed, shall be coated prior to the application of the prime coat with a grease emulsifying agent in accordance with the CSM's written instructions. Nonferrous metal to be immersed shall not be painted. Galvanized metal shall not be immersed even if it is painted.
6. System Thickness:	16 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
C. Coating System Identification: E-3	
1. Coating Material:	Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color required.
4. Surface Preparation:	
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days and allowed to dry to the moisture content recommended by the CSM before coating work proceeds. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Surface preparation can be performed by abrasive blast cleaning or water blast cleaning and must achieve a uniform concrete surface profile of CSP3 in accordance with ICRI 03732. After cleaning, air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats.
b. Masonry:	Masonry surfaces shall be allowed to cure for at least 28 days after being constructed and be allowed to dry to the moisture content recommended by the CSM. Holes or other joint defects shall be filled with a material compatible with the primers and finish coats or shall be filled with masonry mortar that shall cure for at least 28 days. Loose or splattered mortar shall be removed by scraping and chipping.
	Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign, loose, and deleterious substances.
	Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.
5. Application:	Field
a. General:	Apply filler/surfacer as recommended by CSM to fill bugholes and air voids or block texture, etc. leaving a uniformly filled surface that does not produce blowholes or outgassing causing pinholing of the coating system. Filler/surfacers shall dry a minimum of 48 hours prior to application of prime coat or as required by the CSM.
	Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
	Drying time between coats shall be as recommended by CSM.
6. System Thickness:	15 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM’s recommended dry film thickness.
b. Finish:	Two or more coats at CSM’s recommended dry film thickness per coat to the specified system thickness.
D. Coating System Identification: E-7	
1. Coating Material:	Epoxy

Coating System Specification Sheets (COATSPEC)	
2. Surface:	Plastic
3. Service Condition:	Interior; exterior covered, not exposed to direct sunlight.
4. Surface Preparation:	Plastic shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning) and light sanding to produce a uniform surface roughness(uniform surface profile of 1.0 to 1.5 mils) on the plastic.
5. Application:	Field
6. System Thickness:	5 mils dry film.
7. Coatings:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
E. Coating System Identification: E-9	
(NOT USED)	
F. Coating System Identification: E-9-C	
1. Coating Material:	Epoxy
2. Surface:	Concrete or masonry
3. Service Condition:	Immersed, nonpotable; non-immersed, moderately corrosive environment, color required. (Not for Biogenic Sulfide Corrosion areas.)
4. Surface Preparation:	
a. Concrete:	Concrete surfaces shall be allowed to cure for at least 28 days following initial concrete placement and allowed to dry to the moisture content recommended by the CSM before coating work proceeds. Moisture content may be tested by the Construction Manager with a Delmhorst Instrument Company moisture detector, or equal. Except as otherwise specified, loose concrete, form oils, surface hardeners, curing compounds, and laitance shall be removed from surfaces by abrasive blasting and chipping, and voids and cracks shall be repaired as specified in Section 03 30 00. Cleaning can be performed using abrasive blast cleaning or water blast cleaning methods to produce a minimum concrete surface profile of CSP-3 in accordance with ICRI 03732. After cleaning, all air voids or bugholes in the concrete shall be filled with a surfacer or block filler compatible with the specified primer and finish coats.
b. Masonry:	Masonry surfaces shall be allowed to cure for at least 28 days after being constructed and be allowed to dry to the moisture content recommended by the CSM. Holes or other joint defects shall be filled with a material compatible with the primers and finish coats or shall be filled with masonry mortar that shall cure for at least 28 days. Loose or splattered mortar shall be removed by scraping and chipping.
	Masonry surfaces shall be cleaned with clear water by washing and scrubbing to remove foreign and deleterious substances.
	Muriatic acid shall not be used. After cleaning, masonry surfaces shall be sealed or filled with a sealer or block filler compatible with the specified primer.
5. Application:	Field
a. General:	Apply filler/surfacer as recommended by CSM to fill bugholes and air voids or block texture, etc. leaving a uniformly filled surface that does not produce blowholes or outgassing causing pinholing of the coating system.
	Filler/Surfacers shall dry a minimum of 48 hours prior to application of prime coat or as required by the CSM.
	Prime coat shall be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
	Drying time between coats shall be as recommended by CSM.
6. System Thickness:	16 to 20 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	Two or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.

Coating System Specification Sheets (COATSPEC)		
G. Coating System Identification: E-10		
(NOT USED)		
Coating System Identification: EA-1		
1.	Coating Material:	Blended Amine Cured Epoxy
2.	Surface:	Metal
3.	Service Condition:	Immersed, nonpotable; non-immersed, corrosive environment, color not required especially for headspace environments that are corrosive due to biogenic sulfide corrosion.
4.	Surface Preparation:	
a.	Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning) to achieve a uniform surface profile of 3.0 to 3.5 mils. Blast Cleaning shall produce a minimum surface profile of 3.0 mils.
		Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-11 (Power Tool Cleaning to Bare Metal). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) and spot primed with the primer specified. Shop epoxy primed surfaces shall require light abrasive blasting and blow down cleaning prior to receiving finish coats. Cast or ductile iron surfaces to be coated shall be abrasive blast cleaned to a clean, gray uniform metal appearance free of variations in color and loose materials. Ductile iron surfaces shall be prepared in accordance with paragraph 3.02 Metallic Surfaces.
b.	Nonferrous and Galvanized Metal:	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to achieve a uniform surface profile of 2.0 to 2.5 mils. Galvanized metal should generally not be used in these environments.
5.	Application:	Field
a.	General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
		Drying time between coats shall be as specified by the CSM for the site conditions. If the maximum recoat time is exceeded, surface preparation shall require solvent washing, light abrasive blasting, or other procedures per CSM's instructions.
b.	Ferrous Metal:	If shop priming is required or field priming is necessary, the prime coat shall be an epoxy primer compatible with the specified coating system. Generally, the EA-1 coating system is self-priming and does not require a primer unless there is a special reason to prime the steel to hold the blast cleaning from rusting back.
6.	System Thickness:	30 to 40 mils dry film.
7.	Coatings:	
a.	Primer:	One coat at CSM's recommended dry film thickness only if required by special circumstances.
b.	Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
c.	Testing:	Holiday detection shall be performed over 100% of the coated surface area to identify any holidays or pinholes that must be repaired.
d.	Pinhole and Holiday Repair Procedure:	Pinholes and holidays identified by Holiday Detection shall be repaired as follows:
		• Using a pencil grinder, remove a ½-inch diameter area of the coating system material back to the ferrous metal substrate. The metal must be shiny
		• Aggressively sand or abrade the intact coating system surface 2 inches around the complete periphery of the ½-inch diameter removal area to produce a uniform 6 to 8 mils profile
		• Vacuum clean the prepared area to remove all dust and dirt to achieve a clean, sound surface. Tape the peripheral area to prevent coating application onto unprepared surfaces
		• Brush apply one coat of the finish coating material. Following proper recoat cure time, apply additional coats of the finish coating system to achieve 60 mils DFT at

	the coating removal area and feather the coating onto the roughened coated surfaces to form a neat repair outline
H. Coating System Identification: EU-1	
1. Coating Material:	Zinc-Epoxy-Polyurethane System
2. Surface:	Ferrous Metal
3. Service Condition:	Exterior, exposed to direct sunlight, moderately corrosive, non-immersed.
4. Surface Preparation:	
a. General:	Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-3 (Power Tool Cleaning) and recoated with the primer specified.
b. Ferrous Metal:	Bare ferrous metal surfaces shall be prepared in accordance with SSPC SP-6 (Commercial Blast Cleaning) 2.5 – 3.0. Ductile iron surfaces to be coated shall be abrasive blast cleaned in accordance with paragraph 3.02 Metallic Surfaces.
	Ferrous metal with rust bleeding shall be cleaned in accordance with SSPC-SP-11 (Power Tool Cleaning to Bare Metal). Areas of rust penetration shall be spot blasted to SSPC SP-10 (Near White Blast) and spot primed with the specified primer.
c. Galvanized Metal:	Damaged galvanized steel areas with exposed ferrous metal and/or rusted shall be cleaned in accordance with SSPC SP-5 (White Metal Blast Cleaning) or Power Tool Cleaned to Bare Metal in accordance with SSPC-SP-11 to achieve a uniform 1.0- to 1.5-mil profile and spot primed with the primer specified.
	Nonferrous and galvanized metal shall be prepared in accordance with SSPC SP-7 (Brush-off Blast Cleaning) to impart a 1.0- to 2.0-mil profile to the galvanized steel surfaces. Where this cannot be performed, prepare by abrading in accordance with SSPC-SP-3, Power Tool Cleaning to impart a 1.0- to 1.5-mil profile uniformly to the galvanized steel surfaces.
	For EU-1 over galvanized steel, delete the zinc rich primer.
5. Application:	Field
a. General:	Prime coat may be thinned and applied as recommended by the CSM, provided the coating as applied complies with prevailing air pollution control regulations.
b. Ferrous Metal:	Prime coats shall be a zinc rich epoxy or polyurethane primer compatible for use with urethane finish coats and applied in accordance with written instructions of the CSM or in the case of CARB or SCAQMD applications, prime with specified primer that is not zinc rich. In these cases, only a two-coat system is applied.
6. System Thickness:	3 to 4 mils of zinc rich primer, one intermediate or primer epoxy coat at 5 to 6 mils and one finish coat of polyurethane at 2 to 3 mils DFT.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Intermediate:	One coat at CSM's recommended dry film thickness.
c. Finish:	One coat at CSM's recommended dry film thickness per coat to meet the specified system thickness.
I. Coating System Identification: G	
1. Coating Material:	Grease
2. Surface:	Metal
3. Surface Preparation:	
a. Ferrous Metal:	Ferrous metal surfaces shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning).
4. Application:	Field
	Coating shall be applied with stiff brush, hand swab, or airless spray gun.
5. System Thickness:	50 square feet per gallon

Coating System Specification Sheets (COATSPEC)	
6. Coating:	One coat of grease coating.
J. Coating System Identification: L-2	
1. Coating Material:	Latex
2. Surface:	PVC and CPVC pipe.
3. Service Condition:	Exterior, direct sunlight exposure.
4. Surface Preparation:	Plastic pipe shall be cleaned with solvent compatible with the specified primer and sanded to roughen surfaces to achieve a uniform surface profile of 1.0 to 1.5 mils. Vacuum clean after sanding to remove all loose dust, plastic particles, and dirt.
5. Application:	Field
6. System Thickness:	3 mils dry film.
7. Coatings:	
a. Primer:	One coat at CSM's recommended dry film thickness.
b. Finish:	One or more coats at CSM's recommended dry film thickness per coat to the specified system thickness.
K. Coating System Identification: M-1	
1. Coating Material:	Petrolatum based mastic or wax based wrapping tapes.
2. Surfaces:	Metal
3. Service Condition:	Below grade (buried) or where little to no surface preparation can be performed on piping or structural steel.
4. Surface Preparation:	Remove loose scale, rust, dirt, excessive moisture, or frost from the surface in accordance with SSPC SP-2 (Hand Tool Cleaning).
5. Application:	All surfaces shall be hand rubbed or brushed with a priming paste recommended by the CSM. Sharp projections such as threads, irregular contours, or badly pitted areas shall receive a liberal amount of priming paste to ensure maximum protection of metal throughout.
	On irregular shaped surfaces, i.e., nuts, bolts, flanges, valves, etc., the Contractor shall use either of the following systems recommended by the CSM.
	A. Apply recommended mastic by hand in sufficient quantity to build an even contour over entire surface. The Contractor shall pay particular attention to ensure that folds and air pockets within the mastic layer are thoroughly pressed out prior to subsequent application of tape.
	OR:
	B. An extra layer of tape shall be cut and carefully molded around sharp projections, nuts, bolts, etc., before final application of tape, in order to meet specified system thickness.
	Tape shall be spirally wrapped with a 55 percent overlap and sufficient tension and pressure to provide continuous adhesion without stretching the tape. Edges of tape must be continuously smoothed and sealed by hand during wrapping. On vertical application, contractor shall begin at bottom and proceed upward creating a weatherboard overlap.
6. System Thickness:	Smooth contours shall have a minimum thickness of 50 mils while nuts, bolts, and sharp projections shall be 100 mils.
7. Tape:	Number and types of tape wraps shall be in accordance with the CSM's written instructions.

3.6 COATING SYSTEMS SCHEDULE (FINISH SCHEDULE)

A. General:

1. Specific coating systems, colors, and finishes for rooms, galleries, piping, equipment, and other items that are coated or have other architectural finishes are specified in the following coating system schedule. Unless otherwise specified in

the coating system schedule, the word "interior" shall mean the inside of a building or structure, and the word "exterior" shall mean outside exposure to weather elements.

Coating Systems Schedule (Finish Schedule)		
Location/Surface	Coating System Identification	Standard Color
A. General: All Surfaces not Specified by Area or Structure		
1. Structural Steel, Metal Decking, and Galvanized Acoustical Decking	Uncoated or E-2	
2. Equipment and Metal Appurtenances		
a. Equipment, non immersed, unless otherwise specified		
1) Indoors	E-1	FS 20040 Brown
2) Outdoors	EU-1	FS 20040 Brown
b. Equipment, immersed, unless otherwise specified	E-2	TBD
c. Existing equipment		
1) Not damaged nor modified by work in this contract	Uncoated	--
2) Damaged, exposed, or modified by work in this contract		
a) Indoors	E-1 (see paragraph 3.02)	Match existing color
b) Outdoors	EU-1 without primer (see paragraph 3.02)	Match existing color
d. Electrical switchgear panels, unit substations, motor control centers, power transformers, distribution centers, and relay panels; indoors and outdoors	See paragraph 3.03 Electrical and Instrumentation Equipment and Materials	ANSI 61 Grey (outside) FS 27880 White (inside)
e. Instrumentation panels, graphic indicating panels, indicating and transmitting field panels, unless otherwise specified		
1) Indoors	See paragraph 3.03 Electrical and Instrumentation Equipment and Materials	FS 26306 Grey (outside) FS 27880 White (inside)
2) Outdoors	See paragraph 3.03 Electrical and Instrumentation Equipment and Materials	FS 27722 White (outside) FS 27880 White (inside)
f. Existing electrical and instrumentation panels		
1) Not damaged by work in this contract	Uncoated	--
2) Damaged or exposed to outside surfaces by work in this contract		
a) Indoors	E-1 (see paragraph 3.02 Masonry Surfaces)	FS 26306 Grey
b) Outdoors	EU-1 without primer (see paragraph 3.02 Masonry Surfaces)	FS 26306 Grey (Electrical) FS 27722 White (Instrumentation)
3. Conduit, Piping and Ductwork		
a. Ferrous, non-ferrous and galvanized piping, and appurtenant hangers and supports, non-immersed, unless otherwise specified.		

Coating Systems Schedule (Finish Schedule)		
Location/Surface	Coating System Identification	Standard Color
1) Indoors – noncorrosive	E-1	FS 20040 Brown
2) Outdoors – noncorrosive	EU-1	FS 20040 Brown
3) Indoors – in corrosive environment	EA-1	To be determined
4) Buried piping	M-1	Not required
b. Ferrous piping, appurtenant and supports, immersed	E-2	To be determined
c. Conduit, outlet and junction boxes, lighting transformers, lighting, communication and small power panels, control stations, piping, lagged ductwork, appurtenant hangers, clamps, and supports on coated surfaces, unless otherwise specified.		
1) Indoors	E-1	Match background color
2) Outdoors	EU-1	Match background color
d. Conduit, outlets and junction boxes, lighting transformers, lighting, communication and small power panels, control stations, piping, lagged ductwork, appurtenant hangers, clamps and supports on uncoated surfaces, unless otherwise specified		
1) Indoors	E-1	FS 25051 Blue
2) Outdoors	EU-1	FS 20040 Brown
e. Existing conduit, outlet and junction boxes, lighting transformers, lighting communication and small power panels, control stations, piping, lagged ductwork, appurtenant hangers, clamps, and supports		
1) Not damaged nor modified by work in this contract	Uncoated	--
2) Damaged, exposed, or modified by work in this contract		
a) Indoors	E-1 (see paragraph 3.02 Masonry Surfaces)	Match existing color
b) Outdoors	EU-1 without primer (see paragraph 3.02 Masonry Surfaces)	Match existing color
f. Racked conduits and cable trays	Uncoated	--
g. Insulated pipe jacketing	Uncoated	--
h. Plastic, fiberglass and flexible conduit and piping		
1) Unless otherwise specified	Uncoated	--
2) PVC and CPVC Piping	L-2	FS 25051 Blue
a) Exposed to direct sunlight	L-2	FS 25051 Blue
b) Not exposed to direct sunlight	E-7	FS 25051 Blue
i. Exposed ductwork, unless otherwise specified	Uncoated	--
4. Concrete		
a. Concrete base for Sump pump elbow anchorage	E-3	Match equipment color
b. Existing coated surfaces.	L-1	Match existing color
5. Handrails, Gratings, Floor Plates, Manhole Covers, and Hatches		
a. Unless otherwise specified	Uncoated	
b. Existing		

Coating Systems Schedule (Finish Schedule)		
Location/Surface	Coating System Identification	Standard Color
1) Not damaged by work in this contract	Uncoated	--
2) Damaged, exposed, or modified by work in this contract		
a) Indoors	E-1 (see paragraph 3.02 Masonry Surfaces)	Match existing color
b) Outdoors	EU-1 without primer (see paragraph 3.02 Masonry Surfaces)	Match existing color
6. Metal Stairs, Ladders, Platforms, and Supports Except Tread and Grating		
a. Indoors	E-1	FS 25051 Blue
b. Outdoors	EU-1	FS 20040 Brown
c. Existing		
1) Not damaged nor modified by work in this contract	Uncoated	--
2) Damaged, exposed, or modified by work in this contract		
a) Indoors	E-1 (see paragraph 3.02 Masonry Surfaces)	Match existing color
b) Outdoors	EU-1 without primer (see paragraph 3.02 Masonry Surfaces)	Match existing color
7. Aluminum Flashing, Light Standards, Supports, and Louvers		
a. Indoors and outdoors, unless otherwise specified	Uncoated	--
8. Precast Concrete Metalwork		
a. Fasteners, anchors, supports, etc.	EU-1	Match wall
9. Other		
a. Slide gates		
1) Gate	--	--
2) Stem, except potable	G	--
3) Operator		
a) Outdoors	EU-1	FS 20040 Brown
b. Pipe, ductwork, equipment and appurtenances made from fiberglass, plastic, rubber, including flexible hose, conduit, and plastic coated tubing, in areas not exposed to view (indoors) (metal hangers and supports are coated with E-1)	Uncoated	--
c. Buried, sleeve-type and flanged pipe, couplings, valves, mechanical and electrical penetrations	M-1	Manufacturer's color
B. Wet Well		
1. Walls and ceiling above max. water level elevation [_____]	E-9-C	--
2. Walls and ceiling below max. water level elevation [_____]	E-2	--

Note: Owner will select color from coating manufacturer's list of EPA approved colors for potable water.

3.7 INSPECTION AND TESTING BY OWNER

A. General:

1. Inspection by the Owner or others does not limit the Contractor's or CSA's responsibilities for quality workmanship or quality control as specified or as required by

the CSM's instructions. Inspection by the Owner is in addition to any inspection required to be performed by the Contractor.

2. The Owner may perform, or contract with an inspection agency to perform, quality control inspection and testing of the coating work covered by this Section 09800. These inspections may include the following:
   a. Inspect materials upon receipt to ensure that are supplied by the CSM.
   b. Inspect to verify that specified storage conditions for the coating system materials, solvents and abrasives are provided.
   c. Inspect and record findings for the degree of cleanliness of substrates.
   d. Inspect and record the pH of concrete and metal substrates.
   e. Inspect and record substrate profile (anchor pattern)
   f. Measure and record ambient air and substrate temperature.
   g. Measure and record relative humidity.
   h. Check for the presence of substrate moisture in the concrete.
   i. Inspect to verify that correct mixing of coating system materials is performed in accordance with CSM's instructions.
   j. Inspect, confirm, and record that the "pot life" of coating system materials is not exceeded during installation. Inspect to verify that recoat limitations for coating materials are not exceeded.
   k. Perform adhesion testing.
   l. Measure and record the thickness of the coating system.
   m. Inspect to verify proper curing of the coating system in accordance with the CSM's instructions.
   n. Perform holiday or continuity testing for coatings that will be immersed or coatings that will be exposed to aggressively corrosive conditions.

3.8 FINAL INSPECTION

A. General
   1. Contractor shall conduct a final inspection to determine whether coating system work meets the requirements of the specifications.
   2. The Construction Manager will subsequently conduct a final inspection with the Contractor to determine the work is in conformance with requirements of the contract documents.
   3. Any rework required shall be marked. Such areas shall be recleaned and repaired as specified at no additional cost to the Owner.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 10441

WARNING SIGNS

PART 1- GENERAL

1.1 DESCRIPTION

A. This section specifies informational and accident prevention signs.

1.2 OPERATING AND DESIGN REQUIREMENTS

A. General:

1. Accident prevention signs shall conform as to design with OSHA Section 1910.145 of Subpart J, Part 1910, Chapter XVII, Title 29 of the Code of Federal Regulations. Exit signs shall conform with Section 1910.37(g) of the OSHA Safety and Health Standard for General Industry, Article 10, Section 10.113 of the Uniform Fire Code, and where applicable with local fire regulations.

2. In addition to the signs identified on the schedule in Part 3 of this section, the following shall be provided:

3. "Caution Automatic Equipment May Start At Any Time" signs shall be provided in accordance with paragraph 11000-2.07.

B. DESIGN REQUIREMENTS:

1. SIZE: Sign size shall be as follows:

a. A - 14 inch x 20 inch
b. B - 10 inch x 14 inch
c. C - 7 inch x 10 inch

2. TYPE: The sign type shall be as follows:

Type	Message
I	CAUTION—AUTOMATIC EQUIPMENT MAY START AT ANY TIME
II	DANGER--480 VOLTS
IX	DANGER--CONFINED SPACE HAZARDOUS ATMOSPHERE Enter By Permit Only
XXV	ELECTRICAL ENCLOSURE
XVI	LOCK OUT SWITCH BEFORE WORKING ON EQUIPMENT

PART 2--PRODUCTS

2.1 GENERAL

A. Sign lettering shall be single stroke and shall contrast in color with the background. For those messages for which there are international symbols, the international symbols shall be used. Chain mounted signs shall have lettering on both sides.

2.2 MATERIALS

A. Signs shall be 0.100-inch thick fiberglass with embedded fadeproof legends.

PART 3- EXECUTION

3.1 SIGN DISTRIBUTION

A. Signs shall be distributed as follows:

Location	Size	Message	Mount
Wetwell	B	I, IX	Post
All 480 volt electrical equipment: SES, Switchgear, Transfer Switch, Standby Generator, MCC, Switchboard, Motor Starter, VFD, Panelboard, Local Control Panel, Mini Power Center, 480V panel, 480V Receptacle, etc.	C	II	Equipment or Wall
Electrical Enclosure	C	XXV	Door
Local Control Panel	C	XVI	Door

** END OF SECTION **

SECTION 11000

GENERAL REQUIREMENTS FOR EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This section specifies general requirements which are applicable to all mechanical equipment. The Contractor is responsible for ensuring that all mechanical equipment meets the requirements of this section in addition to the specific requirements of each individual equipment specification section.

B. Equipment Lists:

1. Equipment lists, presented in these specifications and as specified on the drawings, are included for the convenience of the Construction Manager and Contractor and are not complete listings of all equipment, devices and material required to be provided under this contract. The Contractor shall prepare his own material and equipment takeoff lists as necessary to meet the requirements of this project manual.

1.2 QUALITY ASSURANCE

A. Arrangement:

1. The arrangement of equipment shown on the drawings is based upon information available to the Owner at the time of design and is not intended to show exact dimensions conforming to a specific manufacturer. The drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revision to meet actual submitted equipment installation requirements; these may vary significantly from manufacturer to manufacturer. The Contractor shall, in determining the cost of installation, include these differences as part of his bid proposal. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be altered to accommodate the equipment actually provided. No additional payment shall be made for such revisions and alterations.

B. References:

1. This section contains references to the documents listed below. They are a part of this section as specified and modified. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified

by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, has been discontinued or has been replaced.

Reference	Title
ABMA Std 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA Std 11	Load Ratings and Fatigue Life for Roller Bearings
ANSI B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Gray Iron Pipe Flanges and Flanged Fittings, (Classes 25, 125, and 250)
ANSI B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ANSI S2.19	Mechanical Vibration – Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Unbalance, Including Marine Applications

C. Unit Responsibility:

1. The Contractor shall cause equipment assemblies made up of two or more components to be provided as a working unit by the unit responsibility manufacturer, where specified. The unit responsibility manufacturer shall coordinate selection, coordinate design, and shall provide all mechanical equipment assembly components such that all equipment components furnished under the specification for the equipment assembly, and all equipment components specified elsewhere but referenced in the equipment assembly specification, is compatible and operates reliably and properly to achieve the specified performance requirements. Unless otherwise specified, the unit responsibility manufacturer shall be the manufacturer of the driven component equipment in the equipment assembly. The unit responsibility manufacturer is designated in the individual equipment specifications found elsewhere in this project manual. Agents, representatives or other entities that are not a direct division of the driven equipment manufacturing corporation shall not be accepted as a substitute for the driven equipment manufacturer in meeting this requirement. The requirement for unit responsibility shall in no way relieve the Contractor of his responsibility to the Owner for performance of all systems as provided in the Contract Documents.
2. The Contractor shall ensure that all equipment assemblies provided for the project are products for which unit responsibility has been accepted by the unit responsibility manufacturer(s), where specified. Unit responsibility for related components in a mechanical equipment assembly does not require or obligate the unit responsibility manufacturer to warranty the workmanship or quality of component products not manufactured by them. Where an individual specification requires the Contractor to furnish a certificate from a unit responsibility manufacturer, such certificate shall conform to the content, form and style of Form 11000-C specified in Section 01999, shall be signed by an officer of the unit responsibility manufacturer's corporation and shall be notarized. No other submittal material will be processed until a Certificate of

Unit Responsibility has been received and has been found to be satisfactory. Failure to provide acceptable proof that the unit responsibility requirement has been satisfied will result in withholding approval of progress payments for the subject equipment even though the equipment may have been installed in the work.

D. Balance:

1. Unless specified otherwise, for all machines 10 HP and greater, all rotating elements in motors, pumps, blowers and centrifugal compressors shall be fully assembled, including coupling hubs, before being statically and dynamically balanced. All rotating elements shall be balanced to the following criteria:

a. $$U_{per} = 6.015\frac{GW}{N}$$

b. Where:

1) U_{per} = permissible imbalance, ounce-inches, maximum

2) G = Balance quality grade, millimeters per second

3) W = Weight of the balanced assembly, pounds mass

4) N = *Maximum* operational speed, rpm

2. Where specified, balancing reports, demonstrating compliance with this requirement, shall be submitted as product data. Equipment balance quality grade shall be *G* 2.5 (G = 2.5 mm/sec) or better in accordance with ANSI S2.19.

PART 2 - PRODUCTS

2.1 FLANGES AND PIPE THREADS

E. Flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI B16.1, Class 125. Pipe threads shall conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.

F. Threaded flanges shall have a standard taper pipe thread conforming to ANSI B1.20.1. Unless otherwise specified, flanges shall be flat faced.

G. Flange assembly bolts shall be heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Threads shall be Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

2.2 BEARINGS

A. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified. Each bearing shall be rated in accordance with the latest revisions of ABMA Methods of Evaluating Load Ratings of Ball and Roller Bearings. Unless otherwise specified, equipment bearings shall have a minimum L-10 rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.

B. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic alemite type.

C. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C and shall be equipped with a filler pipe and an external level indicator gage.

D. All bearings accessible to touch, and located within 7 feet measured vertically from floor or working level or within 15 inches measured horizontally from stairways, ramps, fixed ladders or other access structures, shall either incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature or shall be provided with appropriate shielding shall be provided that will prevent inadvertent human contact.

2.3 V-BELT ASSEMBLIES (NOT USED)

2.4 PUMP SHAFT SEALS (NOT USED – SEE 11176)

2.5 COUPLINGS

A. Unless otherwise specified in the particular equipment sections, equipment with a driver greater than 1/2 HP, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two shafts connected by a flexible coupling which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsional vibrations. The flexible member shall consist of a tire with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap screws, and the flanges shall be attached to the stub shaft by means of taper lock bushings which shall give the equivalent of a shrunk-on fit. There shall be no metal-to-metal contact between the driver and the driven unit. Each coupling shall be sized and provided as recommended by the coupling manufacturer for the specific application, considering horsepower, speed of rotation, and type of service.

B. Where torque or horsepower capacities of couplings of the foregoing type is exceeded, Thomas-Rex, Falk Steel Flex, or equal, couplings will be acceptable provided they are sized in accordance with the equipment manufacturer's recommendations and sizing data are submitted. They shall be installed in conformance to the coupling manufacturer's instructions.

2.6 GUARDS

A. Exposed moving parts shall be provided with guards which meet all applicable OSHA requirements. Guards shall be fabricated of 14-gage steel, 1/2-13-15 expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and shall be designed to be readily removable to

facilitate maintenance of moving parts. Reinforced holes shall be provided. Lube fittings shall be extended through guards.

2.7 CAUTION SIGNS

A. Equipment with guarded moving parts which operates automatically or by remote control shall be identified by signs reading "Caution - Automatic Equipment May Start At Any Time". Signs shall be constructed of fiberglass material, minimum 1/8 inch thick, rigid, suitable for post mounting. Letters shall be white on a red background. The sign size and pattern shall be as shown on the drawings. Signs shall be installed near guarded moving parts.

2.8 GAGE TAPS, TEST PLUGS AND GAGES

A. Gage taps shall be provided on the suction and discharge sides of pumps, blowers and compressors. Pressure and vacuum gages shall be provided where specified. Gage taps, test plugs, and gages shall be as specified in Division 15.

2.9 NAMEPLATES

A. Nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved or stamped stainless steel and fastened to the equipment in an accessible and visible location with stainless steel screws or drive pins.

2.10 LUBRICANTS

A. The Contractor shall provide for each item of mechanical equipment a supply of the required lubricant adequate to last through the specified commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the Owner's current lubricant supplier. The Contractor shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment (Section 01680), the Contractor shall provide the Owner with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

2.11 ANCHOR BOLTS

A. Anchor bolts shall be designed for lateral forces for both pullout and shear in accordance with the provisions of Section 05520. Unless otherwise stated in the individual equipment specifications, anchor bolt materials shall conform to the provisions of Section 05520.

2.12 SPARE PARTS

A. Spare parts, wherever required by detailed specification sections, shall be stored in accordance with the provisions of this paragraph. Spare parts shall be tagged by project equipment number and identified by part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration, such as

ferrous metal items and electrical components, shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with a hinged wooden cover and locking hasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the underside of the cover.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of equipment accessories included in this section shall be as recommended by the equipment manufacturer unless otherwise specified in the individual equipment specification section.

** END OF SECTION **

SECTION 11002

RIGID EQUIPMENT MOUNTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope

1. This section specifies minimum requirements for rigid equipment mounts. Completed equipment mounts shall consist of equipment pads, equipment anchors, and mounting plates (baseplates, soleplates, or fabricated steel frames) set in grout.
2. Equipment mounts shall conform to the requirements specified in this specification. The default mounting configuration for equipment shall consist of pad anchored equipment pads, mounting plates leveled within 0.005 inch/foot, anchored to the equipment pad with cast-in-place equipment anchors and the mounting plate is grouted in position using non-shrink grout.
3. If a conflict exists between this section and requirements of individual equipment manufacturers, the more restrictive requirements shall prevail.
4. Rigid equipment mounts conforming to the requirements of this Section shall be furnished for the equipment pad.

B. Definitions

1. Specific equipment mounting terminology used in this section conforms to the following definitions:
   a. Equipment Pad: Concrete foundation (block or slab) supporting and elevating mounting plates above the supporting structural floor slab or local grade.
   b. Mounting Pads: Milled/machined areas of baseplates, soleplates, and fabricated steel frames where the feet or mounting surfaces of mounted equipment and drivers are bolted to the baseplate, soleplate, or fabricated steel frame.
   c. Leveling Blocks: Steel blocks temporarily placed under baseplates, soleplates, or fabricated steel frames at leveling positions (at equipment anchors) for the purpose of leveling baseplates, soleplates, or fabricated steel frames prior to grouting.
   d. Shims: Thin stainless steel plates of uniform thickness used for fine adjustment of level. Shims are used on top of leveling blocks for mounting plate leveling or used between equipment drivers and baseplates, soleplates, or fabricated steel frames for equipment alignment.
   e. Wedges: Pairs of uniformly tapered metal blocks that are stacked with the tapered surfaces reversed (relative to the other wedge) so that the top and bottom surfaces of the wedges are parallel. Wedges are used between equipment pads and baseplates, soleplates, or fabricated steel frames for the purpose of leveling mounting plates.

f. Mounting Stud: Threaded rod or bolts anchored to baseplates, soleplates, or fabricated steel frames for the purpose of mounting equipment or ancillary devices onto baseplates, soleplates, or fabricated steel frames.

g. Reinforcement Dowels or Reinforcement Hooks: Steel reinforcement rods embedded in concrete, across a cold joint, for the purpose of transferring loads or force across the joint.

h. Leveling Position: A location on the top of a concrete equipment pad where leveling tools and equipment will be temporarily installed or used for the purpose of leveling baseplates, soleplates, and fabricated steel frames prior to grouting.

i. Grout Manufacturer: Refers to the manufacturer of the grout product used for installation of rigid equipment mounts.

j. Grout Manufacturer's Technical Representative(s): Refers to the technical representative(s) of the Grout Manufacturer. The Grout Manufacturer's Technical Representative shall not be an employee of the Contractor.

1.2 QUALITY ASSURANCE

A. References

1. This section contains references to the following documents. Referenced documents are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. References to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ACI 318, Appendix D	Building Code and Commentary, Anchorage to Concrete
ANSI/HI 1.4	Centrifugal Pumps – Installation, Operation and Maintenance
ANSI/HI 2.4	Vertical Pumps – Installation, Operation and Maintenance
API RECOMMENDED PRACTICE 686	Recommended Practices for Machinery Installation and Installation Design
ASTM E329	Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F1554	Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength
MIL-PRF-907E	Anti-Seize Thread Compound, High Temperature
SSPC	Society for Protective Coatings Specifications, Vol. 2
IBC	International Building Code (including local amendments)

B. Special Inspection for Equipment Anchors

1. Equipment anchors shall comply with special inspection requirements specified in Section 05520.

1.3 SUBMITTALS

A. The following information shall be provided in accordance with the submittal requirements specified in Section 01300.

1. A copy of this specification section, including addendum updates, (referenced sections need not be included for this Section) with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations shall be sufficient cause for rejection of the entire submittal with no further consideration. Copies of this specification section shall be numbered and marked (specification number and equipment number) for inclusion (filing) with submittal materials furnished for individual equipment specifications.

2. Name, employer, a copy of the employee's Qualified Millwright card or other equivalent certificate of journeyman qualifications for millwrights who will install rigid equipment mounts, as specified in paragraph 3.03 Leveling.

3. Shop drawings for equipment pads, equipment anchors, and baseplate, soleplate or fabricated steel frame details. Shop drawings shall depict size and location of equipment pads and reinforcement; equipment drains; equipment anchor, size, location, and projection; expansion joint locations; elevation of top of grout and grout thickness; elevation of top of baseplate, soleplate, or mounting block; size and location of electrical conduits; and any other equipment mounting features embedded in equipment pads. Shop drawings for equipment pads, equipment anchors, and baseplate, soleplate, or fabricated steel frames shall be numbered and marked (specification number and equipment number) for inclusion (filing) with the associated equipment submittal requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment and drivers shall be rigidly mounted on a common mounting plate and grouted into place on a concrete equipment pad unless alternate requirements are specified in the Contract Drawings. Unless otherwise specified in the individual equipment specification, mounting plates shall be anchored to equipment pads with a layer of grout between the equipment pad and the mounting plate.

2.2 EQUIPMENT PADS

A. Materials

1. Equipment pads shall be reinforced concrete as shown in the structural details.
2. Minimum dimensions for equipment pads are shown on structural drawings where the equipment pad is required to provide a minimum mass for vibration dampening

2.3 EQUIPMENT ANCHORS

A. Equipment Anchor Materials

1. Equipment anchors shall be all thread rod with heavy hex welded nuts, heavy hex bolts, Post-installed anchors (wedge, sleeve, undercut, expansion, and adhesive anchors), or adjustable canister anchors as required.
2. Post-installed anchors (wedge, sleeve, undercut, expansion, and adhesive anchors) shall conform to the requirements of Section 05520.
3. Adjustable canister anchors shall be cast-in-place pre-manufactured adjustable anchor inserts. Adjustable canister anchors shall provide a minimum of 6 inches of vertical bolt height adjustment and lateral adjustment of the anchor bolt while maintaining the anchor bolt in a true vertical orientation. Adjustable canister anchors shall be Jakebolts as manufactured by Unisorb, Heavy Duty Adjustable Anchors as manufactured by Deco, Rowan Adjustable Canister Anchor Bolt, or approved equal.
4. Equipment anchor materials shall conform to the following table for the area exposure condition where the equipment is installed.

Area Exposure	Equipment Anchor Materials
Indoor, Dry	Carbon Steel, ASTM F1554, Grade 36, weldable per S1 for threaded rod
Indoor, Wet	Galvanized Carbon Steel, ASTM F1554, Grade 36, weldable per S1 for threaded rod
Outdoor	304 Stainless, ASTM F593, Cond. CW
Submerged, Immersed	316 Stainless, ASTM F593, Cond. CW
Process Corrosive	316 Stainless, ASTM F593, Cond. CW
Chemical Corrosive	316 Stainless, ASTM F593, Cond. CW

B. Equipment Anchor Design

1. The size (diameter) of anchors for clamping/fastening mounting plates to equipment pads shall be as specified by the equipment manufacturer.
2. Equipment anchor size, embedment, and edge distance shall comply with the IBC and shall be sufficient to resist the maximum lateral and vertical forces specified in Section 01743.
3. The Contractor shall furnish equipment anchor calculation submittals for the submersible pumps. Equipment anchor calculations shall be furnished as product data and submitted with equipment submittals. Equipment anchor calculations shall be sealed by a registered structural or civil engineer licensed in the State of California.

C. Equipment Anchor Tension

1. Unless alternate bolt torque/tension requirements are specified by the equipment manufacturer, equipment anchors shall be tightened to provide a final clamping force that produces a tensile stress of 15,000 psi in each equipment anchor. Adjustable canister anchors shall be tightened to the manufacturer's maximum safe working load. Equipment anchors consisting of Post-installed anchors shall be tightened to manufacturer's recommendations.

2. Bolt torque values required to produce the specified bolt tension based on well lubricated plain finish national coarse thread bolts are presented in the following table. Revise bolt torque values per equipment manufacturer's recommendations for alternate thread patterns, thread lubrication, bolt material, or bolt finish.

Bolt Diam. (in)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-1/2
Final bolt torque for 15,000 psi bolt stress (ft*lbs)	8	15	30	50	80	125	180	250	400

3. Prior to leveling and grouting mounting plates, grouted equipment anchors shall be pull tested to the values specified in the following table.

Anchor Diam. (in)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-1/2
Pull test load (kips)	2.1	3.8	6.1	9.1	13	17	22	28	43

2.4 MOUNTING PLATES

A. General

1. All baseplates, soleplates, and fabricated steel frames shall have edges of surfaces bearing on grout rounded to a radius of not less than 0.25 inch.

2. Perimeter corners of baseplates, soleplates, or fabricated steel frames shall be rounded to a radius of not less than 2.0 inches to avoid producing stress risers on the grouted foundation.

3. Grout pouring holes (minimum 4 inches in diameter for epoxy grout, minimum 2.5 inches in diameter for cementitious non-shrink grout) shall be provided in all baseplates and soleplates and all baseplates and soleplates shall have air release holes.

4. Grout relief or vent holes (minimum 1 inch in diameter) shall be provided in all baseplates and soleplates.

5. Mounting holes for equipment anchors shall be drilled through baseplates, soleplates, and fabricated steel frames.

6. Mounting holes for equipment anchors shall be drilled. Mounting holes shall not be burned out and they shall not be open slots.

7. Terminations requiring connections to baseplates and soleplates shall be acorn nuts welded to the underside of the baseplate or soleplate or nuts welded to the underside of the baseplate or soleplate and plugged with cork, plastic plugs or grease.

8. Where fasteners terminate only into the baseplate, soleplate, or fabricated steel frame, threaded lengths (tapped or embedded in mounting plates) shall be not less than the bolt diameter.
9. Where baseplates, soleplates, or fabricated steel frames are leveled using jackscrews, jackscrew threads shall be tapped in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.
10. Mounting pads and/or mounting surfaces for baseplates, soleplates, and fabricated steel frames shall be milled flat after all welding and stress relieving and shall be coplanar within 0.0005 inch per foot in all directions. Baseplates shall be pre-grouted prior to milling.
11. Baseplates, soleplates, and fabricated steel frames shall provide common support for the equipment and driver (and flywheel, if one is specified).
12. Baseplates, soleplates, and fabricated steel frames for equipment with drivers 20 horsepower and greater shall be furnished with transverse alignment (horizontal) positioning jackscrews for alignment of equipment drivers on horizontal surfaces of baseplates.
13. Alignment/positioning jackscrews shall be in perpendicular directions in a horizontal plane at the mounting position for each corner or foot of the equipment driver. (Additional jackscrews shall be provided for transverse alignment of the flywheel, if flywheels are specified in the equipment specification.)
14. Where specified in individual equipment specifications; baseplates, soleplates, and fabricated steel frames shall be fitted with RK Fixators as manufactured by Unisorb, or approved equal.
    a. Fixators shall be installed at mounting surfaces for drivers.
    b. Fixators shall be a three-piece wedge leveling adjustment device incorporating a spherical washer assembly to provide true level height adjustment at each mounting surface for the equipment driver.

B. Fabricated Steel Frames
1. Fabricated steel frames shall be plate or fabricated structural steel mounting plates with thickened steel mounting pads for bolting equipment to the mounting plate.
2. Fabricated steel frames shall be rectangular in shape, excepting fabricated steel frames for centrifugal refrigeration machines and pumps which may be T- or L-shaped fabricated steel frames to accommodate the equipment driver and accessories.
3. Perimeter members shall be I-beams or C-channel with a minimum depth equal to 1/10 of the longest dimension of the fabricated steel frame. Beam depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer.
4. Fabricated steel frames shall be furnished with mounting pads welded to the fabricated steel frame.
5. Surfaces of fabricated steel frames in contact with grout shall be sandblasted to white metal per SSPC SP-5.
6.

C. Baseplates

1. Baseplates shall be welded steel, cast steel, or cast iron with thickened mounting pads for bolting equipment to the baseplate.
2. Internal stiffeners shall be provided on all cast and fabricated baseplates and shall be designed to allow free flow of grout from one section of the baseplate to another.
3. The minimum acceptable opening in cross bracing and stiffeners shall be 2 inches high by 6 inches wide.
4. All welds shall be continuous and free from skips, blowholes, laps and pockets.
5. Baseplates shall be pre-grouted at the factory after all welding has been completed and prior to machining the mounting pads on the baseplate. Baseplates that have not been pre-grouted at the factory shall be pre-grouted in the field by removing the equipment from the baseplate, inverting the baseplate, and pre-grouting as specified in this Section.
6. The underside of baseplates shall be sandblasted to white metal per SSPC SP-5 prior to pre-grouting.
7. Pre-grouting shall be completed within 8 hours of sandblasting.
8. Pre-grouting shall fill the underside of the baseplate to the bottom edges of the baseplate.
9. Cast iron baseplates shall be sealed to prevent surface bleeding prior to shipment to the project site.

D. Plate Steel Soleplates

1. Plate steel soleplates shall be not less than 1.0 inch thick for equipment with drivers greater than 30 horsepower.
2. Plate steel soleplates shall be furnished with grout keys/lugs or stiffeners on the underside of the soleplate.
3. Excepting grout keys, grout pour holes, vent holes, and attachment hardware (nuts, bolts, tapped holes, etc.) the underside of plate steel soleplates shall be a flat uniform horizontal surface.
4. The underside of plate steel soleplates shall be scribed with the words “THIS SIDE DOWN” using welding rod material prior to milling the mounting pads for equipment or mounting surfaces.
5. Plate steel soleplates without grout pouring holes are acceptable provided that no dimension of the soleplate (width or length) exceeds 18 inches.
6. Surfaces of plate steel soleplates in contact with grout shall be sandblasted to white metal per SSPC-SP-5 prior to shipment to the project site.
7. Where equipment is fabricated or cast with feet or mounting surfaces that are not fastened to a common baseplate or soleplate, as in dry-pit bottom-suction pumps, the equipment may be supported on individual concrete piers or equipment pads in lieu of mounting on a common equipment pad and soleplate. In such instances, the equipment shall be supported at the feet or mounting surfaces on individual plate steel soleplates, which shall be leveled and grouted into place on the individual piers or equipment pads as specified in this section. Where multiple soleplates are installed for an equipment installation, soleplates shall be installed coplanar within 0.002 inch/foot.

2.5 GROUT FOR EQUIPMENT PADS

A. Cementitious Nonshrink Grout:

1. Where non-shrink grout is specified, Cementitious Non-shrink Grout, specified in Section 03600, may be used for setting bearing surfaces of baseplates, soleplates, or fabricated steel frames. Where the term non-shrink grout or cementitious grout is used in the context of details and specifications for equipment mounting it shall mean Cementitious Non-shrink Grout as specified in Section 03600. Training and quality control by the grout manufacturer's technical representative is not required for rigid equipment mounts installed with cementitious non-shrink grout.

2.6 ANTI-SEIZE/ANTI-GALLING COMPOUND

A. Anti-seize or anti-galling compound shall be a molybdenum disulfide and graphite combination in aluminum complex base grease conforming to MIL-PRF-907E. Acceptable products include Jet Lube 550 by Jet Lube, Inc., E-Z Break by LA-CO, or approved equal.

2.7 PRODUCT DATA

A. The following information shall be provided in accordance with the product data requirements specified in Section 01300:

1. Equipment anchor calculations demonstrating compliance with paragraph 2.03 Equipment Anchor Design.
2. Results of grout strength tests, as specified in paragraph 3.03 Grouting.
3. Completed Rigid Equipment Mount Installation Inspection Checklist Forms (11002-A).

PART 3 - EXECUTION

3.1 GENERAL

A. General Requirements

1. Roughen the underside of soleplates and fabricated steel frames and wipe with a residue-free solvent as recommended by the epoxy primer manufacturer before placement of the baseplate, soleplate, and fabricated steel frames on the equipment pad for leveling. Roughen surfaces of mounting plates that will be in contact with grout by power tool cleaning. Cleaning shall be performed by power wire brushing, power sanding, power grinding, power tool chipping or power tool descaling. Cleaning shall impart a minimum profile of 1.0 mil.
2. Prior to placement on the equipment pad for leveling, exposed grout surfaces of pre-grouted baseplates shall be roughened and wiped with a residue-free solvent as recommended by the manufacturer of the epoxy grout used for pre-grouting.
3. Grouting for installation of equipment on equipment pads shall take place prior to connecting any field piping or electrical and instrumentation systems.

4. Unless the Construction Manager accepts an alternate installation procedure in writing, baseplates, soleplates, and fabricated steel frames shall be leveled and grouted with the equipment removed.
5. Pumps shall be installed in accordance with this section and ANSI/HI 1.4 or ANSI/HI 2.4, as appropriate for the type of pumping equipment installed.
6. Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended function of these joints is maintained in the piping system without imposing strain on the equipment connections.

B. Alternate Piping Connections

1. Where an equipment manufacturer's installation requirements include a rigid connection between the machine and connecting piping systems, the Contractor shall delete any flexible coupling (including equipment connection fittings) shown on the drawings and install the equipment in the following manner, in lieu of installing the flexible coupling:
   a. The equipment pad shall be installed as shown on the detail specified in the Equipment Mounting Schedule.
   b. The baseplate, soleplate, or fabricated steel frames supporting the equipment shall be installed, leveled, and grouted in place as specified in this section.
   c. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding one of the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure-tested.
   d. All piping shall be fully supported by supports designed to accept their full weight and thrust forces.
   e. The final sections of piping shall be aligned with the equipment and field connections without the use of jacks, chain falls, or other devices to force it into alignment.
   f. The final piping joints shall be welded only after the previous steps have been completed and accepted by the Construction Manager.

3.2 INSTALLATION

A. Concrete Equipment Pad Preparation

1. Roughen the top of the equipment pad after the concrete has reached its 28-day compressive strength.
2. Remove all laitance and defective or weak concrete.
3. Roughened surface profile shall be 0.25 inch amplitude, minimum.
4. Expose broken aggregate without dislodging unbroken aggregate from the cement matrix and without fracturing concrete and aggregate below the concrete surface.
5. Roughen using a light-duty (15 pounds or less), hand-held chipper with a chisel type tool.
6. Abrasive blast, bush-hammer, jack hammers with sharp chisels, heavy chipping tools, or needle gun preparation of concrete surfaces to be grouted are not acceptable.

7. Demonstrate removal of defective or weak concrete to the Construction Manager prior to leveling.
8. The chipped surface of the concrete shall be such that the final elevation of the equipment pad provides the grout manufacturer's recommended thickness between the surface of the equipment pad and the lower baseplate flange, underside of the soleplate, or underside of the fabricated steel frame.
9. All dust, dirt, chips, oil, water, and any other contaminants shall be removed and the surface protected with plastic sheeting until grout is installed.
10. Concrete equipment pad surfaces that have been finished smooth and level for use as leveling positions shall be protected from damage during chipping activities. Alternatively, leveling positions may be restored on chipped surfaces. Leveling positions shall be restored by installing leveling blocks or leveling plates for jackscrews on a high compressive strength epoxy putty (Philadelphia Resins, Phillybond Blue 6A, or equal). Leveling blocks and leveling plates shall be installed level on the epoxy putty.

B. Leveling

1. Except where union rules require installation by another trade, all equipment and machinery shall be mounted and leveled by a Qualified Millwright.
2. Use precision surveying equipment for leveling.
3. Machinists' spirit levels will not be permitted for leveling purposes for any baseplate, soleplate, or fabricated steel frame with a plan dimension greater than 4 feet.
4. Baseplates, soleplates, and fabricated steel frames shall be leveled to the tolerance specified in the Equipment Mounting Schedule or as otherwise required by the equipment manufacturer, if more stringent.
5. An anti-seize or anti-galling compound specified in paragraph 2.07 shall be applied to all equipment anchor threads prior to beginning baseplate, soleplate, or fabricated steel frame leveling.
6. All baseplates, soleplates, and fabricated steel frames shall be leveled against steel surfaces (jackscrew plates, leveling blocks, leveling nuts, support plates, or other steel surfaces). Use of other materials for leveling purposes is strictly and specifically prohibited.
7. Leveling equipment and tools shall be stainless steel leveling blocks and shims, steel wedges, or jackscrews bearing on leveling plates.
8. Leveling nuts may be used for leveling baseplates, soleplates, and fabricated steel frames weighing less than 200 pounds (including the weight of the equipment if leveled with the equipment on the mounting plate).
9. Leveling blocks shall be stainless steel, 4 inches square and 1.5 inches thick with an open-ended slot terminating in the center for the equipment anchor.
10. Leveling blocks shall be machined flat on all horizontal surfaces and placed under the baseplate or soleplate at each equipment anchor.
11. Shims shall be pre-cut stainless steel, slotted for removal after grouting. Leveling blocks and shims shall be coated with a light oil just prior to beginning the leveling and grouting work. Shims shall be placed so the tabs on the shims are easily accessible.

12. Clamp baseplates, soleplates, or fabricated steel frames in position (after leveling) by installing the equipment anchor nuts and washers.
13. Bolt tension to fix the position of mounting plates during grouting shall be 30 to 60 percent of the final clamping force applied to clamp the mounting plate to the equipment pad.
14. Prior to grouting, verify that the correct level and position of the baseplate, soleplate, or fabricated steel frame has been maintained after clamping it to the equipment pad.

C. Grouting

1. Design forms for a minimum of 6 inches hydrostatic head above the final elevation of the grout.
2. Install grout expansion joints at 4 to 6 foot intervals, perpendicular to the centerline of baseplates. Design expansion joints in accordance with the grout manufacturer's written instructions.
3. Coat forms with three coats of paste wax on all areas of the forms that will be in contact with the grout.
4. Wax forms before assembly.
5. Prevent accidental application of wax to surfaces where the grout is to bond.
6. Remove any foreign material, such as oil, sand, water, wax, grease, etc., from concrete surfaces that will contact grout before forms are installed.
7. Forms shall be liquid tight. Seal any open spaces or cracks in forms, or at the joint between forms and the foundation using sealant, putty, or caulking compound.
8. Vertical and horizontal edges of the grout shall have 45-degree chamfers as specified in equipment pad details. The 45-degree perimeter chamfer strip shall be located at the final elevation of the grout.
9. Match chamfers in concrete portions of the equipment pad.
10. Install block outs at all leveling positions to allow removal of leveling equipment and leveling nuts to be backed off after the grout has cured.
11. Coat jackscrews with a light oil or other acceptable bond-breaking compound prior to grouting.
12. Final elevation of grout on fabricated steel frames shall be at the top of the lower flange of the perimeter I-beams or C-channel.
13. Top of grout elevation for baseplates and soleplates shall be at least 0.125 inch but not more than 0.5 inch above the bottom or underside of the perimeter edge of the baseplate or soleplate.
14. Seal equipment anchor sleeves to protect the sleeved length of the anchor from contact with grout.
15. Wrap exposed portions of equipment anchors with duct tape to protect them from grout splatter and to prevent bonding to grout.
16. Adjust ambient temperature to maintain mounting plate, foundation, and grout temperatures to grout manufacturer's recommended temperature.
17. Mix grout for equipment mounting in accordance with the grout manufacturer's written recommendations.

18. Place grout at one end of the baseplate or soleplate and work grout toward the opposite end to force the air out from beneath the baseplate or soleplate.
19. Pour grout through a head box into grout pouring holes.
20. When the head box is moved to the next grout hole, a 6 inch standpipe shall be placed over the grout hole and filled with grout.
21. Use of vibrating tools and/or jarring (rapping or tapping) forms to facilitate grout flow is not permitted during placement of epoxy grout.
22. Never allow the grout in the head box to fall below the top of the baseplate or soleplate once the grout has made contact with the baseplate or soleplate.
23. Grout placement shall be continuous until all portions of the space beneath the baseplate, soleplate, or fabricated steel frame have been filled.
24. Prepare subsequent batches of grout prior to depleting the preceding batch.
25. Maintain grout height in standpipes after the space under the baseplate, soleplate, or fabricated steel frame has been filled.
26. When the grout has started to take an initial set (typically this is determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.
27. Check for leaks throughout grout pours. Leaks shall be repaired immediately to prevent formation of voids.
28. Check baseplate, soleplate, or fabricated steel frame level and elevation before the grout sets.
29. Cure grout in accordance with the grout manufacturer's written instructions.

D. Completion

1. Upon acceptance by the Construction Manager and the equipment manufacturer's representative and after the grout has reached sufficient strength, grout forms and block outs at leveling positions shall be removed. Leveling blocks and shims or wedges and support plates shall be removed, and leveling nuts and jack screws shall be backed off to allow the grout to fully support the baseplate, mounting block, or soleplate. Take care not to damage the grout during removal of extended shimming material or leveling equipment and tools.
2. The equipment anchor nuts shall be tightened, using calibrated indicating torque wrenches, to develop the full bolt tension specified in paragraph 2.03 Equipment Anchor Tension.
3. Equipment anchor nuts shall be tightened in increments of not more than 25 percent of the final torque value in an alternating pattern to avoid stress concentration on the grout surface. After tightening equipment anchor nuts to final values, apply additional wax, grease, or mastic to all exposed portions of the equipment anchor beneath the baseplate, soleplate, or mounting block.
4. After applying additional wax or mastic to exposed portions of equipment anchors, block outs (pockets) for access to leveling nuts, leveling blocks and shims, or wedges shall be filled with the grout material installed under baseplates, soleplates, or fabricated steel frames and pointed after the equipment anchor nuts have been tightened to final values. Jackscrews shall be removed and holes in the baseplate, soleplate, or fabricated steel frames filled with a flexible sealant (silicone rubber) or a short cap screw.

5. Check for baseplate, soleplate, or fabricated steel frame movement (soft foot) by individually loosening and re-tightening each equipment anchor. Vertical movement at each equipment anchor shall be measured and recorded during loosening and retightening and shall not exceed 20 micrometers (0.001 inch). Vertical movement shall be measured using a magnetic-based dial indicator on the baseplate, soleplate, or fabricated steel frame referenced to the epoxy grout surface of the equipment pad or other approved method. Soft foot conditions shall be sufficient cause for removal and reinstallation of grout and baseplates, soleplates, or fabricated steel frames.
6. Check for grout voids by tapping along the upper surfaces of the baseplate, soleplate, or mounting block. Grout voids shall be sufficient cause for removal and reinstallation of grout and baseplates, soleplates, or fabricated steel frames. Grout voids shall be marked. At the discretion of the Construction Manager, grout voids may be repaired as specified in Chapter 5, Section 3.16 of API RP 686.

3.3 FINAL INSPECTION

A. The Construction Manager will conduct a final inspection with the Contractor for conformance to requirements of this section.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 11020

VIBRATION AND CRITICAL SPEED LIMITATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies vibration and critical speed limitations for rotating mechanical equipment. Factory and/or field testing and vibration measurements shall be taken when specified in the individual equipment specification sections.

1.2 VIBRATION LIMITATIONS

A. General:

1. Vibration frequencies shall span the range from 5.0 to 5000 Hz. Where specified, measurements shall be obtained while the installed equipment is operating within the specified speed range.

B. Centrifugal:

1. Machines With Sleeve Bearings:

a. Unless otherwise specified, centrifugal machines with sleeve bearing shafts shall not exhibit unfiltered RMS readings for vibration displacement in excess of the following:

Shaft speed range, rpm	Displacement, peak to peak, mils
Up to 900	3.5
901-1800	3.0
1801-3000	2.5
3001-4500	2.0
Above 4500	1.6

b. Displacement measurements shall be taken radially on the shaft at two points at each bearing, except for well pumps which shall be measured at top of motor. Measuring points shall be 90 degrees apart.

2. Machines with Antifriction Bearings:

a. Unless otherwise specified, centrifugal machines with antifriction bearing shafts shall not exhibit unfiltered RMS readings for vibration velocity in excess of 0.12 inch per second. Velocity measurements shall be taken on one point of each bearing housing.

C. Positive Displacement Machines: (NOT USED)

1.3 CRITICAL SPEED REQUIREMENTS

A. Unless otherwise specified, rotating mechanical equipment shall not exhibit critical speeds within the specified range of operating speeds. Critical speeds for equipment with rigid rotor systems shall be at least 20 percent greater than maximum operating speed.

Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below minimum operating speed and 20 percent above maximum operating speed.

PART 2 - PRODUCTS

2.1 PRODUCT DATA

A. Manufacturer's certified data showing location of critical speeds in relation to operating speeds shall be provided as product data in accordance with Section 01300.

PART 3 – EXECUTION (NOT USED)

** END OF SECTION **

SECTION 11175

PUMPS, GENERAL

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing general requirements for pumps and pumping appurtenances and providing special tools and spare parts.

B. The WORK also includes coordination of design, assembly, testing and installation.

C. The WORK of this Section applies to the WORK of the following Sections:

1. Section 11176 Submersible Wastewater Pumps – Constant Speed

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 11000 Equipment, General Provision

1.3 SPECIFICATIONS AND STANDARDS

A. Specifications and standards shall comply with Section 11000 and shall include the following:

Reference	Title
ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
AISC	American Institute of Steel Construction—Manual of Practice
ANSI/API 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries (also referenced as ISO 13709-2009)
ANSI/ASME B46.1	Surface Texture, Surface Roughness, Waviness and Lay
ANSI/HI 1.1–1.6	Rotodynamic (Centrifugal) Pumps
ANSI/HI 2.1–2.4	Rotodynamic (Vertical) Pumps
ANSI/HI 9.1–9.5	Pumps – General Guidelines for Types, Applications, Definitions, Sound Measurements and Documentation
ANSI/HI 9.6.1	Rotodynamic Pumps—Guideline for NPSH Margin
ANSI/HI 9.6.2	Centrifugal and Vertical Pumps for Allowable Nozzle Loads
ANSI/HI 9.6.3	Rotodynamic Pumps (Centrifugal and Vertical) Guideline for Allowable Operating Region
ANSI/HI 9.6.4	Rotodynamic Pumps—Vibration Measurements and Allowable Values
ANSI/HI 9.6.6	Rotodynamic Pumps for Pump Piping
ANSI/HI 9.6.8	Rotodynamic Pumps—Guideline for Dynamics of Pumping Machinery
ANSI/HI 9.8	Pump Intake Design
ANSI/HI 11.6	Submersible Pump Tests
ANSI/HI 14.6	Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

Reference	Title
API 686/PIP REIE 686	Recommended Practices for Machinery Installation and Installation Design
ASME B18.8.2	Taper Pins, Dowel Pins, Straight Pins, Grooved Pins, and Spring Pins (Inch Series)
ASME Code	ASME Boiler and Pressure Vessel Code
ASTM A27	Steel Castings, Carbon, for General Application
ASTM A36	Carbon Structural Steel
ASTM A148	Steel Castings, High Strength, for Structural Purposes
ASTM A322	Steel Bars, Alloy, Standard Grades
ASTM A564	Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A571	Austenitic Ductile Iron Castings for Pressure-Containing Parts Suitable for Low-Temperature Service
ASTM A995	Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts, Grades 2A, 3A, or 6A
ASTM B148	Aluminum-Bronze Sand Castings
AWWA C213	Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
AWWA C550	Protective Epoxy Coatings for Valves and Hydrants
NSF/ANSI 61	Drinking Water System Components – Health Effects
IEC 61298-2	Process Measurement and Control Devices. General Methods and Procedures for Evaluating Performance Tests Under Reference Conditions
ISO 1940-1:2003	Mechanical Vibration—Balance quality requirements for rotors in a constant (rigid) state—Part 1: Specification and verification of balance tolerances
ISO 9001	Quality Management Systems—Requirements, 3rd Edition (2000)
ISO 10816-1	Mechanical Vibration—Evaluation of Machine Vibration by Measurement on Non-rotating Parts—Part 1: General Guidelines, Annex B, Table B.1. Class I, II or II, as applicable. For the purposes of this specification, Annex B of ISO 10816, Part 1 forms a part of this specification and ISO 10816, Part 1.
ISO 10816-3	Mechanical Vibration—Evaluation of Machine Vibration by Measurement on Non-rotating Parts—Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 r/min and 15000 r/min when measured in situ, Annex A, Table A.1 and A.2. For the purposes of this specification, Annex A of ISO 10816, Part 3 forms a part of this specification and ISO 10816, Part 3.
ISO 10816-6	Mechanical Vibration—Evaluation of Machine Vibration by Measurement on Non-rotating Parts—Part 6: Reciprocating machines with power ratings above 100 kW, Annex A, Table A.1, machine vibration classification number 3. For the purposes of this specification, Annex A of ISO 10816, Part 6 forms a part of this specification and ISO 10816, Part 6.
ISO 10816-7	Mechanical Vibration—Evaluation of Machine Vibration by Measurement on Non-rotating Parts—Part 7: Rotordynamic Pumps for Industrial Applications, Including Measurements on Rotating Shafts, Annex A, Tables A-1 and A-2 Category II as applicable. For the purposes of this specification, Annex A of ISO 10816, Part 7 forms a part of this specification and ISO 10816, Part 7.
MIL STD 167-2	Mechanical Vibrations of Shipboard Equipment (Reciprocating Machinery and Propulsion System and Shafting)

1.4 SHOP DRAWINGS AND SAMPLES

A. In addition to the requirements of Section 11000 and the material listed in the detailed specification, the following shall be submitted in compliance with Section 01300:

1. Successfully operating installation of comparable size and complexity (including no cavitation, damaging vibration or shaft damage within the first three years of

operation) designed and installed in the recent past by the proposed pump manufacturer, with address and telephone numbers.

2. A Certificate of Unit Responsibility Assignment signed by officers of both the Contractor and the pump manufacturer corporations, attesting to the assignment of responsibility in accordance with these Contract Documents. ***No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.***

3. A copy of this specification section and the referencing section and all other applicable specification sections governing the pump, drive and motor, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. ***Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.***

4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked ***"no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.***

5. Documentation of certification in accordance with ISO 9001 as specified under paragraph 11175-2.1 A.

6. Predicted pump performance curves for each condition point specified showing head, power, efficiency, and NPSH required on the ordinate plotted against capacity (in mgd) on the abscissa. Pump inlet, bowl, column and discharge head losses for column pumps shall be shown as separate curves. Curves for variable speed pumps shall be provided at 100-rpm intervals between the minimum and maximum speeds required to achieve the specified operating conditions. Manufacturer's recommended operating range for stable operation and prevention of surge, cavitation and vibration. Under no circumstances shall the manufacturer's recommended operating range be less than that required to meet the pump operating conditions specified.

7. NPSHR margin calculations performed in accordance with paragraph 11175-1.9G.2 and including the information required under paragraph 11175-1.9G.1.

8. Motor submittal information as specified in paragraph 111-1.06.

9. Drawings showing general dimensions and confirming the size of pumps, motors, and specified appurtenances; piping connections; construction details of equipment; wiring diagrams; and weight of equipment.

10. Shaft deflection calculations to demonstrate compliance with paragraph 11175-1.10 if shaft deflection calculations are required by the terms of these specifications.
11. Details of the pump support, including type, size, number, and arrangement of anchor bolts, and dimensional drawing

1.5 OWNER'S MANUAL

A. In addition to the requirements of Section 11000, the following shall be included in the OWNER'S MANUAL submittal in compliance with Section 01300:
1. Manufacturer's written guarantee that pumping equipment operates with efficiencies, heads and flow ranges indicated and meets vibration and critical speed limitations indicated.
2. Shaft deflection calculations to demonstrate compliance with paragraph 11175-1.10 if shaft deflection calculations are required by the terms of these specification

1.6 SERVICES OF MANUFACTURER

A. Services of manufacturer shall be provided in accordance with Section 11000, this Section, and the detailed pump specifications

1.7 NOT USED

1.8 FIELD TESTS

A. All pumping units shall be field tested after installation to demonstrate proper operation, without excessive noise, vibration, cavitation, and overheating of bearings. The field testing shall be performed in the presence of an experienced field representative of the manufacturer of the equipment, who shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation and shall witness the following:
1. Startup, checking, and operation of the equipment at the specified pumping conditions.
2. Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, and pump discharge head, for at least 4 pumping conditions at the respective pump rpm. Each power lead to the motor shall be checked for proper current balance.
3. Ensure that electrical and instrumentation testing complies with Division 13 and Division 16 Sections.

B. Additional field testing requirements are specified in Section 11000, Part 1, and may be specified in the individual equipment specifications.

1.9 DESIGN REQUIREMENTS FOR CENTRIFUGAL AND AXIAL FLOW PUMPING EQUIPMENT

A. General: Provisions and requirements contained in this paragraph (1.9) apply specifically to centrifugal and axial flow pumps, both vertical and horizontal, commonly falling into the generic types covered by ANSI/H11.1 through 1.6 and 2.1 through 2.6. More

restrictive requirements, where found in individual pump specifications, shall supercede requirements of this paragraph. This paragraph does not apply, except by specific reference, to positive displacement pumps of any type.

1. **Centrifugal and axial flow pumping equipment shall conform to the requirements of paragraph 2.1.1, API 610.** All components in the rotating elements in the drive train, including equipment supports and supports for rotating elements, shall be selected and designed to function without damage or disassembly at reverse rotational speeds up to 150 percent of maximum operational speed during flow reversals through the pump. The complete pumping unit shall operate without overload on any component at any point along the pump's entire full-speed operating curve. Pumps required by virtue of the specified operating conditions to operate against a closed or throttled valve for any period of time exceeding five seconds, shall be furnished with drivers sized to operate continuously at the power requirement for that condition even though the power requirements at the rated condition may be less.

B. Pump Selection: Pumps shall be selected to place all specified continuous duty operating conditions within the manufacturer's Allowable Operating Range as defined in ANSI/HI 9.6.3. Unless otherwise specified in individual pump specifications, rated conditions and all other continuous duty full speed operating conditions specified in the detailed pump specifications shall fall within the manufacturer's Preferred Operating Range as defined in ANSI/HI 9.6.3. The Preferred Operating Range shall be not less than that specified in paragraph 2.1.12, API 610. Proposed pump selections shall be selected to allow not less than a five percent increase in head, as specified in paragraph 2.1.4 of API 610. Variable speed operation to achieve this objective will not be considered. Pump selections proposing maximum diameter impellers for the proposed pump model and casing size will not be accepted.

1. Pumping equipment shall be suitable for the operating modes described in the detailed pump specifications and other relevant portions of the Contract Documents.
2. All pumps shall be designed in accordance with applicable portions of ANSI/HI 1.1 - 1.6, 2.1 - 2.6 and ANSI/HI 9.1 - 9.6 and the requirements of this Section. The pumps shall be specifically designed to pump the fluids described in the detailed pump specifications and shall operate without clogging or fouling caused by material in the pumped fluid at any operating condition within the range of service specified.
3. The pumps shall operate without cavitation or damaging vibration over the entire specified range of flow and head conditions and shall be specifically selected for NPSHR characteristics conforming to the requirements of paragraph 11175-1.9G.
4. Unless otherwise indicated, the pump head capacity curves shall slope in one continuous curve within the specified operating conditions. No points of reverse slope inflection capable of causing unstable operation will be permitted within the specified zone of continuous duty operation. Pumps with head/capacity curves as described in paragraph 9.6.3.3.12 of ANSI/HI 9.6.3 are specifically prohibited if these characteristics will cause unstable operation within the specified range of operating conditions and where startup/shutdown conditions entail operation against a slow opening/closing valve.

C. NOT USED

D. Impeller Clearances and Keyways: The radial clearance between the tip of the impeller vane and diffuser or volute vanes shall be not less than 3 percent and 6 percent, respectively, of impeller diameter. The ratio of liquid channel widths (diffuser or volute/impeller) shall be not less than 1.15 nor more than 1.3 for diffuser pumps and 1.4 - 1.5 for volute-type pumps.

1. Impeller keyways for multistage diffuser-type pumps shall be cut at differing positions on the impeller shaft to avoid multiple simultaneous vane passing pulses.

E. Component Design Criteria:

1. General: Unless otherwise indicated, combined stresses in steel frames and supports shall not exceed those permitted by the AISC Manual of Steel Construction. Combined stresses in cast, forged, rolled or fabricated pressure retaining components, frames and supports shall not exceed that allowed for the given material in Section VIII, Division 1 of the ASME Code. Design pressures for pressure-retaining parts shall be not less than twice the pump's shutoff head at the manufacturer's listed maximum operating speed.

   a. The term "combined stresses" in this paragraph (1.9) shall mean the sum of all operating stresses, including stresses induced by dynamic and static forces as developed via the analysis procedures stipulated in this section. Dynamic forces shall include both steady state and transient stresses induced by operating conditions.

2. Anchorage: Unless otherwise indicated, anchor bolts for vertical volute-type pumps shall be designed to restrain twice the forces developed by operation of the pump at maximum speed against a closed valve with no restraint at the pump inlet and discharge flanges.

   a. Anchor bolts and connecting bolts for ail assemblies supported by other assemblies furnished under this Section or sections referencing this Section, shall be designed in accordance with the requirements of this Section, Section 11000, and the individual pump specifications. Anchor bolts, nuts and washers shall comply with paragraph 11175- o 2.2.

3. Torsional and Combined Shaft Stresses: The pump rotor shall be free from torsional criticals and shall comply with all stress requirements indicated in paragraph 11000-1.12A. Additional requirements are indicated in paragraph 11000-1.12

4. Shaft Deflection: Pump shafts on volute type pumps shall be design to provide sufficient stiffness to operate without distortion or damaging vibration throughout the range of service specified. Shaft deflection at the face (impeller side) of the shaft seal shall be limited to no more than 1.5 mils at any continuous condition within the zone described by the specified continuous duty operating conditions.

5. Bearings: Unless otherwise specified, anti-friction bearings shall be selected for an L-10 life expectancy in accordance with the requirements specified in paragraph 11000-2.8.

F. NOT USED

G. Net Positive Suction Head Required Limitations:

1. General:

a. Pumps furnished under this section and sections referencing this section shall be selected for NPSHR (Net Positive Suction Head Required) characteristics using the suction energy methodology set forth in ANSI/HI 9.6.1. NPSHR characteristics for the candidate pump shall be based upon documented test data not more than five years old, performed on a pump not more than two nominal pump diameters larger or smaller than the proposed pump with an impeller of the same geometry as that proposed for the pump to be used for the subject application, and operating at the same speed as the pump for the proposed application. The Contractor shall document the basis for NPSH characteristics as set forth in this paragraph.

b. Individual restrictions shall apply to NPSH margin as set forth below, depending upon the type of pumping equipment and the fluid to be pumped. The detailed specification sections provide NPSH A (Net Positive Suction Head Available or wet well elevation) information for anticipated operating conditions for each application. This information is generally referenced to a specific elevation, stated in terms of project datum. It shall be the Contractor's responsibility to adjust the NPSHA information to the elevation of the pump impeller eye for the specific pump model and size proposed for the application. NPSHR, as used in the following paragraphs, shall mean the NPSHR at the impeller eye, determined in accordance with ANSI/H11.6 or 2.6, as applicable for the proposed pump. The Contractor shall document the method used to determine NPSHR for the proposed pump and justifying compliance with the NPSH margin limitations established under this paragraph in material submitted under paragraph 11175-1.4. documentation shall include justification of the NPSHR tests used to develop NPSHR characteristics, including the following:

   1) Date, test procedure, and test logs of original NPSHR information used to project requirements for pump selected for the application.

   2) Test pump size, impeller diameter, impeller model, eye diameter, and speed. Q Calculations projecting NPSHR test information to NPSHR curve information for pump proposed for the application.

   3) Calculations demonstrating compliance with the NPSH margin requirements established in this paragraph.

c. The Contractor, using suction energy rules in selecting pumps proposed for each application, shall apply criteria set forth in the individual paragraphs below. Percentages stated below shall apply to pump capacity on the selected pump's head/capacity curve at the speed required to achieve the specified operating condition.

d. The Contractor shall submit the manufacturer's suction energy calculations justifying the proposed pumps selections with the material required under paragraph 11175-1.4.

2. Pumps Used for Solids Bearing Liquids: The following restrictions shall apply to pumps specified for wastewater, stormwater, primary effluent, return mixed liquor, RAS, and trickling filter service:

a. A minimum NPSHA/NPSHR margin ratio of 1.3 shall apply at any operating condition within 85 percent and 115 percent of the best efficiency capacity. The minimum acceptable NPSHA/NPSHR margin ratio at any other locations on the pump's head/capacity curve shall be 1.8.

b. Notwithstanding item a above, the manufacturer shall use the methodology in ANSI/HI 9.6.1 to determine the proposed pump's suction energy, in determining the proposed pump's suction energy, the inlet nozzle size shall be increased by two nozzle sizes to account for impeller design considerations. In employing the suction energy method, the minimum NPSHA/NPSHR ratio shall be not less than that recommended in ANSI/HI 9.6.1 or item a., above, whichever is greater. For submersible and wet pit pumps, suction nozzle size shall be the impeller eye diameter of the proposed pump.

c. If the proposed pump's suction energy, as determined in item b, falls into the "high" or "very high" region, as determined from Figure 3 in ANSI/HI 9.6.1, the minimum acceptable NPSHA/NPSHR margin ratios shall be 1.5 and 2.0, respectively.

H. Motor Selection: Unless otherwise specified, pumps shall be electric motor driven. Electric motors shall conform to the requirements set forth for severe duty motors in Section 11176 or shall be as specified in the detailed pump specification. All motors shall be selected to be non-overloading at any operating point along the pump's full speed operating curve, including all points located beyond specified operating conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: Pumping equipment shall comply with this Section, the detailed pump specification, and Section 11000. In addition, the pump manufacturer and the pump manufacturing site shall be certified under ISO 9001. Evidence of the required certifications shall be included with the initial submittal under paragraph 11175-1.4.

B. Combinations of Equipment: Pumping equipment shall be new and shall incorporate all necessary mechanisms, couplings, electric motor and drives, shafts, appurtenances, and mounting.

C. Tools: Tools shall comply with Section 11000 and shall include one pressure grease gun for each type of grease required for pumps and motors.

D. Spare Parts: Spare parts shall include for each pump with complete sets of seals, packing, gaskets, nuts, bolts, washers, wear rings, lantern ring removal tools, and a set of spare bearings as well as all parts indicated in the detailed pump specifications.

E. Nameplates: Nameplates shall comply with Section 11000 and shall indicate rated head and flow, impeller size and pump speed. Flywheel nameplates shall include manufacturer, serial number, model, weight, and moment of inertia.

2.2 MATERIALS

A. General: Materials used in the pumping equipment shall be suitable for the intended application and shall be free from defects. Materials of construction specified under the individual pump sections take precedence. Materials of construction not specified in the individual pump sections shall conform to the requirements listed below. However, where the individual pump sections and this Section are silent with respect to materials of construction of any component, material selection shall follow the requirements of Table H-1, API 610, Materials Class 1-1.

1. Cast Iron: Close-grained gray cast iron conforming to ASTM A 48, with 2 to 3 percent nickel added to the cast iron for raw sewage, wastewater and sludge applications. Pressure class shall be suitable for the application but shall be not less than Class 30 for pumps [4] [6]-inch and larger.
2. Ductile Iron {where indicated): ASTM A 395.
3. Pressure Casings, Inner Casing Parts such as Bowls, Diffusers and Diaphragms, and Impellers: Cast iron conforming to the requirements of API 610, Materials Class 1-1 and paragraph 2.2A.1 above.
4. Stainless Steel Pump Impellers (where indicated): Cast Type 316 stainless steel conforming to API 610, Materials Class S-8.
5. Bronze Pump Impellers (where indicated): ASTM B 62 or ASTM B 584.
6. Pump Shafts: Stainless steel, Type 316 unless higher strength is required.
7. All shaft sleeves for packed boxes, fretting seals and interstage seals shall be Type 316 stainless steel conforming to API 610, Materials Class S-8 requirements.
8. Miscellaneous Stainless Steel Parts: Type 316 except Type 304 in septic environments.
9. Internal Fastener Parts of All Types in Wetted Areas: Type 316 stainless steel conforming to API 610, Materials Class S-5.
10. Discharge Heads and Suction Cans: Carbon steel conforming to the requirements of API 610, Materials Class 1-1.
11. Anchor Bolts, Nuts and Washers: Materials shall be as specified in paragraph 11000- 2.20.

B. General Quality: Details of manufacture and assembly of equipment furnished under the individual pump sections and this Section shall follow the requirements of API 610 with respect to the following features (paragraph references, API 610):

1. Alignment aids (paragraph 2.1.24).
2. Removal of rotating element (paragraph 2.1.25).
3. Jackscrews for assistance in alignment on all baseplates and equipment supports (paragraph 5.3.7.3.4).
4. Castings (paragraph 2.11.2).
5. Welding (paragraph 2.11.3).

C. Wearing Rings: Unless otherwise specified, centrifugal pumps shall be fitted with both stationary and rotating wearing rings. Wearing rings shall be of hard faced Type 316 stainless steel and shall conform to the requirements of API 610, paragraph 2.6.2, Material class S-8. Maximum wearing ring clearances shall not exceed 150 percent of the

values stated in Table 2-2, API 610. Provisions shall be made for adjustment of wearing ring clearance via adjusting screws and shims in the back head design. L-form wearing rings are not acceptable for wastewater, sewage or stormwater pumping service. Wearing rings shall be the axial type with a wear allowance of 0.25 inches minimum. Minimum wearing ring hardness on the rotating ring shall be 350 (BHN), with the stationary ring not less than 100 hardness points greater.

D. Protective Coatings: Pumps shall be protected with coatings as specified in Section 09800, unless otherwise specified in the individual equipment specifications.

2.3 ACCESSORIES

A. Pressure Gauges: Pressure gauges shall be installed at pump discharge lines. Pressure gauges shall comply with Section 13300 and shall be mounted at a location selected to minimize the effect of vibrations.

B. Local Control Panels: The NEMA rating of local control panels shall comply with the area designations of Section 16050, unless indicated otherwise.

C. Lifting Eyes: Pumps and nozzles shall be provided with lifting eyes to permit removal and/or disassembly.

2.4 PUMP REQUIREMENTS

A. Pumps shall comply with the following:

1. Mechanical Seals: Shafts for pumps specified with mechanical seals shall be furnished with no reduction in size through the seal area. Hard/hard faces shall be used. The seal design must be such that the dynamic o-ring moves towards a clean surface as the face wears and the springs are not in the fluid pumped to avoid fouling. The cartridge/split seal shall be a single balanced design capable of 400 psig service with o-ring secondary seals. For ease of equipment maintenance split seals shall be preferred, such as the Chesterton 442, Burgmann VGH, or approved equal. Should an unsplit cartridge design be used, acceptable designs include AES CURC, Chesterton 155, or approved equal. Materials shall be carbide or carbon faces, 316SS metals, Hastelloy/Elgiloy springs, and Viton elastomers. The mechanical seal shall be drilled and tapped for connection of a clean water purge supply. Pumps shall be fitted with SpiralTrac Version D, installation type I, as recommended by EnviroSeal Engineering Products, Ltd, Nova Scotia, Canada. Material of construction shall be stainless steel. For vertical (not vertical turbine) pumps an automated air vent shall be installed to vent the stuffing box of air.

B. Bearing Temperatures: Where possible, the bearing temperature at the worst loading condition and ambient temperature shall not exceed 150 degrees F.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall comply with Section 11000, the requirements of this Section, and the

requirements of the detailed pump specifications.

3.2 TESTING

A. Field testing shall be performed as specified in Part 1 of this Section.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 11293

FABRICATED SLIDE GATES

PART 1- GENERAL

1.1 SUMMARY

A. This section specifies the minimum requirements for corrosion-resistant fabricated slide gates (gates) for control of wastewater flow as shown on the Drawings and specified herein. Gates shall be all 316L stainless steel construction. The scope of supply shall include gate frames, slides, seals, stems, stem guides, operators, floor stands, gate enclosures where specified, and all other appurtenances, in-place and complete. Powered operators for gates are specified in Section 15185.

B. Equipment List: Equipment provided under this section is listed in paragraph 1.04, Service Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards: This Section incorporates by reference the latest revisions of the following documents. In case of conflict between the requirements of this Section and the listed documents, the requirements of the Contract Specifications shall prevail.

Reference	Title
ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
AWWA C561-12	Fabricated Stainless Steel Slide Gates
ASTM A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

B. Unit Responsibility: Unit responsibility, as specified in Section 11000, is assigned to the gate manufacturer (Manufacturer) for the gates and appurtenances specified in this Section and for the powered operators specified in Section 15185.

C. All gates for this project shall be supplied by the same Manufacturer, who shall be fully experienced, reputable and qualified in the manufacturing of the equipment furnished.

1.3 SUBMITTALS

A. Procedures: Section 01300.

B. Product information, calculations, charts and graphs demonstrating compliance with the requirements of this Section and the Drawings.

C. Plans, elevations, sections, and details showing dimensions and mounting requirements for each gate specified.

D. Manufacturer’s data including materials of construction, construction details of equipment, and weight of equipment.

E. Manufacturer’s product literature.

F. Submit actuator data per Section 15185-1.3, including but not limited to, electric motor operator data, including manufacturer's catalog information, complete dimensional data, drive unit size, calculations substantiating selection and wiring diagrams.

G. Certificate of unit responsibility attesting that unit responsibility has been assigned as specified in this Section and Section 11000. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with these requirements.

H. Results of factory testing including leak testing per AWWA C-561, Section 5.22.

I. Name, location and qualifications of the passivation shop.

J. Certification attesting that all gate components have been cleaned, passivated and tested in accordance with the procedures described in this section

K. Manufacturer’s operation and maintenance manual defining maintenance requirements per Section 01730.

1.4 SERVICE REQUIREMENTS

A. Performance Requirements:

1. Gates are intended to isolate channels and pipes or to control water surface elevations.

2. Gates shall be designed for the Design Head specified. The Design Head is defined as the maximum head that will be applied to the gate. The Design Head is measured from the maximum water surface elevation to the bottom of the gate.

3. Slides and frames shall have a safety factor of 5 with regard to ultimate tensile, compressive and shear strength; calculations shall be submitted to show conformance.

4. Gates shall comply with field leakage tests as defined in AWWA C561.

5. Gates shall not require exercise at a frequency of more than once per year to meet the extended warranty requirements described in this section.

6. Gates shall be passivated prior to shipping in accordance with the requirements of this section.

B. See the Gate Schedule for specific dimensional and design requirements.

Gate Schedule

Equipment Number	Gate Type[a]	Size WXH[b] (inches)	Frame Type[c]	Frame Mounting[d]	Design Head[e], feet		Operator Type[f]	Operator Mount[g]	Special Feature[h]
					Seating	Unseating			
M03-SLG105	S	24x24	NSC	5	15	15	E	SP	RM

a. C = channel, S = Sluice, W = weir
b. Nominal size of opening (aperture style gates) or channel width x slide height (channel and weir gates). See Drawings for additional dimensional requirements.
c. SC = self contained, NSC = non self contained
d. 1 = embedded frame/sill, 2 = wall mounted with embedded sill, 3 = upper section of frame wall mounted with sill and lower portion of frame embedded (e.g., sluice style gate mounted in channelized structure), 4 = flange mounted, 5 = wall mounted inside round manhole (see dwgs)
e. Design Head is the maximum water surface elevation minus the invert elevation of the gate.
f. MH = manual hand wheel, MFN = manual 2" floor nut, E = electric motor
g. YTT = yoke-mounted torque tube, SP = structure-mounted pedestal, YA = yoke-mounted actuator, WB = wall bracket
h. RM = gate frame mounted in front of a flush pipe inside a 12-ft diameter manhole, RB = radius bottom, DS = dual stem, EN = stainless steel enclosure.

Electric Motor Actuator Schedule

Item	ID TAG	ENCLOSURE RATING	POWER SUPPLY	CONTROLS VOLTAGE	INTEGRAL CONTROLS	POSTION TRANS-MITTER	POSI-TIONNER
Gate Actuator	M03-MOV105	EX	480 V, 3 Phase	110 V	110 V	110 V	110 V

ABBREVIATIONS:
ENCLOSURE RATINGS:
WT: Watertight IP68/NEMA 4&6
EX: Explosion Proof
Refer to Section 15185 for additional actuator requirements.

1.5 COMPONENT SIZING

A. Operating forces used for determining the strength of gate components (yokes, frames, slides, stems, slide nut pockets, and other load-bearing members) shall be based on the sum of the guide friction force (computed using an opening breakaway friction factor of 0.2) and the weight of slide and stem.

B. When the gate is in motion, the operating forces shall be based on the sum of the frictional force (using a guide friction factor of 0.25) and the weight of slide and stem.

1.7 PICKLING AND PASSIVATION OF STAINLESS STEEL

A. General:

1. Equipment specified under this section shall be cleaned, descaled and passivated in accordance with methods defined in ASTM A380 – *Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts,* and the specific requirements of this section.

2. For purposes of this section, passivation is defined as the removal of exogenous iron or iron compounds from the surface of stainless steel by means of treatment

with an acid solution that will remove the surface contamination but will not significantly affect the stainless steel itself.

3. The processes specified in this section shall be performed in an environmentally controlled shop with experience performing nitric-hydrofluoric acid solution pickling in compliance with all state and federal laws. The equipment manufacturer shall submit the name and qualifications of the passivation shop in accordance with the submittal requirements of Section 01300 prior to shipping parts for passivation.

4. Equipment components that bolt together shall be disassembled prior to passivation treatment to allow for effective circulation and removal of cleaning solutions.

5. All fasteners and anchor bolts required for assembly and mounting of equipment shall be batch processed at the passivation shop, then dried and sealed in plastic bags and labeled. Fasteners shall conform to the requirements of Section 11000.

6. The use of "fabricator's crayons" shall be prohibited during fabrication of equipment as these marks may prevent proper passivation.

B. Passivation Process Requirements:

1. The processes required for proper passivation shall include precleaning, chemical descaling, neutralization, post-cleaning inspection, testing, certification, and protection as defined below.

a. Precleaning – Precleaning required for the removal of all grease, oil, paint, soil, grit and other gross contaminants preparatory to the fabrication process shall be accomplished by vapor degreasing, immersion or spray application of alkaline or emulsion cleaners, steam, or high pressure water jetting.

b. Chemical Descaling –Chemical descaling (pickling) shall be accomplished by immersion bath or spray application of a nitric-hydrofluoric acid solution to produce a matt white, pristine appearance. The acid solution and process used shall conform to Code B, Table A1.1, ASTM A380.

c. Neutralization – The chemical reactions of the pickling media shall be stopped by rinsing of the part with a 10 percent soda ash solution for a minimum of 30-minutes followed by a water bath using high pressure water jetting. The pH of the wetted part surface shall be same as the water used for rinsing.

d. Post Cleaning Inspection – Post treatment inspection of the chemically pickled and neutralized part shall exhibit a clean surface with no signs of etching, pitting, or frosting resulting from the pickling procedure.

e. Testing – The passivated part shall be tested for the presence or absence of free iron with a solution of potassium ferricyanide as defined in Verification Test Practice E, ASTM A967. The test solution shall be mixed and used within 24-hours or less and applied with sterile cotton swabs. The test result shall indicate an absence of free iron on the surface of the part.

f. Certification – All parts passivated shall be certified by an officer of both the manufacturer and the passivating shop as having been cleaned and passivated and tested in accordance with the procedures described in this section. Test results shall indicate an absence of free iron on all passivated surfaces. Submit certification prior to shipping the equipment to the project site. Equipment that is not certified will not be accepted.

g. Protection – Protection shall be provided by applying shrink wrap to all parts of the equipment sufficient to prevent exposure of passivated surfaces to contaminants during handling, shipping and installation. Protected equipment shall be tagged with highly visible warning signs stating the equipment has been passivated and shall only be opened by authorized personnel. Equipment arriving at the project site without proper protection will require retesting for the presence of free iron and re-passivation if free iron is detected.

C. Assembly of equipment following passivation – If assembly of bolted parts is required following passivation, it shall be done at the manufacturing facility under clean conditions such that the parts will not be contaminated with exogenous iron or iron compounds. Following assembly, retest for the presence of free iron per ASTM A967 and treat any contaminated areas with citric acid solution. Equipment requiring assembly shall be re-shrink wrapped sufficient to prevent exposure of passivated surfaces to contaminants during handling, shipping and installation.

D. Witness Of Passivation Process: The Owner retains the right to witness the stainless steel passivation process. Provide at least 30-days notice prior to start of passivation process.

PART 2- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Gates shall be all stainless steel construction. Acceptable manufacturers include the following:

1. Stainless steel slide gate manufacturers:

a. Fontaine Aquanox, Series 20
b. Whipps, Inc. Athol, Massachusetts
c. Waterman Valve, LLC, Exeter California

B. The manufacturer's standard models or products may require modifications to conform to specified requirements.

2.2 MATERIALS

A. Materials of construction shall be as follows:

Component	Material
Slide	ASTM A240 Type 316L stainless steel
Frame	ASTM A276 Type 316L stainless steel
Slide Seats	ASTM D4020 UHMW Polyethylene
Seating faces or seals	ASTM D4020 UHMW PE
Stem and supports	ASTM A276 Type 316 stainless steel
Fasteners, adjusting hardware, and anchors	ASTM A276 Type 316 stainless steel
Yoke	ASTM A276 Type 316L stainless steel
Flush bottom seal	Resilient synthetic rubber bonded to frame or ASTM D2000 neoprene
Pedestal/Torque Tube	ASTM A276 Type 316L stainless steel
Enclosure	ASTM A276 Type 316L stainless steel

2.3 FEATURES

A. General:

1. Mounting requirements as shown on the Drawings and specified in this section.

2. Unless otherwise indicated, provide gates with rising stems with clear, graduated plastic covers in accordance with AWWA C561.

3. Stainless Steel Passivation: All stainless steel components to be cleaned, descaled, and passivated after fabrication in accordance with ASTM A380 and the specific requirements of this section.

B. Slide:

1. Slides shall consist of steel plate reinforced with steel members welded to the plate. Minimum thickness of the steel plate shall be ¼".

2. Slides shall be reinforced with horizontal stiffeners welded to vertical stiffeners. Slides shall not deflect more than 1/1000 of the span of the gate under the design head.

3. Gates with an opening width x design head of 80' or greater shall incorporate a 3" minimum structural edge extended into the guide grove or design equivalent.

4. The slide manufacturer shall submit drawings and comprehensive design criteria to substantiate that the maximum deflection for each slide has not exceeded 1/1000 of the span regardless of the type used. Comprehensive safety factor calculations shall include bending moments, buckling stress, and bonding stress

with thermal expansion factors. Safety factors shall be calculated for the slide under the maximum head indicated in this section, and for shear at the slide/seal interface.

C. Frame:

1. Guide frames extending above operating floors or slabs shall be self-contained and sufficiently strong so that no further support or reinforcement is required. Frames for self-contained gates shall be designed for maximum loads imposed by gate operators in the stalled condition plus the weight of the slide, stem, torque tube or pedestal, and operator.

2. The yoke shall be formed by two structural members welded at the top of the guides to provide a one-piece rigid frame and configured to enable slide removal without removing the yoke. The yoke shall be designed to support the maximum stall force applied by the operator in addition to the weight of the stem, torque tube or pedestal, and operator where this equipment is being supported at the yoke.

3. The frame shall be designed with a minimum factor of safety of 4 with regard to ultimate tensile, compressive, and shear strength.

4. Wall-mounted frames shall be wide flanged type mounted on the inside of a round manhole**.** Guides for wall mounted frames shall be formed from one plate with wrap around gussets. Bolted together guides are not accepted.

D. Seals:

1. Gates shall incorporate factory-set self-adjusting seals utilizing a sealing surface of UHMW PE to achieve the leakage rates specified. Self adjusting seals shall not require adjustment and shall be replaceable without removing the guide frame.

2. All moving contact surfaces shall be incompatible to each other thereby minimizing sticking or jamming.

E. Stems:

1. All stems shall be of the rising type unless otherwise specified.

2. Provide stem diameter to withstand at least twice the rated output of the electric operator or the manual operator at 40-pounds pull. Stems shall be minimum 1-3/8-inch diameter.

3. Stem guides shall be provided at intervals necessary to maintain a slenderness ratio (L/R) of the unsupported stem length of less than 200, where R is the radius of gyration of the stem.

4. Stems shall be designed to withstand tensile and compressive loads that occur under maximum operating conditions. Design for compressive loading shall meet AISC code where K=1 with a minimum safety Factor of 2 to 1.

5. Stem sections shall be joined together by solid couplings, threaded and keyed to the stems. All couplings of the same size shall be interchangeable.

6. The threaded portion of the stem shall have dual lead, machine rolled, full depth ACME type threading with a 16 micro-inch finish or better. Stub threads are not acceptable.

7. Stems shall be fixed to the slide by a threaded and keyed assembly into a lifting nut attached to the disc in a lifting bracket, which is bolted to the disc. The bolts securing the bracket shall be in tension and not shear.

8. Yoke-supported stems shall be provided with a torque between the top of the yoke and the operator constructed of 316L SS. The torque tube shall have appropriate flanges at the top and bottom for mounting to the operator and yoke, and be sized and constructed to provide lateral support to the stem between the yoke and the operator. Torque tubes shall be provided with UHMW stem guides at appropriate intervals to provide lateral support to the stem. Torque tubes shall be equipped with tabs for bolting lateral supports; the dimensions and location of the tabs shall be determined by the manufacturer and coordinated during the submittal review process.

F. Operators:

1. See Gate Schedule for operator requirements.

2. Unless otherwise indicated, manual operators shall meet requirements of AWWA C561 as appropriate.

3. Yoke-supported operators shall be provided with 316 SS pedestals between the top of the yoke and the operator. See drawings for length requirements.

4. Unless otherwise indicated and whenever possible, operator base shall be set 42” above the walking surface.

5. Electric operators are specified in Section 15185.

G. Enclosures:

1. Enclosures shall be designed and fabricated by the gate manufacturer to meet the enclosure rating specified in the gate actuator schedule herein. Submit drawings prior to fabrication.

2. Enclosures shall be essentially air tight and designed to withstand negative pressure of 0.3” WC.

3. Enclosures shall be compatible with specified electric actuators and shall be

removable without removing the actuator.

H. Enclosure face panels shall be removable from one side. Removable panels shall be provided in sections weighing no more than 30-pounds each. Provide handles for lifting the removable face panels.

2.4 FACTORY TESTING

A. Conduct shop performance test per AWWA C563 or AWWA C561 as applicable. Gates to be field leak tested following installation**.** Submit written report of results.
B. The Owner retains the right to witness the stainless steel preparation and passivation process. Provide at least 30-days notice prior to start of passivation process for gates and appurtenances.

PART 3--EXECUTION

3.1 INSTALLATION

A. Install gates and appurtenances in accordance with manufacturer's instruction and as shown on the Drawings.
B. For embedded gates, fill blockouts along guide frames and gate sill with grout following installation.
C. Provide all 316 SS anchors; size anchors in accordance with the design requirements specified in this section and in accordance with Section 05502 and 11000.
D. Proper handling shall incorporate all practices described in Section 8.5 – Protection of Cleaned Surfaces, ASTM A380. Passivated parts contaminated due to improper handling and installation will require retesting for the presence of free iron and re-passivation if free iron is detected.

3.2 FIELD TESTING

A. Operation and Leakage Tests: In accordance with AWWA C563 or AWWA C 561 as appropriate.

B. Leakage rates shall not exceed 0.05 gpm per linear foot of seating perimeter.

3.3 TRAINING

A. Provide four hours of training as specified in Section 01680.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 13300

GENERAL REQUIREMENTS FOR INSTRUMENTATION AND CONTROL

PART 1- GENERAL

1.1 DESCRIPTION

A. Scope:

1. This section specifies general requirements which are applicable to providing a complete, functional process control, instrumentation, communication, and signal systems for the MBC Storm Drain Diversion Project. The requirements of this section are applicable to all work specified in Division 13 of these specifications.

2. Electrical requirements applicable to this work include those specified in Section 16000 for general electrical requirements; Section 16175 for electrical devices; and Section 16485 for control panels.

B. Description Of Work:

1. Instrumentation and Control System: The work consists of :

a. Field Instrumentation:

1) New field instruments.

b. Process Control Hardware:

1) Integration/Expansion of an existing DCS.

2) Field controllers use programmable logic controllers (PLC).

3) New control panels.

c. Process Control Software, Programming, and Integration:

1) Integration/expansion of an existing DCS per Section 13303 (by Owner).

2) Integration/Programming of field controllers per Sections 13301 and 13302.

3) Coordinated programming and testing responsibilities between Contractor and Owner.

d. Communications and Networking

1) Interface to existing Owner networks.

2) Hardwired fiber-optic network

2. Programming: Programming shall be provided per Section 13301.

C. Definitions:

1. General: Definitions of terminology related to Instrumentation and Industrial Electronic Systems used in the specifications shall be as defined in IEEE 100, ISA S51.1, and NEMA ICS 1.

2. Two-Wire Transmitter: A transducer which derives operating power supply from the signal transmission circuit and requires no separate power supply connections. A two-wire transmitter produces a 4 to 20 milliampere current regulated signal in a series circuit with a 24 volt direct current driving potential and a maximum circuit resistance of 600 ohms.

3. Four-Wire Transmitter: A transducer which derives operating power from separate power supply connections. A four-wire transmitter produces a 4 to 20 milliampere current regulated signal in a series circuit with a maximum circuit resistance of 600 ohms. Four-wire transmitters typically require 120Vac or 24Vdc input power supply.

4. Galvanic Isolation: Electrical node having no direct current path to another electrical node. Galvanic isolation refers to a device with electrical inputs and/or outputs which are isolated from ground, the device case, the process fluid, and separate power supply terminals. Inputs and/or outputs may be externally grounded without affecting the characteristics of the devices or providing path for circulation of ground currents.

5. Panel: An instrument support system which may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems including consoles, cabinets and racks. Panels provide mechanical protection, electrical isolation, and protection from dust, dirt, moisture, and chemical contaminants which may be present in the atmosphere.

6. Data Sheets: Data sheets shall refer to ISA S20 or ISA TR20.00.01.

7. Signal Types: Used in systems specified in Division 13:

a. Low-Level Analog: Signal with full output level of 100 millivolts or less including thermocouples and resistance temperature detectors.

b. High-Level Analog: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4 20 mA transmission.

c. Digital Code: Coded information from the output of an analog to digital converter or digital transmission terminal.

d. Pulse Frequency: Counting pulses emitted from speed or flow transmitters.

d. Modulated Signals: Signals from modems or low level audio signals. Normal signal level: plus 4 dBm to minus 22 dBm. Frequency range is 300 to 10,000 Hertz.

e. Discrete Control Or Events: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits.

f. Low Voltage Discrete Control Or Events: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits operating at less than 30 volts and 250 milliamperes.

g. High-Level Audio Signals: Audio signals exceeding plus 4 dBm, including loudspeaker circuits.

h. Radio Frequency Signals: Continuous wave alternating current signals with fundamental frequency greater than 10 kilohertz.

8. Systems Integrator: A firm engaged in the business of detailed control system design and engineering, instrumentation component purchase, system and panel assembly, programming, and implementing the specified process control and industrial automation systems.

1.2 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).

3. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

4. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE 100	Standard Dictionary of Electrical and Electronics Terms

Reference	Title
ISA S5.4	Instrument Loop Diagrams
ISA S20	Specification Forms For Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S51.1	Process Instrumentation Terminology
ISA TR20.00.01	Specification Forms for Process Measurement and Control Instruments Part 1: General Considerations
NEMA ICS 1	General Standards for Industrial Control and Systems

B. Systems Integrator Responsibility:

1. General

a. The specified control system and instrumentation integration including panel building, PLC programming, instrument calibration, testing, start-up, operational testing, and training shall be performed by a Systems Integrator staffed with qualified personnel, possessing necessary equipment and experience in performing similar installations.

b. The control system components shall, as far as practical, be of one manufacturer.

c. The components, modules, devices, and control system equipment shall be recognized industrial quality products. Recognized commercial or office grade products are prohibited.

d. The overall system performance shall be demonstrated to and accepted by Owner.

e. The application software packages shall be latest versions available, or compatible with existing software currently in use, as specified in Section 13375.

2. Systems Integrator Qualifications:

a. Contractor-proposed Systems Integrator shall be evaluated based on submittal of the following Evidence of Experience:

1). Submit organization chart and resumes for proposed project personnel.

2) Submit Training and Certification information. Completion of the following training courses or appropriate portions thereof or possession of the following certifications included with the Systems Integrator's personnel experience requirements described above:

a) Project manager: Control System Engineer (CSE) registration, Professional Engineer (PE) registration.

b) Systems engineer: Control System Engineer (CSE) registration, Professional Engineer (PE) registration, or completion of the relevant core courses in the Engineering Skills Training program.

c) Programmer: Control System Engineer (CSE) registration, Professional Engineer (PE) registration.

d) Field instrument technician: Certified Control Systems Technician (CCST) registration or completion of the relevant core courses in the Technical Skills Training program.

e) Certified training programs, as offered by ISA.

C. Process Equipment Coordination

1. Division 13 specified equipment shall be coordinated for proper operation with equipment related process equipment specified in other Divisions.

2. Equipment shall be integrated, furnished, and installed in conformance with the drawings, specifications, and the recommendations of the equipment manufacturer and the related processes equipment manufacturers.

3. Systems Integrator shall obtain manufacturer's technical information for items of equipment not provided with, but directly connected to, the control system. Provide the necessary coordination and components for correct signal interfaces between specified equipment and the control system.

4. Systems Integrator shall coordinate with project subcontractors and equipment suppliers.

5. Systems Integrator shall provide installation supervision for the duration of the project, a minimum of 1 man-week on-site.

6. Conflicts between the plans, specifications, manufacturer/vendor drawings and installation instructions, etc., shall be presented to the Construction Manager for resolution before proceeding.

1.3 ENVIRONMENTAL CONDITIONS

A. General: Specified data communication and process control equipment shall suitable for operation in indoor locations and in outdoor locations.

B. Corrosive Locations: Corrosive locations shall be as specified in Division 16.

C. Hazardous (Classified) Areas: Hazardous areas shall be as specified in Division 16.

D. Seismic: Equipment and supports shall be braced per Section 16050.

1.4 FUNCTIONAL REQUIREMENTS

A. General: The instrumentation and control system functions are shown on the drawings and specified in subsequent sections of Division 13. The Systems Integrator drawings and integration practices shall be as defined in IEEE 100, ISA S51.1, and NEMA ICS 1.

B. Submittal Drawings:

1. General: The drawings included in the project manual are functional in nature and do not show exact locations of equipment or interconnections between equipment. The Contractor's Systems Integrator shall prepare detailed installation drawings as specified below.

a. Drawings prepared in Microstation version **[J]** with borders and title blocks identifying the project, system, revisions to the drawing, and type of drawing. Each revision of a drawing shall include the date and description of the revisions. Drawing prints shall be 11" x 17" with a minimum lettering size of 1/8". Drawings shall be generated in adherence to Owner's drawing standards.

b. Diagrams shall carry a uniform and coordinated set of wire numbers and terminal block numbers in compliance with panel wiring, Section 16000 and Section 13370, to permit cross-referencing between contract documents and the drawings prepared by the Contractor.

2. Connection Diagrams: Show components of a control panel in an arrangement similar to the actual layout of the panel including internal wiring between devices within the panel. Show terminal blocks used for internal wiring or field wiring, identified as such. Indicate insulation color code, signal polarities, and wire numbers and terminal block numbers.

3. Interconnection Diagrams: Show panels, panel devices, and field devices with wire numbers, cable numbers, raceway numbers, terminal box numbers, terminal block numbers, panel numbers, and field device tag numbers.

4. Elementary or Schematic Diagram: Shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. Provide schematics for internal panel power distribution, lighting, and any panel HVAC.

5. Arrangement, Layout, Or Outline Drawings: Show the dimensioned external and interior control panel views with components and Bill of Material. Provide panel heat load calculations, and indicate cooling or ventilation provisions as required.

1.5 SUBMITTALS

A. The following information shall be provided in accordance with and Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each

paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. A check mark shall denote full compliance with a paragraph as a whole.

a. If deviations from the specifications are indicated, and therefore requested by the Contractor, each requested deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

b. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

c. Failure to include a copy of the marked-up specification sections, along with justification for requested deviations from the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Detailed product literature, showing product specifications and model number breakdown. Mark to denote features and options included. Include only the applicable pages.

3. Manufacturer's installation manual excerpts, as to be used for this project:

a. Installation details/drawings.

b. Electrical connection diagrams

c. Calibration procedures.

4. Drawings and diagrams specified in paragraph 13300-1.04 B.

5. Nameplate list with material, tag number and description as specified herein.

6. Systems Integrator Evidence of Experience per paragraph 13300-1.02 B 3.

7. Data Sheets in accordance with ISA 20 for each instrument. Identical instruments may be submitted with one common ISA Data Sheet and accompanying tag list.

B. Review the submittal requirements specified in other Division 13 Sections.

PART 2--PRODUCTS

2.1 GENERAL

A. Materials and Quality:

1. Equipment material shall be new, free from defects, and industrial-grade, as specified. Each type of instrument, **instrument** accessory, and device used throughout the work shall be manufactured by one firm, where possible.

2. Electronic equipment shall be of solid-state construction with printed or etched circuit boards of glass epoxy of sufficient thickness to prevent warping.

B. Enclosures: Table A specifies the instrument and control panel enclosure material and minimum NEMA rating for the location and application.

Table A

Location	Enclosure Material and NEMA Rating
Outdoor: Non-Corrosive Areas	NEMA 4X: 316 Stainless Steel
Hazardous Area:	NEMA 7: Galvanized Malleable Iron or Aluminum or NEMA 4X and UL listed or FM Approved for the Hazardous Area.

2.2 NAMEPLATES

A. Nameplates shall be provided for all field mounted instrument, analyzer, or equipment specified in Division 13. Nameplate lettering shall include the equipment or instrument loop title and the instrument or equipment tag number, where nameplate engraving is not specified or shown. Nameplates shall be machine engraved black phenolic with white 5/32-inch high lettering, as minimum, unless otherwise specified or shown. Nameplate wording may be changed without additional cost or time, if changes are made prior to commencement of engraving.

B. Nameplates shall be attached to support hardware with a minimum of two self-tapping type 316 stainless steel screws in a readily visible location so the nameplate will remain to identify the service when the device is removed. Field instrument namplates shall be attached with braided stainless steel straps where not stand mounted.

2.3 PRODUCT DATA

A. The following Product Data shall be provided in accordance with Section 01300.

1. Record drawings specified by paragraph 13300-1.04 B and the schedules included in Division 13 shall be provided in accordance with Section 01720 in MicroStation format and PDF format on CD.

a. Provide record drawing prints of all drawings following project start-up, but prior to acceptance of the work showing the final constructed state of the instrumentation and control systems.

2. Operating and maintenance information shall be provided in accordance with Section 01730. Include the following in each Operation and Maintenance manual:

a. Final reviewed Submittals, including revised as-built record drawings.

b. Manufacturer's operation and maintenance instructions, edited for this project.

c. Written record of menu configuration, jumpers, switch settings, and other configurable parameters for each instrument.

PART 3--EXECUTION

3.1 INSTALLATION

A. General:

1. Equipment shall be installed in locations that are accessible for operation and maintenance services. Equipment not accessible shall be reinstalled at no cost to the Owner.

2. Installation, calibration, settings, and testing procedures are specified in Section 13300, Section 13310 – Instrument Index Part 3 Execution, and subsequent sections of Division 13.

B. Field Equipment:

1. Equipment shall be provided with ports and adjustable items accessible for in-place testing and calibration. Install equipment between 48 inches and 60 inches above the floor or permanent work platform. Equipment shall be mounted to avoid shock or vibration that may impair operation. Equipment shall be mounted for unobstructed access and walkways. Equipment support systems shall not be attached to handrails, process piping or mechanical equipment.

2. Instruments and cabinets supported by concrete walls shall be spaced 5/8 inch by framing channel between instrument or cabinet and wall. Block wall shall have additional installation supports, as required, to avoid damage to the wall. Equipment supports shall be hot-dip galvanized after fabrication or shall be 316L stainless steel, as shown or specified.

3. Support systems including panels shall be designed in accordance with Section 01999 to prevent deformation greater than 1/8 inch in any direction under the attached equipment load and under an external load of 200 pounds.

4. In wet or outdoor areas, conduit penetrations into instrument housing shall be made through the bottom (preferred) or side of enclosures to minimize water entry from around or from inside of conduits. Provide conduit hubs for connections and waterproof mastic for moisture sealant.

5. Nameplates shall be provided for all field mounted equipment. Nameplates shall be attached to support hardware with a minimum of two self-tapping Type 316 stainless steel screws in a readily visible location, but such that if the field device is changed out, the nameplate will remain to identify the service.

C. Electrical Power Connections:

1. Equipment electric power wiring shall comply with Division 16. Power disconnect switches shall be provided within sight of equipment and labeled to indicate the specific equipment served and the power source location. "Within sight of" is defined as having an unobstructed view from the equipment served and within 50 feet of the equipment served.

2. Equipment power disconnect switches shall be mounted between 36 inches and 72 inches above the floor or permanent work platform. Where equipment location requirements cannot be met by a single disconnect switch, provide two disconnect switches: one at the equipment and one at the work platform.

3. Provide a surge arrestor on each 120 volt AC disconnect switch serving equipment located outdoors. Surge arrestor shall be Telematic, LP Series or equal.

D. Signal Connections:

1. Equipment electric signal connections shall be made on terminal blocks or by locking plug and receptacle assemblies. Flexible cable, receptacle and plug assemblies shall be used where shown or specified.

2. Jacketed flexible conduit shall be used between equipment and rigid raceway systems. Flexible cable assemblies may be used where plug and receptacle assemblies are provided and the installation is not subject to mechanical damage in normal use. The length of flexible conduit or cord assemblies shall not exceed 2 feet.except where sufficient length is required to allow withdrawal of instruments for maintenance or calibration without disconnection of conduit or cord assemblies.

3.2 FIELD TESTS AND INSPECTIONS

A. Delivery Inspection: The Contractor shall notify the Owner's Representative upon arrival of any material or equipment to be incorporated into the work. The Contractor shall remove protective covers or otherwise provide access in order that the Owner's Representative may inspect such items.

B. Inspection and Installed Tests: Refer to Section 13305 – Process Instrumentation and Control System Testing.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 13301

CONTROL SPECIFICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies controls for the Programmable Logic Controller (PLC) based control system.

B. Control strategies describe sequential and interlocking control functions.

C. The Contractor shall provide the labor and equipment to test the specified control strategies per Section 13305.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CONTROL STRATEGY - DIVERSION GATE (SLG105)

A. P&ID: I-003

B. General Description: The diversion gate isolates the diversion structure from the storm drain system.

C. Control Strategy Overview: The diversion gate operator is equipped with integral controls. The gate is normally open. The gate closes during a storm event when the required storm water volume is captured by the diversion structure.

D. Local Control:

1. Field:

a. Local-Off-Remote (LOR) Switch

1) When the LOR Switch is in the LOCAL position the valve can be opened or closed by using the OSC switch

2) When the LOR switch is in the OFF position the valve shall not operate.

3) When the LOR switch is in the REMOTE position the valve is controlled by the PLC.

b. Open-Stop-Close (OSC) Switch:

1) The OSC switch shall spring return to the STOP position
2) When the OSC switch is held in the OPEN position the valve shall open.

3) When the OSC switch is in the STOP position the valve shall stop and not move.

4) When the OSC switch is in the CLOSE position the valve shall close.

c. Remote Indication – When the LOR switch is in the REMOTE position the valve operator shall indicate that the valve is in remote.

d. Opened Indication – When the valve is in the full opened position the valve operator shall indicate that the valve is in the opened position.

e. Closed Indication - When the valve is in the full closed position the valve operator shall indicate that the valve is in the closed position.

2. Local Control Panel – None

3. Hardwired Interlocks – None

E. Remote Control

1. Control Strategy

a. The diversion gate is normally opened. The gate closes during a storm event after the preset volume of water enters the diversion structure.

b. Remote-Auto Operation

1) The beginning of a storm event is defined by the lead pump starting. When the lead pump starts Storm Event Timer shall be started. The Storm Event Timer shall be in hours to the nearest tenth. (0.0 – 999.9 hours)
2) When the storm event begins the volume of water that enters the diversion structure shall be totalized.
3) The totalized volume equals the running flow total through FIT-125 (from the start of the storm event) plus the volume of water in the diversion structure.
4) The volume of water in the diversion structure will be calculated by the PLC. The calculation will be the depth of water in the structure as measured by the active level transmitter (LIT-100 or LIT-101) multiplied by the area of the diversion structure. The diversion structure will be provided by the Contractor during construction.
5) When the totalized volume reaches 927, 520 gallons the gate shall close.
6) When the gate is completely closed, the PLC shall start an adjustable timer (initially 24 hours). If the gate is closed less than

24 hours into the Storm Event when the timer expires (24 hours after the gate is closed) the gate shall be opened. If the gate is closed after 24 hours into the storm event the gate shall remain closed until the storm event is over.
The storm event ends when the pumps have stopped and the water level in SDR 1-3-1 is below a hardcoded level determined at start-up.

c. Remote-Manual Operation

1) The operator shall be able to open and close the diversion gate while in Remote-Manual mode.

2. DCS
   a. When the diversion gate is in remote the operator shall be able to toggle the control mode between Remote-Auto and Remote-Manual from the DCS.
   b. When in Remote-Manual mode the operator shall be able to open and close the diversion gate from the DCS.
   c. The operator shall be able to designate the diversion gate as Out-of-Service from the DCS. When the diversion gate is Out-of-Service the gate shall not operate in either remote control mode.
   d. The operator shall be able to reset the Fail to Open and Fail to Close alarms from the DCS.

3. Software Interlocks – None.

4. Alarms

   a. Fail to Open – When the gate is commanded to open and does not reach its fully opened position in the allotted time a Fail to Open alarm shall be issued. The allotted time will be determined during startup and shall be 1.25 time longer than the average time for the gate to transition from fully closed to fully open (10 samples). The alarm shall require a reset from the OIT or DCS.

   b. Fail to Close – When the gate is commanded to close and does not reach its fully closed position in the allotted time a Fail to Close alarm shall be issued. The allotted time will be determined during startup and shall be 1.25 time longer than the average time for the gate to transition from fully opened to fully closed (10 samples). The alarm shall require a reset from the OIT or DCS.

3.2 CONTROL STRATEGY – DIVERSION PUMPS (P-110, P-120)

A. P&ID: I-003

B. General Description: There are two fixed speed pumps in the diversion structure wetwell. The pumps operate in a Lead-Lag configuration.

C. Control Strategy Overview: The pumps are equipped with a Local Control Panel (LCP) that is located adjacent to the diversion structure. Each of the pumps may be operated locally from the LCP. In REMOTE-AUTOMATIC control the are started and stopped by ball floats

D. Local Control:

1. Field: None

2. Local Control Panel:

a. Refer to the pump control schematic on sheet E-3 of the drawings.

b. The pump control panel has a HAND-OFF-REMOTE switch for each pump.

c. When the HOR switch is in the HAND position the pump shall run provided the wet well is above low-low level and all interlock conditions are satisfied.

d. When the HOR switch is in the OFF position the pump shall not operate.

e. When the HOR switch is in the REMOTE position the pump shall operate when called by the PLC provided all interlock conditions are satisfied.

f. All hardwired interlocks shall be active in all control modes.

3. Hardwired Interlocks: Refer to the pump control schematic on sheet E-3 of the drawings.

E. Remote Control

1. Control Strategy

a. The pumps shall normally operate in REMOTE-AUTO control. The default operating mode of the pumps is REMOTE-AUTOMATIC. On power up or when initially placed in REMOTE the pump shall default to automatic operation.

b. Remote-Auto Operation

1) The lead and lag pump shall initially be selected by PLC logic to equalize run time. The operator may change the lead pump selection at any time.

2) When the level in the wetwell rises above the Lead Pump Start Level of (initially) 5.75 feet the lead pump shall start.

3) When the level in the wet well rises above the high-level Lag Pump Start Level of (initially) 8.5 feet the lag pump shall start.

4) Once started the pumps shall stop when the level of the wetwell falls below the Pump Stop Level of (initially) 3.5 feet.

5) The final start and stop levels will be determined by observation during startup and commissioning and hard coded into the PLC after approved by the Engineer.

c. Remote-Manual Operation: The operator can start and stop the pumps from the DCS provided all interlock conditions are satisfied.

2. DCS

a. When a pump is in remote the operator shall be able to toggle the control mode between Remote-Auto and Remote-Manual from the DCS.

b. When in Remote-Manual mode the operator shall be able to start and stop the pump from the DCS.

c. The operator shall be able to designate the pump as Out-of-Service from the DCS. When a pump is Out-of-Service the pump shall not operate in either remote control mode.

d. The operator shall be able to reset the Fail to Start alarm from the DCS.

3. Software Interlocks

a. High Level Interlock – If the Centrate Wetwell is above an operator adjustable high level setpoint the DCS shall issue a High Level Interlock to the diversion structure PLC to prevent the operation of the diversion pumps. The diversion structure pumps shall not operate in any mode when the High Level Interlock is set.

4. Hardwired Interlocks

a. Low-Low Level switch – The pump shall not operate is the level in the wet well is not above the low-low level ball float.

b. High Discharge Pressure switch – The pump is protected by a normally closed high discharge pressure switch. When the switch trips (opens) the pump shall stop. The high pressure shutdown shall require a local reset.

5. Alarms:

a. High-High Level – When the level in the diversion wetwell rises above the High-High Level ball float for 3 seconds an High-High level alarm shall be issued. The High-High alarm shall automatically clear when the wet well level is below the High-High Level for 10 seconds.

b. Low-Low Level – When the level in the diversion wetwell falls below the Low-Low level ball float for 3 seconds a Low-Low alarm shall be

issued. The Low-Low alarms shall automatically clear when the level in the wetwell is above the low low level ball float for 30 seconds.

c. Failed to Start- When a pump is called to start and the PLC does not receive a running signal from the pump control panel in 10 seconds a Failed to Start alarm shall be issued. If the lead pump fails to start the lag pump shall be designated as lead. The failed to start alarm can be reset from the OIT or the DCS.

d. Additional alarm shall be issued for inputs from the pump control panel. Refer to the pump control schematic. These alarms shall be reset from the pump control panel.

1) Fault

2) High Temperature

3) Seal Leak

4) High Discharge Pressure

3.3 CONTROL STRATEGY – FLOW METER (FIT-125)

A. P&ID: I-003

B. General Description: Measures the flow produced by the pump station.

C. Control Strategy Overview:

1. Flow totalization will be calculated and maintained by the PLC whenever flow signals exceeds 2-1/2 % of full scale value and analog signal has not failed (refer to CS10). Totalize in gallons times 1,000 (kGal) or gallons times 1,000,000 (MGal) as shown on the P&ID. Totalize from 0 to 9999.

2. A separate storm flow totalization calculation shall be initiated at the start of a storm event as indicated by a signal from the DCS. The storm event calculation shall be reset at the start of a storm event.

3. The storm flow totalization calculation shall calculate the volume of water that passes through the diversion structure beginning from the instant that the storm event is started from the DCS. The calculation will be the volume of water in the diversion structure plus the volume of water (totalized flow) that has been pump out of the diversion structure since the start of the storm event. The diversion structure volume calculation will be based on the as constructed dimensions of the structure and the level in the wetwell.

D. Local Control: None

E. Remote Control: None

3.4 CONTROL STRATEGY – LEVEL TRANSMITTERS (LIT-100, LIT-101)

A. P&ID: I-003

B. General Description: Redundant level transmitters continuously monitor the level of the wetwell.

C. Control Strategy Overview:

1. The Operator may select the following from the DCS

a. Level Transmitter 1 In/Out of Service
b. Level Transmitter 2 In/Out of Service

2. The In Service Level Transmitter is used for control. If both Level Transmitters are in service, the average value of the two transmitters is used for control.

3. A deviation alarm shall be generated if the level transmitter outputs are not within acceptable limits (initially 2").

4. The In Service Level Transmitter is used for control and alarming, including calculating the volume of water in the diversion structure.

3.5 CONTROL STRATEGY – LOWER EXPLOSIVE LIMIT DETECTORS (AIT-103, AIT-107, AIT-109)

A. P&ID: I-003

B. General Description: LEL analyzers continuously monitor the methane levels in the wetwell and diversion structure.

C. Control Strategy Overview:

1. An alarm shall be issued when the LEL is reached.

** END OF SECTION **

SECTION 13302

PROCESS CONTROL SYSTEM
DEVELOPMENT AND PROGRAMMING

PART 1- GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies the general requirements applicable to the development and programming of the process control logic.

1.2 QUALITY ASSURANCE

A. Implementation Plan Meetings:

1. The Systems Integrator shall include as work of this section of the specifications the requirement for two (2) meetings to be held at the project site. The primary function of the meetings shall be to solicit input from the Owner regarding the implementation of the process control system and to facilitate preparation of the Process Control System Implementation Plan specified herein.

2. The Systems Integrator shall have in attendance at each meeting a representative who is responsible for the preparation of the Process Control System Implementation Plan. The preliminary schedule and agenda for each of the meetings shall be as described below. The specific dates for each of the meetings shall be scheduled by the Systems Integrator and approved by the Construction Manager.

3. The Construction Manager shall be provided with two (2) weeks minimum advanced written notice of proposed scheduled meeting dates. The System Integrator shall prepare a detailed meeting agenda and submit it to the Construction Manager with the notice of proposed scheduled meeting dates.

a. Meeting-1 shall be held within sixty (60) days of receipt of Notice to Proceed. The purpose of this meeting shall be to begin preparation of the Process Control System Implementation Plan. The System Integrator shall be prepared to present the capabilities of the proposed process control system software and the alternatives available for each of the major areas of implementation described by the Process Control System Implementation Plan.

b. Meeting-2 shall be held within thirty (30) days of completion of the Engineer's review of the Process Control System Implementation Plan submittal. The purpose of this meeting shall be to discuss the submittal review comments and resolve any related issues.

1.3 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300:

1. Process Control System Implementation Plan

PART 2- PRODUCTS

2.1 PRODUCT DATA

The following data shall be provided in accordance with Section 01300:

A. Process Control System Developer's Guidelines: The Process Control System Implementation Plan shall be modified and updated during the course of development of the process control system control logic and graphical operator interface to reflect the conventions and standards used in the final system development. Upon final acceptance of the work, the updated implementation plan shall be re-published and submitted as the Process Control System Developer's Guidelines.

B. Process Control System Configuration Report: Report documenting the final configuration of the process control system including the following:

1. Hardware Configuration: Final switch settings and jumper positions shall be documented for all process control system components including processors, communications adapter modules, motor controllers and adjustable frequency drives, power metering systems, etc.

2. Process Control Logic: Bound hard copy of the annotated process controller program listing. The program listing for each processor shall be separately bound and shall have tab dividers for each program file listing. Program listing shall include cross references.

PART 3- EXECUTION

3.1 PROCESS CONTROL SYSTEM IMPLEMENTATION PLAN

A. General: The Systems Integrator shall prepare an implementation plan for the process control system development and programming work. The implementation plan shall establish guidelines for the programmable logic controller (PLC) process control logic and shall insure the consistent application of conventions and methods through the course of development. The implementation plan shall specifically address the following:

1. Tag database structure and configuration.

2. Tag naming conventions.

3. PLC program file organization.

4. PLC data file organization.

B. Tag Database Structure and Configuration: The implementation plan shall define how the tag database will be organized to logically associate tags with specific input/output types,

functions, or process areas. In addition, the plan shall prescribe guidelines for configuration of tag alarm handling.

C. Tag Naming Conventions: A tag naming convention shall be established which provides a structured organization to the tag database facilitating tag searches and substitutions during system development and provide for effective and efficient design, management and operation of the process control system. The tag naming convention shall be developed to take full advantage of the capabilities of the process control system software and not impose any artificial constraints in the operation or management of the process control system. Tag names shall minimally be comprised of the following information:

1. Equipment type designation.

2. Equipment loop number.

3. Signal type designation.

D. Graphical Operator Interface Standards:

1. The configuration and development of the graphical operator interface shall be by the Owner.

2. The Contractor shall provide read and read write registers for integrating the PLC into the DCS via MODBUS TCP/IP link.

E. Process Control Logic Configuration: Guidelines shall be developed which define the organization and structure of the process control logic and data memory within the process controller. These guidelines shall address the following:

1. Structure of the control logic including the use of subroutines and the allocation of memory to accommodate modifications and expansion of the control logic.

2. Methodology for handling common control functions shall be standardized such that similar functions are implemented in a consistent manner across the entire project. Standardized routines for motor control, VFD control, instrument data handling, alarm management, etc. shall be developed and reviewed by the Owner prior to final programming.

3. Assignment of data storage memory including data formats and method of documenting memory mapping.

4. Methodology for implementing PLC to DCS communications and DCS control including allocation of memory or register addresses is such a way as to organize data for optimum efficiency of data exchanges between the PLC and the DCS.

    a. DCS control shall included the ability to toggle the control mode of devices between REMOTE-AUTO and REMOTE-MANUAL as well has remotely operate devices while in REMOTE-MANUAL mode.

F. Process Control Strategies: Process control strategies shall be reviewed with the Owner and refinements made as agreed to by the Systems Integrator. Modifications to the control strategies that are determined to be a change in scope will be addressed by change order. The final process control strategies shall be incorporated into the Implementation Plan.

3.2 TAG DATABASE DEVELOPMENT

A. General: The process control system tag database development shall include the definition of all device, derived and soft tags and the required alarm processing and data logging and archiving definitions for each tag. Conventions used in the development of the tag database shall be as defined in Process Control System Implementation Plan.

B. Tag Definition: The definition of tags in the tag database shall comply with the following guidelines except as otherwise modified by the Process Control System Implementation Plan:

1. Tag Naming Conventions: Tag names shall minimally consist of two distinct components. The leading component shall represent the tag equipment number. The trailing component (tag descriptor) shall be an abbreviated description of the associated process variable or the function of the tag. Each component shall be assigned a fixed maximum length which shall be dependent on the available tag name length supported by the process control system software.

The tag equipment number shall be derived from the primary item of process equipment or instrumentation most closely associated with the process variable and shall be comprised of an equipment type prefix followed by process loop number. The equipment numbers shall be as defined by the Contract Documents.

The tag descriptor shall provide a description of the process variable referenced by the tag name or a description of the function associated with the tag. Tag descriptors shall be based on ANSI/ISA-S5.1 and Appendix B of ISA-RP60.6. The tag descriptor may be comprised of several parts to clearly define the tag function. The following typographical convention shall be used to create the tag descriptor:

a. Symbol identification letters (ANSI/ISA-S5.1) shall be all upper case.

b. The first letter of an abbreviation (ISA-RP60.6) shall be upper case. The remainder of the abbreviation shall be lower case.

Examples of the tag names are provided in Table 3.02.B.1:

Table 3.02.B.1

Tag Name	Tag Function
P1121PSH	Pump P1121 pressure switch high
FIT1101	Flow transmitter 1101
P1121Run	Pump P1121 run status

2. Tag Descriptions: Describe the tag in terminology consistent with this application. Abbreviations and equipment numbers shall be not be used in the tag description without prior approval of the Owner. Tag descriptions shall not include any wording which implies the state or condition of the tag. For example, the tag description for P1121PSH shall read "Backwash Water Pump 1 Discharge Pressure" in lieu of "Backwash Water Pump 1 Discharge Pressure High."

3. ON/OFF and Alarm State Labels: The ON/OFF and alarm state labels shall consist of words which describe the state of the tag. For digital tags, the logic TRUE state of the tag will generally be the state labeled.

   Examples of ON/OFF and alarm state labels include RUN, OFF, OPEN, CLOSED, READY, ALARM, NORMAL, HIGH, LOW, HIGH-HIGH, LOW-LOW, etc. Abbreviations shall not be used in ON/OFF or alarm state labels.

C. Tag Types: Tags shall be classified as either device tags, derived tags or soft tags. Device tags shall be those tags which have a physical device as the data source. Derived tags are those tags whose value is calculated or otherwise derived from another tag. Derived tags have no data source address. Soft tags are those tags whose value is obtained from another process software application. Tags shall be defined for each of the following tag data sources:

1. Physical input/output process variables derived from the process control input/output subsystems. Refer to the Input/Output Summary, paragraph 13375-3.04.

2. Control and status data derived from the process control logic required to fully implement the process control strategies specified in paragraph 13310-3.04. This data shall include the following types of information:

   a. Operating setpoints.

   b. Process operations setup and control parameters including start/stop, lead/lag, auto/manual, enable, etc.

   c. Operating status and fault data including ready, fail-to-run, etc.

   d. Timing/counting function data including preset and accumulated values.

3. Operating, fault and diagnostic data derived from the external systems, such as chlorine generator, metering pump systems, including the following:

   a. Process variable transmitters and analyzers.

   b. Operating status of all system equipment including run and ready status.

   c. Power parameters.

   d. System trouble and alarm conditions.

e. Process control system diagnostic data.

f. System status, control and configuration parameters including lead/lag selection, operating setpoints, etc.

g. Refer to the particular equipment specification section in Div. 11 for specific data to be produced, consumed and transmitted by external systems.

4. Operating, fault and diagnostic data derived from motor starters including the following:

a. Run status

b. Drive fault

c. Start/stop control

5. Diagnostic data derived from the process control system controllers, I/O subsystems, and communications controllers including the following:

a. Controller operating mode

b. Controller performance (eg. Scan time)

c. Controller fault status and fault code

d. Controller time and date values

e. Controller network address

f. I/O subsystem fault status

g. I/O module channel health

h. Communication controller fault status

6. Table 3.02.C.8 specifies the types of derived process variables and the associated real-time process variable.

Table 3.02.C.8

Real-time Process Variable Type	Derived Process Variable	Description
Flow	Totalized Flow	Totalized flow process variable shall be defined for all flow process variables.
Level	Volume	A process variable representing tank volume shall be defined for all chemical and fuel storage tanks and shall be based on the real-time level process variable and the geometry of the storage tank.
Run Status	Accumulated Runtime	An accumulated runtime process variable shall be defined for all rotating equipment which has an associated run status tag defined in the tag database.

D. Data Logging: Data logging will be provided by the Owner. Tags representing the following types of process variables shall be defined in the tag database for data logging. This data shall support historical and real-time dynamic trending functions.

1. Flow

2. Process pressure

3. Wetwell level and volume

4. Power parameters representing line current, kilowatts, kilovars, kilovolt-amperes, and power factor.

E. Alarm Handling, Annunciation, and Logging:

1. Alarm handling, annunciation and logging will be provided by the Owner. All discrete tags representing alarm or trouble conditions shall be defined in the tag database to be processed as alarms. All analog tags shall have alarm thresholds defined in the tag database. The value of the alarm thresholds shall be defined by the Owner during the preparation of the Process Control System Implementation Plan.

2. The tag database shall be configured to implement alarm processing and annunciation as defined by the Process Control System Implementation Plan. Each tag's alarm definition shall prescribe whether the occurrence of the alarm condition is logged to journal, printed, or audibly annunciated or any combination thereof.

3. The Integrator shall coordinate alarm handling in the PLC logic (acknowledgement, reset, etc) with the Owner.

3.3 PROCESS CONTROL LOGIC DEVELOPMENT

The process control system control logic development shall include the preparation of control logic required to implement the specified control strategies and support the specified operator interface functions.

A. Organization:

1. The control logic shall be organized in a hierarchical structure which correlates to the actual process relationships. Individual control logic program files shall be prepared for each system or equipment item and shall be organized by process area. Data table files shall be similarly organized by process area. Data types shall be consistently applied throughout the control logic in accordance with the Process Control System Implementation Plan.

2. The control logic and data table organization shall facilitate the addition of future control logic.

B. Documentation: All control logic shall be completely annotated down to and including the instruction level. Each rung or statement of control logic shall be provided with annotation specific to its function. Each program file shall have a title and a detailed description of the

control strategy represented by the control logic. Terminology consistent with the Process Control System Implementation Plan shall be applied throughout.

C. Control Logic Implementation: The project control strategies outline the general control requirements of the treatment process and associated utility systems. In addition to the requirements of the control strategies, the following control features shall be implemented in the process control logic:

1. Fail to operate: All automatically operated equipment shall be monitored for failure to respond to control requests from the process control system. Upon a call to start, stop, open, close, etc., a fail timer shall be initiated. If the appropriate equipment status signal (run, off, full open, full closed) is not reported back to the process control system within the time duration defined by the fail timer, an alarm shall be initiated through the DCS.

2. Time based control: Process control logic for all equipment and processes controlled on the basis of time duration shall provide for operator access to the preset value of the time function through the MMI and report back to the MMI the instantaneous value of the time function associated value.

3. DCS Communication: Control logic shall be implemented to facilitate and optimize the communication of data between the DCS and the PLC. Paragraph 3.02 of this specification defines the types of tags to be defined in the tag database. Control logic shall be implemented as required to make the specified real-time data available to the DCS. Data of similar format (binary, integer, floating point, string, etc.) shall be grouped in data tables designated a communication buffer files. All tags defined in the tag database shall be addressed to the designated communication buffer files.

3.4 HISTORICAL DATA MANAGEMENT SYSTEM

A. The historical data management system development shall be provided by the Owner. The Contractor shall make the required information available to the DCS over the MODBUS TCP/IP Link..

Table 3.06

Process Variable Type	Sample Interval	Attribute			
		Total	Average	Maximum	Minimum
Flow	Hourly		X	X	X
	Daily	X			
Level	Daily		X	X	X
Power	Daily	X	X	X	X
Pressure	Daily		X	X	X
Equipment Run	Daily	X			
Volume/Weight	Daily		X	X	X

3.5 TESTING AND COMMISSIONING

A. The DCS interface shall be tested and commissioned in accordance with specification 13305.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 13305

PROCESS INSTRUMENTATION AND CONTROL SYSTEM TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies Contractor and Systems Integrator performance in testing and documentation of process instrumentation and control system materials and equipment (PICS).

B. The term instrumentation covers field and panel instruments, analyzers, primary sensing elements, transmitters, power supplies, and monitoring devices.

C. Provide the labor, tools, material, power, and services necessary to provide the process instrumentation and control system inspection and testing specified herein. Coordinate all testing with Section 01680:

D. Pre-Operational Performance Testing Sequence:

1. Wiring Testing

2. Installation Inspection

3. Instrumentation Calibration

4. Loop Testing

E. Functional Testing Sequence:

1. Process Control Strategy Testing

2. Control System Closed Loop Commissioning

3. Functional Checkout

F. Operational Testing: System Acceptance Testing (SAT)

1.2 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents with additional references listed in Section 13000.

2. All references shall be to the current edition of the document unless specifically stated otherwise. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

3. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no bids). If referenced documents have been discontinued by the issuing organization, reference to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

4. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ISA RP7.1	
ISA S51.1	Process Instrumentation Terminology

B. Project Labeling: The items specifying project labeling herein shall include the following as a minimum: Owner's name, facility name, project name, and project number.

1.3 SUBMITTALS

Submittal material, to be submitted in accordance with Section 01300, shall consist of the following:

A. Qualification Submittal: Provide the following submittal in accordance with Section 01300-Submittals:

1. Example test forms per paragraph 13305-3.01 D revised to show Project Labeling per paragraph 13305-1.02 D.

2. Example I/O interface summary per paragraph 13305-2.02 D.

B. Network Testing Qualification Submittal: Qualifications of independent industrial network testing firm and staff performing the inspection and testing.

C. Definition Submittal: Provide the following submittal after review of the Qualification Submittal.

1. Control descriptions per paragraph 13305-2.02 C.

2. I/O Interface Summaries per paragraph 13305-2.02 D.

3. Testing status spreadsheets per paragraph 13305-2.02 A. 3.

4. Test procedures per paragraph 13305-3.01 D.

5. Proposed test forms per PART 3 of this Section 13305, detailed for each test for this project.

6. Certified Factory Calibration Reports.

7. Provide a copy of this specification and the referenced and applicable sections with addenda updates included with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

8. Provide a copy of Section 13310 Instrument Index with Addenda updates included, marked to indicate requested deviations from specified requirements.

9. Provide a copy of all referenced and applicable Instrumentation Drawings with addenda updates included, marked to indicate requested deviations from specified requirements.

10. Provide a copy of all referenced and applicable Electrical Drawing's Control Diagrams with addenda updates included, marked to indicate requested deviations from specified requirements.

11. Failure to include a copy of the specifications and drawings with the submittal shall be cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.1 PRODUCT DATA

A. Provide the following product data submittal after completion of testing.

B. The following information shall be provided in accordance with specification Section 01300:

1. Completed test forms per PART 3.

2. List of factory calibrated items and calibration certificates.

3. Final Test Report assembled in a three-ring binder and submitted at the completion of the inspection and testing activities for a process area.

a. The binder cover and spine shall be labeled to identify the project name and process area. Test report shall include the applicable test procedures for the process area and the completed inspection and test report forms associated with the equipment and systems of that area.

b. Test results shall be organized by equipment item or system with individual, labeled tab dividers to identify each. System deficiencies and

non-compliant test results identified in the final test report shall be acknowledged by the responsible testing entity as corrected.

PART 3—EXECUTION

3.1 GENERAL

A. General Requirements:

1. Materials, equipment, and construction included under this specification shall be inspected in accordance with this section and subsequent sections of this division. Testing shall be performed by the Contractor in accordance with this and subsequent sections of this division.

2. No required test shall be applied without prior notice to the Construction Manager. Between 60 and 70 days before the commencement of any testing activity, the Contractor shall provide a detailed step-by-step test procedure complete with forms for the recording of test results, testing equipment used, and a place for identification of the individual performing or, if applicable, witnessing the test.

3. Provide detail assistance to the Contractor in generating Test forms, customized for this project. Submit detailed form prior to testing per the requirements of Section 01680.

B. Technician Qualifications:

1. Field instruments and analyzers shall be calibrated and set up by a certified instrument technician qualified to calibrate the instrumentation.

2. Technicians shall be qualified by completion and certification from training courses offered by The Instrumentation, Systems, and Automation Society (ISA), the instrumentation and analyzer manufacturer's training courses, or technician training courses at a recognized trade school that specializes in instrumentation calibration.

C. Test Equipment and Materials:

1. Provide test equipment to conduct the specified tests that simulate inputs and read outputs with a rated accuracy at the point of measurement at least three times greater than the component under test.

2. Test instruments shall have a current calibration sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required. Certified calibration reports traceable to the National Institute of Standards and Technology shall be included with the final test report.

3. Provide a documenting calibration system to conduct process instrumentation calibration activities that consist of a documenting process calibrator and an

instrumentation data management software system that captures the calibration results and electronically document instrument data, date of calibration, calibration procedures, and as-found and as-left instrument calibration data.

4. Provide an instrument calibration system such as Fluke 743B with Fluke DPC/Track Instrumentation Management software or similar system. Calibration files shall be submitted with the final test report in hard copy and electronic formats that does not require specialized equipment or software to read and print the files.

D. Field Test Procedure Documentation:

1. Test procedures submitted for approval within **60** days from the date of Notice to Proceed.

2. Test procedures for each analog and discrete loop in the process control system shall be organized and assembled in separate volumes for each process area. Final test records shall be submitted in electronic form by scanning and converting the records and files to Adobe PDF format, to preserve actual signatures and signoffs.

3. Test procedure documentation shall include a detailed, step-by-step description of the required test procedure, panel and terminal block numbers for points of measurement, input test values, expected resultant values, test equipment required, process setup requirements, and safety precautions.

4. Test report forms for each loop, including forms for wiring, and individual component tests, shall be included with the test procedure documentation. The actual test results shall be recorded on these forms and a final test report assembled as specified in paragraph 13305-3.05.

5. Test report forms shall be preprinted and completed to the extent possible prior to commencing testing. Test report forms that document the field test procedures shall include the following information:

a. Project name

b. Process area associated with the equipment under test.

c. Instrument loop description.

d. Instrument loop identification number.

e. Instrument nameplate data.

f. Instrument setup and configuration parameters.

g. Time and date of test.

h. Inspection checklist and results.

i. Reference to applicable test procedure.

j. Expected and actual test results for each test point in the loop including programmable controller data table or register values.

k. Test equipment used.

l. Space for remarks regarding test procedure or results, unusual or noteworthy observations, etc.

m. Name, date, and signature of testing personnel.

n. Test witness' name and signature.

E. Performance Deviation Tolerances:

1. Tolerances shall be specified in Division 13. Where tolerances are not specified, refer to the manufacturer's published performance specifications.

2. Overall accuracy requirements for loops consisting of two or more components shall be the root-summation-square (RSS) of the component accuracy specifications. Tolerances for each required calibration point shall be calculated and recorded on the associated test report form.

F. Installed Tests:

1. Section 01680 specifies testing of the mechanical, electrical, instrumentation and HVAC systems. The Contractor's Quality Assurance Manager shall coordinate, manage, and supervise the quality assurance program that includes:

a. Testing plan with the sequence for the test work.

b. Documentation program that records tests results.

c. Performance testing program systems.

2. Test forms provided shall conform to the requirements of reference forms 13300-A through 13300-K included in Section 01999. Additional or detailed forms shall be developed as necessary to suit complex instrumentation. Usage of terms used on test forms shall comply with ISA S51.1.

G. Witnessing: The Engineer reserves the right to observe factory and field instrumentation testing and calibration procedures. The Engineer shall be notified prior to testing, as specified herein.

3.2 FACTORY TEST

A. Factory Acceptance Test (FAT):

1. GENERAL: Control system equipment shall be subject to a Factory Acceptance Test. Control system panel programmable logic controllers shall be loaded with the PLC software, at the control system equipment supplier's factory prior to the FAT.

2. Equipment, panel instruments, panels, or cabinets shall be inspected with factory testing performed. Provide written notice to the Engineer thirty working days before the commencement of the FAT activity and include:

a. Schedule for the FAT.

b. Location of the FAT.

c. Testing equipment used.

d. Detailed test procedure with forms for the recording of test results.

e. Sign-off spaces for the individuals performing the tests.

3. FACTORY ACCEPTANCE TEST PROCEDURES: Panels provided shall be interlocked or networked as applicable, operated, and checked-out by the equipment supplier prior to the FAT. Submit certification indicating that the panels are ready for the FAT.

4. The FAT shall include the following:

a. Visual inspection of equipment, instruments, control panels, and graphic displays.

b. Validation of each input loop and output loop by simulated signals for analog inputs and by shorting discrete inputs.

c. Validation shall include:

1) Monitoring state changes on operator interface screens based on the inputs state change.

2) Observation of online PLC programming application software with the associated PLC outputs state change.

3) Outputs triggered by operator interface software devices (pushbuttons, sliders, manually-entered values, etc.)

4) Calibration and operation of instruments on or in the control panels.

d. Repair of loops which do not pass validation.

e. Retest of the FAT at no additional cost.

5. Panels that pass the FAT may be shipped to the site upon shipping schedule and storage accommodation approval by the Construction Manager.

3.3 PRE-OPERATIONAL PERFORMANCE TESTING

A. General Requirements: In general, tests shall be performed in the following order:

B. Wiring Tests: Electrical power and signal cable ring-out and resistance testing. Conducted in accordance with Sections 16000 and 16030. Wiring tests shall not be conducted until cables have been properly terminated, tagged and inspected.

1. Power and Control: Per Section 16030.

2. Signal: Test form 13300-A.

C. Instrument and Component Inspection: PICS components inspection activities include the following:

1. Compare and validate instrument type and nameplate data with the drawings, specifications, and data sheet.

2. Validate instrument identification tag.

3. Confirm instrument installation conforms to drawings, specifications, and manufacturer’s instructions.

4. Verify proper conductor termination and tagging.

5. Visual check for physical damage, dirt accumulation, and corrosion.

6. Verify including isolation amplifiers, surge protection, and safety barriers are properly installed.

7. Report deficiencies identified within 24 hours of discovery. No instrument or system component shall be tested until all deficiencies are addressed.

E. Instrumentation Calibration:

1. Instruments and final elements shall be field calibrated in accordance with the manufacturer's recommended procedures and tested in accordance with the Contractor's test procedure.

2. Individual Component Calibration and Testing shall not commence until Instruments and Component Inspections are completed and documented to the satisfaction of the Engineer.
3. Analog instrument calibrated at 0, 10, 50, 90, and 100 percent of the specified full scale range. Each signal sensing trip and process sensing switch shall be adjusted to the required setting. Test data recorded on test forms as specified herein

4. Final element alignment tested and adjusted to verify that each final element operates smoothly over the full range in response to the specified process control signals

5. Test data shall be entered on the applicable test forms at the time of testing: Alarm trips, control trips, and switches shall be set to initial values specified in Section 13310 Instrument Index at this time. Final elements shall be checked for range, dead-band, and speed of response.

6. Any component that fails to meet the required tolerances shall be repaired or replaced by the manufacturer. Repeat the specified tests until the component is within tolerance.

7. Install a calibration sticker on each instrument following successful calibration that indicates the date of calibration, the name of the testing company, and personnel who calibrated the instrument.

8. Test forms **13300-C through 13300-I**.

9. Certified Test Reports: Field test and inspection activities include verification of instrument parameter setup, verification of instrument zero, and performance at three operating points within the instrument range. Instrument which fail to demonstrate proper performance shall be returned for re-calibration or replaced as agreed depending on the impact to the project as determined by the Construction Manager.

10. Where instrument field calibration is not feasible, certified factory calibration reports may be submitted that includes the name and address of the laboratory that conducts the calibration testing. Certified factory test reports may be submitted for the following instrument types in lieu of field calibration:

TABLE-A. FACTORY CALIBRATION INSTRUMENT LIST

Instrument Identification	Instrument Section	Description
FM	13312	Magnetic Flow Meter

F. Loop Testing:

1. Loop Testing shall not commence until the Individual Component Calibration and Testing has been completed and documented to the satisfaction of the Engineer.

2. Each instrument loop shall be tested as an integrated system. Check operation from field instruments to transmitter to receiving components to the vendor panel or the Plant Control System Operator Interface Station. Test signals shall be injected at the process impulse line connection where the measuring technique permits, and otherwise at the most primary signal access point.

3. Testing of loops with an interface to a programmable logic controller shall include verification of the programmable logic controller input/output assignment and verification of operation of the input/output system and processor. Inspect the data table or register in the programmable logic controller memory to verify proper operation.

4. If the output control or monitoring device fails to indicate properly, corrections to the loop circuitry or device shall be made. The test shall be repeated until devices and instruments operate as required.

5. Correct loop circuitry and repeat the test until the instruments operate properly.

6. Test form 13300-J.

3.4 FUNCTIONAL TESTING

A. Process Control Strategy/Functional Testing:

1. Control Strategy Testing shall not commence until the Loop Testing has been completed and documented to the satisfaction of the Engineer.

2. Control Strategy Testing is performed by the Programmer and witnessed by the Engineer and consist of installing and debugging the PLC control logic program, verifying the interface points between the PLCs and field devices and equipment, and exercising the control strategies. Control Strategy Testing will be performed on one PLC at a time.

3. Provide qualified personnel to immediately correct any deficiencies in the Work that may be encountered during Control Strategy Testing. Failure of the Contractor to provide such personnel in a timely manner may prolong the time allotted to complete Control Strategy Testing.

B. Control System Closed Loop Testing:

1. Closed-Loop Commissioning shall not commence until the Control Strategy Testing has been successfully completed and documented to the satisfaction of the Engineer

2. Closed-loop commissioning tests, performed as part of the system tests, shall demonstrate stable operation of each loop under operating conditions. Tests shall include adjustment of loop tuning parameters.

3. Tuning parameters: gain (or proportional band), integral time constant, and derivative time constant for each control loop, adjusted to provide 1/4-amplitude damping, unless otherwise specified.

4. The loop response to a step disturbance shall be provided for each loop. Two graphs shall be made for cascaded control loops, one showing the secondary loop response with its set point in manual, and the second showing overall loop response.

5. Control loops with "batch" features shall be adjusted to provide optimum response following start-up from an integral action saturation condition.

6. Graph recording shall be provided showing the response and made at sufficient speed and amplitude to show 1/4 amplitude damping. Label to show loop number and title, and settings of parameters and set point.

7. Where a loop is controlled under the direction of a programmable logic controller, the Engineer will perform the necessary adjustment of loop tuning parameters and setpoints; Contractor shall record the loop response, adjusting final elements, and assuring total integrated loop performance as specified.

C. Functional Checkout: Conducted to verify the operation of discrete and hardwired control devices, refer to Section 01680. Exercise the operable devices and energizing the control circuit. Operate control element, alarm device, and interlocks to verify the specified action occurs.

3.5 OPERATIONAL TESTING

A. System Acceptance Test (SAT) shall be performed after component and subsystem tests have been completed. The test of the completed system shall be performed in full operation and shall demonstrate that all functional requirements of this specification have been met. SAT shall demonstrate the following:

1. Each component of the system operates correctly with all other components of the system.

2. Analog control loops operate in a stable manner.

3. Hard-wired and software equipment interlocks perform correctly.

4. Process control sequences perform correctly.

5. PLC application program performs monitoring and control functions correctly.

6. Operator interface graphics represent the monitoring and control functions correctly.

** END OF SECTION **

SECTION 13310

INSTRUMENT INDEX

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This section specifies the Instrument Index and general requirements applicable to process instrumentation and analyzer systems consisting of process sensors, process indicators, signal conditioning module, control and monitoring devices, transmitters, and accessories.

2. The Contractor shall provide, calibrate, and test the complete process instrumentation and analyzer systems and place in operation and test the system. Testing includes tuning loops and making final adjustments to instruments and analyzers during facility start-up.

3. The Contactor shall provide the services of certified instrument technicians for testing and adjustment activities as specified in Section 13300.

4. The Contractor shall examine the mechanical drawings and specifications to determine actual locations, sizes, materials and ratings of process connections. Process taps shall be indicated on pipe shop drawings as specified in paragraph 15050-2.04.

1.2 REFERENCES

A. Refer to Section 13300 – General Requirements for Instrumentation and Control.

B. Refer to Section 13305 – Process Instrumentation and Control System Testing.

1.3 SUBMITTALS

A. Refer to Sections 13300 and 13305.

PART 2 - PRODUCTS

2.1 INSTRUMENT INDEX

A. The Instrument Index, paragraph 13310-3.3, lists instruments and analyzers required for the project. Instrument functions specified on this list shall be provided by the Contractor.

B. Additional instrumentation devices such as process taps, seals, and other items required to complete the instrument loops due to characteristics of the equipment selected by the Contractor and not specified in the instrument index or on the contract drawings shall be provided at no additional cost to provide a complete working system.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Materials, equipment, and installation shall be tested and inspected per Sections 13300, 13305, and this section.

B. Provide buffer solutions and reference fluids for analytical equipment test procedures.

3.2 INSTALLED EQUIPMENT - TESTS AND INSPECTION

A. Refer to Section 13305 – Process Instrumentation and Control System Testing.

3.3 INSTRUMENT INDEX

The following is an index of the instrumentation equipment, analyzers, and devices.

A. Description of Headings:

1. Tag Number: Tag Number appears as a heading (PREFIX and NUMBER) and consists of a two, three or four letter prefix indicating the instrument function followed by a number identifying the process loop with which the instrument is associated. Tag Number provides an identification of the instrument, analyzer, or device.

2. Description: Provides the functional description of the instrument, analyzer, or device.

3. P&ID Number: Lists the Process and Instrumentation Diagram on which the instrument, analyzer, or device appears.

4. Specification: Provides the specification reference and “INSTRUSPEC” designation for the instrument, analyzer, or device.

5. Range: Provides the calibrated instrument range for each application.

6. Setpoint: Provides the calibrated switch setpoint.

7. Comments: Provides the features, interlocks, and information applicable to the instrument, analyzer, or device.

INSERT INSTRUMENT INDEX SCHEDULE HERE

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

Plant Code	Tag Area Code	Tag Function Abb.	Tag Loop Identifier	Tag Suffix 1	Tag Suffix 2	Device Function	Size or Connection	Instrument Range	Operating Range	Min Calibration or Setpoint	Max Calibration or Deadband	Units	Signal Type	Power Req.	Comments	Device Type	Specification Number	P&ID Number	Installation Detail Number
M	03	LE/LIT	100			Level Transmitter, Ultrasonic	Bracket	0-50	0 - 25			Ft	4-20 mA	Loop	Class 1 Div 2 Area	LUT	13312	I-003	
M	03	LE/LIT	101			Level Transmitter, Radar	Bracket	0-50	0 - 25			Ft	4-20 mA	Loop	Class 1 Div 2 Area	LRFM	13312	I-003	
M	03	LSHH	100			Level, float				20.5				NA	Class 1 Div 2 Area	LFS	13316	I-003	
M	03	LSLL	100			Level, float				2.5				NA	Class 1 Div 2 Area	LFS	13316	I-003	
M	03	PSH	110			Pressure Switch					16	PSIG		NA		PS	13316	I-003	
M	03	PSH	120			Pressure Switch					16	PSIG		NA		PS	13316	I-003	
M	03	FE/FIT	125			Flow Meter			300 - 800			GPM	4-20mA	120 VAC		FM	13312	I-003	
M	03	LE/LIT	130			Level Transmitter, Radar	Bracket	0-50	0-30			Ft	4-20mA	Loop	Class 1 Div 2 Area	LRFM	13312	I-003	
M	03	AE/AIT	103			Ambient Air Analyzer	Bracket	0-100	0-100			% LEL			Class 1 Div 2 Area	MI	13312	I-003	
M	03	AE/AIT	107			Ambient Air Analyzer	Bracket	0-100	0-100			% LEL			Class 1 Div 2 Area	MI	13312	I-003	
M	03	AE/AIT	109			Ambient Air Analyzer	Bracket	0-100	0-100			% LEL			Class 1 Div 2 Area	MI	13312	I-003	
** END OF SECTION **																			

SECTION 13312

TRANSMITTERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies requirements for process parameter transmitters, associated indication devices, and accessories.

B. The application requirements are specified in the Instrument Index - Section 13310.

1.2 REFERENCES

A. References shall be as specified in Section 13300.

1.3 SUBMITTALS

A. Submittals shall be provided as specified in Sections 01300 and 13300, including:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Referenced and applicable sections to be marked up and submitted include:

   a. Section 01664 - TRAINING

   b. Section 01730 – OPERATING AND MAINTENANCE DATA

   c. Section 13300 - GENERAL REQUIREMENTS FOR INSTRUMENTATION AND CONTROL

   d. Section 13310 – INSTRUMENT INDEX

2. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

3. A copy of the contract document Control Diagrams and Process and Instrumentation Diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked *"no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

4. Marked Contract Document Mechanical and/or Electrical Plan drawings, sections, and details showing sensor installation locations and details. *Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

5. Marked product literature of all equipment and features to be provided.

6. Installation drawings for only the transmitters, sensors, and mounting accessories to be provided.

7. Electrical and signal connection drawings for only the transmitters and sensors to be provided.

8. List of miscellaneous items, cables, spare parts, that will be provided in accordance with INSTRUSPEC sheet requirements.

9. Marked product literature for surge protectors.

PART 2 - PRODUCTS

2.1 GENERAL

A. Measuring elements and transmitters shall comply with the following requirements:

1. Measured parameter output indicators complying with paragraph 13312-2.02 shall be provided with any transmitter that does not include an integral indicator. Indicators, whether integral or separate, shall be calibrated in process units, and engraved on the indicator scale plate.

2. The two-wire type transmitters shall have operating power derived from the signal transmission circuit.

3. Transmitters shall meet specified performance requirements with load variations within the range of 0 to 600 with the power supply at a nominal 24 volts DC with the default range of 0 to 100% corresponding to 4 to 20 mA DC.

4. Transmitter output shall increase with increasing measurement.

5. Time constant shall be adjustable from 0.5 to 5.0 seconds for transmitters used for flow, level transmitters used for flow measurement, or pressure measurement.

6. Transmitter output shall be galvanically isolated via electro-mechanical or optical technology.

7. Transmitter enclosures shall be rated NEMA 250, Type 4, unless otherwise specified.

8. Transmitters located outdoors shall be provided with surge protectors:

   a. Signal: Emerson/Rosemount Model 470 D, Emerson/EDCO SS64-036-2, CCI SPN-42 FS28 Series, or accepted equal.

   b. AC Power: UL 1449, LED indicator, screw terminal connections, NEMA 4X. EDCO HSP121A or accepted equal.

9. Two-wire transmitter located in a facility area classified as hazardous per the NFPA and the NEC shall be made safe by means of an intrinsic safety barrier as specified in paragraph 13312-2.03.

10. Four-wire transmitters shall be isolated from the process and power or provided with a loop-powered signal current isolator as specified in paragraph 13312-2.05 connected in the output signal circuit.

2.2 PROCESS PARAMETER OUTPUT INDICATOR

A. Provide digital LED or LCD indicators that integral to the instrument housing where available from the manufacturer. Displays shall be scaled in engineering units, over the calibrated range of the instrument. Calibrate the indicator scale in process units.

B. Analog output indicators shall be 2.5-inch milli-ammeter with 90-degree movement enclosed in a NEMA 7/9 rated meter case. Provide indicators with accuracy within two percent of span. Provide a diode to maintain loop continuity for indicator removal.

2.3 INTRINSIC SAFETY BARRIERS

A. Intrinsic safety barriers for two-wire transmitters shall be of the active, isolating, loop powered type. Barrier shall be Measurement Technology LTD Type MTL7700, Stahl Series 9000, Accepted equal.

2.4 INSTRUMENTATION SPECIFICATION SHEETS (INSTRUSPEC)

A. General requirements for instruments specified in this section are listed on INSTRUSPEC sheets in paragraph 13312-3.03.

B. Application requirements are specified in the Instrument Index, paragraph 13310-2.03, and/or on the drawings.

2.5 SIGNAL CURRENT ISOLATOR

A. Isolator shall provide galvanic isolation of milliampere transmission signals from transmitters. Isolator shall be housed in a NEMA 250, Type 4/7 conduit body and derive operating power from the signal input circuit.

B. Input and output signals shall be 4 to 20 milliamperes, and error shall not exceed 0.1 percent of span. Input resistance shall not exceed 550 ohms with an output load of 250 ohms.

C. Isolator shall be Moore Industries SCX 4-20madc to 4-20madc / 5.5VPL / -RF DIN rail mounted with maximum 250 Ohm output impedance, or equal.

2.6 PRODUCT DATA

A. The following data provided in accordance with Section 01300:

1. Operating and maintenance information as specified in paragraph 13300-2.03. Include final reviewed submittal and separate record of all final configuration, jumper, and switch settings for each transmitter.

2. Test results as specified in Section 13305-Part 2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation requirements are specified in paragraph 13300-3.1.

3.2 TESTING

A. Testing requirements are specified in Section 13305.

3.3 INSTRUMENT SPECIFICATION (INSTRUSPEC) SHEETS

A. General requirements for instruments specified in this section are listed on INSTRUSPEC sheets herein. Application requirements are specified in the Instrument Index, paragraph 13310-3.03, and/or on the drawings. INSTRUSPEC sheets for the transmitters listed in the following Table A are included in this paragraph:

Table A: Process Monitors and Indicating Transmitters

INSTRUSPEC Symbol	Instrument Description	Instrument Function
FM	Magnetic Flow Transmitter	Flow Measurement
LRFM	Radar Level Transmitter, 80 GHz	Water Level Measurement
LUT	Ultrasonic Level Transmitter	Wastewater Level Measurement
MI	Combustible Gas Infrared Detector	Ambient Air Analyzer

3.4 INSTRUMENT IDENTIFICATION: FM

A. Instrument Function: Flow Measurement

B. Instrument Description: Magnetic Flow Metering System

C. Signal Input: Process

D. Signal Output: Analog signal as specified in paragraph 2.02.

E. Process Connection:
   1. Flow tube shall be flanged, ANSI B16.5, Class 150, raised face.

F. Product Requirements: Magnetic flow meter provided as a system consisting of a flow tube with separate indicating transmitter, unless otherwise scheduled in the Section 13310 Instrument Index, complete with interconnecting cables of sufficient length between the flow tube and the transmitter.
   1. Indicating transmitter for full-scale flow rates from 1.0 to 30 feet per second. System error shall not exceed the greater of 0.5 percent of flowrate or 0.1 foot per second from 3 to 30 feet per second.
   2. Flow Tube: Shall be rated NEMA 6P for continuous submergence up to 20 feet. Flow tube shall be suitable for installation in "Hazardous" classified spaces.
   3. Grounding Rings: Provide up-stream and downstream 316L stainless steel grounding rings shall be fabricated from the same metal as for the electrodes below.
   4. Electrodes: Shall have conical shaped probes that are cleaned by the velocity of the flow stream. Probes shall be manufactured of 316L stainless steel, Hastelloy C4 or titanium unless otherwise specified in Section 13350.
   5. Liner: Hard rubber.
   6. Transmitter: Contain electronics associated with the magnetic flow meter system. Enclosure rating NEMA-4X, cast aluminum or metal compartment for power, field connections and calibration adjustments separate from digital circuitry.
      a. Means to calibrate the metering system without use of external calibration units. Transmitter self-diagnostics. Traceability certificate of actual flow lab certification provided with each flowtube.
      b. Integral 4-digit LCD flow indication calibrated in process units. Data retained in non-volatile memory.
      c. Internal circuitry to drive flow signal to zero upon flow meter determined empty pipe condition.
      d. Provision for accepting an external contact to force signal output to zero provided.

G. Manufacturers:
      a. ABB Magmaster MFE
      b. Endress + Hauser Promag 50W/53W
      c. Krohne Optiflux 4000
      d. Accepted equal.

3.5 INSTRUMENT IDENTIFICATION: LRFM

A. Instrument Function: Level Measurement

B. Instrument Description: Radar Level Transmitter:
   1. Type-1: Frequency Modulated Continuous Wave (FMCW)

C. Power Supply: Loop.

D. Signal Input Process

E. Signal Output: 4-20 mA

F. Signal Converter/Transmitter:
   1. Signal type-1: FMCW radar, 80 GHz range, maximum output power of 1.0 mW.
   2. Enclosure: NEMA 4X integral mount.
   3. Operator Interface: LCD display, scaled in engineering units, with soft-keys for scrolling and configuration.
   4. Networks: HART standard.
   5. Measuring range: 0-150 ft.
   6. Accuracy: ±0.5 inch
   7. Analog Output: One isolated 4-20 mA, minimum of 300Ω.
   8. Ambient Temperature Range: -20 to +140°F.
   9. Process Temperature Range: -40 to +600°F
   10. Pressure Range: full vacuum to 250 psig.
   11. Sensor: Flush mounted
   12. Process Connection: 6 inch 150 pound ANSI flange.
   13. Wetted Materials: 316 SS, PTFE, PVDF, Viton, or as approved.
   14. Accessories:
      a. Provide mounting hardware and cable length glands.
      b. Provide Hart data communication interface and software for field programming.
   15. Acceptable Manufacturer:
      a. Endress + Hauser MicroPilot FMR62.
      b. VegaPuls 64
      c. Accepted equal.

G. Execution:
   1. Installation: Install in accordance with manufacturer's instructions and the Engineer's installation detail.

3.6 INSTRUMENT IDENTIFICATION: LUT

A. Instrument Function: Level Measurement

B. Instrument Description: Ultrasonic Level Transmitter

C. Power Supply: Loop powered (24Vdc)

D. Signal Output: 4 to 20 milliamperes at 24Vdc into 0 to 550 ohms

E. Process Connection: As shown or specified

F. Signal Converter / Indicating Transmitter:
   1. Processor: Selectable algorithms for level, volume, or flow.

2. Flow: Parshall Flume, Weir, or configurable flow device.

3. Indicator: 4-digit LCD with integral display, scaled in engineering units.
   a. Accuracy: 0.25% of level range.
   b. Enclosure: NEMA 4X
   c. Accessories:
      1) Mounting hardware and cable glands.
4. Programming software and cable length as required.

5. Acceptable Manufacturer:
   a. ABB LST300.
   b. Accepted equal.

G. Sensor:
   1. Measuring range: 1 to 33 feet
   2. Beam Angle: 5° maximum
   3. Pressure Limit: 30 psi
   4. Temperature Limits: -40 to +175°F.
   5. Wetted Materials: PVDF
   6. Cable: #16 to #20 TSP with PVC jacket
   7. Maximum Sensor/Transmitter Separation: 1200 ft.
   8. Rating: Class I, Div. 1, Groups A, B, C & D.

H. Execution:
   1. Installation: Install in accordance with manufacturer's instructions and the Engineer's installation detail.
      a. Contractor to verify size and type of specified process connection with approved submittals.
      b. Transducer rigidly mounted and accurately leveled.
      c. Transmitter integral or stand mounted as specified.

3.7 INSTRUMENT IDENTIFICATION: MI

A. Instrument Function: Ambient Air Measurement

B. Instrument Description: A complete, factory provided unit including sensor and analyzer/transmitter that measures combustible gas concentrations (as a % of Lower Explosive Limit (LEL)) in ambient air using infrared technology. Sensor and analyzer/transmitter shall be compatible with the environmental classification(s).

C. Power Supply: 8 – 30 VDC.

D. Signal Output:
   1. 4 to 20 mA
   2. Two SPDT outputs rated at 5 A at 120 VAC.

E. Product Requirements:

1. Sensor and analyzer/transmitter shall be from the same manufacturer.
2. Analyzer/transmitter shall have an integral LCD display.
3. The unit assembly shall be approved by Factory Mutual.
4. The detector shall operate on the infrared absorption principle incorporating a heated double-compensated optical bench (2 lamps, 2 detectors) with non-focusing optics design.
5. The analyzer/transmitter shall be microprocessor controlled and shall perform self-diagnostics with error indications such as "Beam block", indicating the beam is more than 80 percent interrupted by dirt or impurities. The detection shall automatically compensate for temperature and humidity changes in the surrounding atmosphere.
6. Performance Parameters:
   a. Range: 0 – 100% LEL.
   b. Temperature Range: -40 F to 140 F.
   c. Zero Drift: ±2%/year.
   d. Repeatability: ±1% full scale.
   e. Linearity: ±5% full scale.
   f. Response Time (T90 combustible): <2 seconds.
   g. Humidity: 0% - 95% RH, non-condensing.
7. Calibration Kit: Provide manufacturer's recommended calibration kit consisting of the following:
   a. Provide two cylinders of zero and span gas; one pair of zero and span gas shall be used by the Contractor for initial calibration, the second pair shall be delivered to the owner.
   b. Flow regulator(s) with tubing.
   c. Environmental guard (if needed).
   d. Carrying case.
   e. Controller for configuration, one for all analyzers.

F. Manufacturers:

MSA Safety Ultima XIR, or equal.

G. Execution:

1. Installation: Sensor and analyzer/transmitters shall be installed in accordance with manufacturer's recommendations. Sensor mounted near the most likely area of a leak or gas source. For methane gas, whose density is less than air, the sensor shall be mounted close to the ceiling. Remote-mounted sensors shall be mounted within the manufacturer's recommended distance(s).
2. Configure alarm contacts to open upon alarm for the following:
   a. Trouble.
   b. Gas level/concentration alarm.
3. Application/Calibration: In accordance with Section 01664.

** END OF SECTION **

SECTION 13316

PROCESS SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for process activated switches, devices, and accessories.

A. Scope: This section specifies requirements for instrumentation devices, which form a part of the process control systems. Application requirements are as specified in the Instrument Index, paragraph 13310-3.3.

B. Operating Requirements: The devices specified in this section quantitatively convert the measured variable energy into a form suitable for process measurement and control.

1.2 QUALITY ASSURANCE

A. Manufacturer: Equipment furnished under this section shall be the products of firms regularly engaged in the design and manufacture of such equipment for a minimum of five years.

B. Installer: Installation, calibration and testing of equipment furnished under this section shall be performed by qualified, skilled, Certified Technicians specified in Section 13300, who are regularly engaged in such activities involving systems of similar complexity.

C. References: References are listed in Section 13300 and are a part of this section as specified and modified.

1.3 ENVIRONMENTAL CONDITIONS

A. Equipment provided under this section shall be suitable for operation under ambient conditions described in paragraph 13300-1.3.

1.4 SUBMITTALS

A. Submittals shall be provided as specified in Sections 01300 and 13300, including:

1. A copy of this specification section, referenced and applicable sections, with addendum updates included and with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Referenced and applicable sections to be marked up and submitted include:

    a. Section 01664 - Training

    b. Section 01730 - Operating and Maintenance Data

c. Section 13300 - General Requirements for Instrumentation and Control

d. Section 13310 - Instrument Index

e. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, **then** each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

f. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

g. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. A copy of the contract document Control Diagrams and Process and Instrumentation Diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal.

   If no changes are required, the drawing or drawings shall be marked "no changes required". *Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

3. Marked Contract Document Mechanical and/or Electrical Plan drawings, sections, and details showing sensor installation locations and details. *Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

4. Marked product literature of all equipment and features.

5. Installation details for the process switches and mounting accessories.

6. Electrical and signal connection drawings for process switches and devices.

PART 2 - PRODUCTS

2.1 GENERAL

A. Process switches and devices shall comply with the following requirements:

1. Contact outputs used for alarm actuation shall be normally-closed or normally-opened as required by the process condition to open to initiate the alarm.

2. Contact outputs used to control equipment shall be normally-opened and shall close to start the equipment.

3. Contacts monitored by solid state equipment such as programmable controllers or annunciators shall be hermetically sealed and rated for switching currents from 20 to 100 mA at 24 volts DC.

4. Contacts, monitored by electromagnetic devices such as mechanical relays, shall be rated as NEMA ICS 2, designation B300.

5. Double barriers provided between switch elements and process fluids such that failure of one barrier will not permit process fluids into electrical enclosures.

6. Switch electrical enclosures rated as NEMA 250, Type 4 minimum.

7. Switch contacts located in Class I, Division 1 areas and monitored by solid-state circuits shall be made safe by intrinsic safety barriers as specified herein.

8. Switch range shall be selected so that the specified set point is at least 30 percent but not more than 70 percent of the span, between the upper range limit and the lower range limit.

2.2 INSTRUMENTATION SPECIFICATION SHEETS (INSTRUSPEC)

A. General requirements for instruments specified in this section are listed on INSTRUSPEC sheets in paragraph 13316-3.03.

B. Application requirements are specified in the Instrument Index, paragraph 13310-3.03, and/or on the drawings.

2.3 PRODUCT DATA

A. The following data shall be provided in accordance with Section 01300:

1. Operating and maintenance information as specified in paragraph 13300-2.03. Include final reviewed submittal and separate record of all final and switch settings.

2. Test results as specified in Section 13305-Part 2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation requirements are specified in paragraph 13300-3.1.

3.2 TESTING

A. Testing requirements are specified in Section 13305.

3.3 INSTRUMENT SPECIFICATION (INSTRUSPEC) SHEETS

A. General requirements for instrumentation specified are listed on INSTRUSPEC sheets herein. INSTRUSPEC sheets for the process switches listed in the following Table A are included in this paragraph:

Table A: Process Switches

INSTRUSPEC Symbol	Instrument Description	Instrument Function
LFS	Float Switch, Free Floating	Level Measurement
PS	Pressure Switch	Pressure Measurement

3.4 INSTRUMENT IDENTIFICATION: LFS

A. Instrument Function: Level Measurement

B. Instrument Description: Float Switch, weighted

C. Power Supply: N/A

D. Signal Input: Process

E. Signal Output: Contacts, in accordance with paragraph 2.02 of this section.

F. Process Connection: N/A

G. Product Data:

1. Switch shall be weighted type, suspended from an oil resistant waterproof cable. The cable designed to support the weight of the float without additional strain relief and permanently sealed where it enters the float body.
2. The conductors shall be a minimum size of 18 AWG. The switch shall be a single pole double throw dry contact type and rated at not less than 10 amperes at 120 Vac. Mercury switches are not acceptable. The float shall have a PVC or ABS corrosion and impact resistant shell.
3. The switch shall be rated for installation in the area classification shown on the drawings.

H. Execution:

1. Installation: Install in accordance with the manufacturer's instructions, the drawings, and the specified functional requirements.
2. Test: In accordance with Section 13305.
3. Application/Calibration: In accordance with Section 13310. Switch set point and reset point adjusted as specified. I.
4. Approved Manufacturers: Flygt ENM-10eX, Mercoid FSW2, or approved equal.

3.5 INSTRUMENT IDENTIFICATION: PS

A. Instrument Function: Pressure Measurement

B. Instrument Description: Pressure Switch

C. Signal Input: Process

D. Signal Output: As specified in paragraph 2.02

E. Process Connection: 1/2-inch female NPT

F. Product Requirements:

1. Pressure switch shall consist of a pressure transducer and a precision switch. Pressure transducer shall be the diaphragm piston type with wetted materials as recommended by the switch manufacturer. Piston backed by a cylinder disc to permit 10 times over-range pressure without affecting calibration.
2. Range spring and piston shall be isolated from process fluids by the diaphragm. Switch provided with two 3/4-inch conduit connections. Switch assembly housing shall be cast aluminum rated types 3, 4, and 7D per NEMA ICS6. Contractor shall select pressure transducer so that set point falls between 30 and 70 percent of maximum range.
3. Approximate set point and, if applicable, reset point indicated on calibrated scales. Repeatability and sensitivity shall be 1.0 percent of operating range. Unless otherwise specified, switches nonadjustable deadband type. G. Approved Manufacturers: SOR Inc. Static-O-Ring, Mercoid Series 1000, or equal.

G. Execution:

1 Installation: Install in accordance with manufacturer's instructions and to the specified requirements.
2. Application/Calibration: Application, calibration, and set points as specified in Section 13310.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 13370

INSTRUMENT AND CONTROL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This section specifies requirements for panels, cabinets for instrument, control, and communication equipment for the MBC Storm Drain Diversion Project per the Panel Schedule herein.

2. Provide the instrument, control, and monitoring features indicated on the P&ID and electrical drawings. Panels shall be arranged to separate control and instrument devices from power wiring. Panel shall be arranged for dedicated field wiring terminations rated for 600 Vac or less for power, control, and instrument signal wiring shall be fabricated by a UL-508A recognized facility and shall bear the appropriate UL 508A Industrial Control Panel label. Panels for Hazardous (Classified) Locations shall bear the appropriate UL 698A label.

3. Transmitters, Analyzers, signal conditioning modules and other equipment or devices as specified in the other Division 13 sections.

4. Panels that contain programmable logic controllers (PLC) and operator interface stations (OIS) units shall be as indicated in the Panel Schedule. Specific panel devices are specified herein and in Section 16175 – Miscellaneous Electrical Devices.

5. PLC and OIS shall comply with the specified products in Division 13. Panels that do not comply with the specified products and specified logic method, hardwired or PLC logic, shall not be accepted. Cost to retrofit the panel as specified shall be borne by the panel supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier's facility for corrections, testing, relabeling and inspection.

6. Field modifications require a UL inspector site inspection for approval of panel corrections and to re-label the panel after the field modifications are completed.

7. Refer to Local Control Panels - Section 16485 that specifies requirements for manufacturer, vendor, and Contractor provided panels that include motor controllers, combination motor starters, control devices, and logic devices as shown on the electrical drawings.

B. Panel Schedule:

	Panel No.	Spec / P&ID	Features *	Enclosure Type	Panel Title	E-Dwgs / Notes
1	M-03-LCP-002	13370 / I-004	1, 5, 7, 9	NEMA-4X	MBC Storm Drain Diversion Control Panel	

1 - Programmable Logic Controller (PLC) or Remote I/O devices*
2 - Panel mounted Operator Interface Station (OIS)*
3 - Hardwired control logic required*
4 - Windowed outer door and inner door for displays or devices.*
5 - UPS*
6 - Fans*
7 - Heating*
8 - Air Conditioning*
9 - Sun/Rain Hood*

C. Panel Design:

1. General: Panel hardware and software is specified in other Division 13 sections.

2. Control Power Distribution: Panel containing 120-volt powered equipment shall use the din-rail power distribution method with fuses and blown fuse indication. Power is restricted to 120 Vac and 24 Vdc.

3. Power Supplies: Panel containing direct current powered instruments or serving as the termination point for transmission loop powered field instruments shall contain direct current power supply system as specified herein.

4. Electrical Control Devices: Pushbuttons, indicating lights, relays, and similar equipment located in panels specified in this section shall comply with the requirements of Section 16175.

6. Uninterruptible Power Supplies: Panel mounted 120 Vac input and 120 Vac output are specified herein.

1.2 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents that are part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid or on the effective date of the Agreement if there were no Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

3. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
EIA RS-310C	Racks, Panels, and Associated Equipment
NEMA 250	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508A	Industrial Control Panels
UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

B. This Section references other sections with associated work specified therein:

1. Section 01680 specifies Equipment and System Performance and Operational Testing with reference to Contractor's Quality Assurance Manager that is responsible for startup commissioning of system including mechanical, HVAC, electrical, and instrumentation system.

2. Section 16000 specifies raceways, conductors, and device requirements.

3. Section 13305 Instrumentation and Control System Testing

4. Section 13375 Programmable Logic Controller, and software requirements.

5. Section 13301 Control Specifications.

C. Listed Products:

1. Equipment and components shall be Underwriters Laboratory (UL) listed for the purpose per Section 16000 or UL recognized.

2. The control panels shall have factory applied UL 508A labels. Where intrinsic safety barriers are used within a control panel, provide UL 698A factory applied label as required by UL.

D. Factory Testing: Prior to shipment, the manufacturer shall test the functional operation of the control panel as described in the control specifications Section 13301.

E. Shipment, Protection and Storage: Equipment shipment, protection and storage shall conform to the requirements specified in Section 01605.

1.3 SUBMITTALS

A. General: Submittals and transmittal procedures for submittals are defined in Section 01300. Submit In accordance with the procedures set forth in Sections 00710 and 01300 that include drawings, information and technical data for equipment and as required in Section 13300. Submittal information shall be included in one complete submittal.

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

2. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

3. The Owners Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

4. A marked copy of specification Section 13300.

5. A marked copy of specification section 13305.

6. A marked copy of specification section 01680.

7. A marked copy of specification section 16175.

8. A marked copy of specification section 16485.

9. A copy of the contract document Process and Instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". *Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.*

10. Marked contract document Control Schematic diagrams related to the submitted equipment.

11. Marked contract document Control Single Line diagrams related to the submitted equipment.

12. Marked product literature of all the enclosure electrical devices and components mounted on or within the control panel.

13. List of miscellaneous items, cables, spare and replenishment parts, and chemicals to be provided, including MSDS information.

14. Dimensioned drawings:

    a. Exterior panel and layout
    b. Interior devices and layout
    c. Door-in-door construction devices, where required

15. Panel assembly drawings including sections showing clearances between face and rear mounted equipment.

16. Nameplate engraving schedule:

    a. Indicate engraving by line
    b. Character size
    c. Nameplate size
    d. Panel and equipment tag number and description

17. Heat load calculations for each cabinet based on the highest ambient temperature listed in Section 13300 for the area in which the subject panel will be located.

18. Wiring drawings:

    a. Schematic diagrams
    b. Internal wiring diagrams
    c. Connection diagrams

1.4 ENVIRONMENTAL CONDITIONS

A. Refer to Section 13300.

PART 2 - PRODUCTS

2.1 FABRICATION

A. General:

1. Panels shall be designed for the seismic requirements of Section 01743. Structures, equipment, and devices shall be braced to prevent damage from specified forces. Equipment panels shall be capable of operation following a disturbance.

2. Nameplates with tag number and equipment description shall identify face-mounted instruments. Instruments shall be mounted for access to components and ease of removal. Cutouts for future equipment shall be blanked off with suitable covers. Instrument tag numbers shall be identified on the panel rear.

3. Face-mounted equipment shall be flush or semi-flush with flat-black escutcheons. Face-mounted instruments that are more than 6 inches deep, weigh more than 10 pounds, or exert more than a 4 ft-lb moment force on the face of the panel shall be supported underneath at the rear by a 1-inch x 1/8-inch thick steel angle.

4. Panels less than 60 inches high shall be provided with floor stands to raise the top of the panel to 60 inches above the floor or work platform. Panels that weigh less than 100 pounds may be wall mounted.

5. Panels with specified requirements including stainless steel or aluminum mounting requirements that are indicated on the project drawings or on the project details take precedence over the panel types or panel features indicated herein.

B. Panel Layout:

1. Provide minimum of 20 percent spare terminal blocks, with a minimum of 10 analog, discrete, power.

2.2 HEATING, VENTILATING AND COOLING

A. Forced air ventilation shall be provided for panels where indicated in the Panel Schedule or if the cabinet's heat load calculations indicate that the interior temperature of the cabinet will exceed 115 degrees-F, under worst case conditions.

B. Ventilation for panel racks shall be venturi fans provided on 5-1/2-inch high-notched panel. Ventilation for consoles shall be similar to that for panel racks except EIA RS-310 mounting is not required. Fans shall be equipped with UL-approved washable filters and provide at least 240 cubic feet per minute (CFM). Fans shall be thermostatically controlled. Noise level at 3 feet from exterior wall and 30 degrees off axis shall not exceed 60 NC units.

C. Outdoor panels shall also be provided with thermostatically controlled space heaters. Space heater surface temperature that exceeds 120 degrees F requires an expanded metal guard. Thermostats shall be Honeywell T631B1013, Penn Controls A28AA-4, or equal.

D. Panel air conditioning cooling requirements shall be a cooling system that does not exchange cabinet interior air with ambient air. The cooling system shall be either a closed glycol loop heat exchange system or a CFC-free refrigeration system as required for the specified equipment and instrument complement and ambient temperature conditions.

E. Panel air conditioner shall be NEMA rated based on the installed area environment and the coils shall be Heresite, or equal coated and protected from corrosion.

2.3 PROTECTION COATING AND FINISH

A. Panels located outdoors or located in corrosive areas shall be bottom coated with waterproof coatings.

2.4 NAMEPLATES

A. External door-mounted components and the panel description shall be identified with plastic nameplates. Machine embossed metallic adhesive labels shall identify tag number of instruments inside panels. Nameplates shall be attached to panel surfaces, not to instruments.

B. The machine engraved laminated black phenolic nameplates with white shall be provided for panel-mounted equipment. Nameplate engraving shall include the instrument tag number and description in 3/32-inch minimum size lettering.

C. The machine embossed metallic adhesive labels shall identify tag number of instruments inside panels. Nameplates shall be attached to panel surfaces, not to instruments.

D. The nameplates shall be attached to the panel with a minimum of two self-tapping 316 stainless steel screws. Provide RTV sealant for nameplates for NEMA-4X stainless steel panels.

E. The nameplate wording may be changed without additional cost or time prior to commencement of engraving. Submit nameplate legend with the panel submittal.

2.5 PANEL FEATURES

A. Interconnection Wiring: Panel Interconnecting Wiring:

1. Panel control wiring: Single conductor stranded copper NFPA No. 70 Type MTW No. 16 AWG minimum, with an exception for factory supplied PLC wiring harnesses that are U.L. approved.

2. Panel instrument wiring: Twisted No. 16 AWG shielded pair or tri conductors.

3. Panel power wiring: Conductors specified in Division 16 and meet the NFPA No. 70 NEC requirements for power including phase, grounded, and grounding conductors.

4. Wiring shall be supported independently of terminations by lacing to panel support structure or by slotted flame retardant plastic wiring channels.

5. Wiring channels shall comply with UL 94, Type V.

6. Wiring channel fill shall not exceed 50 percent.

B. Conductor Identification: Wiring shall be tagged at terminations with machine printed plastic sleeves with three-part wire numbers for instrument and control panel internal conductors:

1. Part-1: Prefix of the wire number shall be the instrument loop number or equipment tag number.

2. Part-2: Code letter and wire colors per the following tables.

3. Part-3: Number that identifies individual circuit conductor Terminal Number.

Code	120 Vac Conductor	Color
L	Power	Black
C	Control	Red
N	Neutral	White
PG	Ground	Green

Code	V dc Conductor	Color
PS	24 Vdc Power	Blue
PS	12 Vdc Power	Violet
S+	Signal (+)	Black
SG	Signal Ground	White
EG	Equipment Ground	Green
FV	Panel Foreign Voltage	Yellow

C. Conductor Installation And Protection:

1. Power and control wiring shall be carried in covered channels separate from low voltage signal circuits. An interior steel barrier shall be provided between AC control devices and the electronic equipment.

2. Terminal blocks shall be strap screw type rated for 600 volts. Each terminal trip shall have a unique identifying alphanumeric code at one end and a vinyl-marking strip running the entire length of the terminal strip with a unique number for each terminal. Numbers shall be machine printed and 1/8 inch high.

3. No more than two connections shall be made to one terminal.

4. Wire connectors shall be locking fork tongue or ring tongue insulated crimp type terminals.

5. Terminal blocks shall be;

   a. Allen-Bradley 1492-HM1 600 V 30-amperes, finger-safe terminal block.
   b. Allen-Bradley 1492-CD3 600 V 35-amperes with #8 screw terminal block for ring or spade terminals.
   c. Phoenix Contact or Weidmuller equal products.

D. Field Wiring: blocks in a dedicated part of the panel where the field cables enter the panel.

E. Fuse and Fuse Holders:

1. Fuses for 120 Vac circuits shall have a minimum of 12,000-amperes interrupting capacity and blown fuse indicators.

2. Fuses for 24 Vdc circuits shall be fast acting glass tube type rated 1/8 or 1/10 amp for 4-20 mA loops.

3. Fuses for 24 Vdc circuits shall be 1/2 amp for the power supply to individual instruments.

4. Fuse holders shall be tip-out or draw-out type.

5. Provide Phoenix Contact or equal products.

F. Control Power: 120 Vac control power source: Single power source for all control and DC power. Dual power sources, one for control power and one for DC power. Dual power sources, one for PLC and DC power and one for PLC output control power.

1. Provide control power transformers, as required for the load.

2. Provide direct current power supplies, as required for the load.

3. Provide UPS for PLC and derived loop power as defined above, as required for the load.

G. Panel Power: Panel power source:

1. Provide a 120 Vac circuit for the panel light, receptacle, heating, fan, heat exchanger, or air conditioner cooling load as required.

H. Accessories:

1. Panels greater than 24" high x 24" wide shall include GFCI convenience receptacles and LED utility lights.

2. Receptacles and utility lights shall not be powered by the UPS, where included.

3. Print pocket.

4. Fold-up shelf of sufficient size, sufficient weight capacity, and the proper angle for supporting a laptop computer.

2.6 SURGE PROTECTION

A. Surge protectors shall be multi-stage, plug-in type selected to protect the equipment. Surge protectors shall be removable without changing the impedance of the circuit. Surge protectors product manufactures shall be:

1. Circuit Components Inc: Din Rail SDD-400 Series for Data or Analog Signals.

2. Circuit Components Inc: SPD-Series at the 120 AC incoming power.

3. Joslyn Model 1663-08

4. Taylor 1020FA

5. Phoenix Contact

6. Telematic

7. Edco

8. Or equal.

2.7 PANEL GROUNDING

A. Each panel shall be provided with two copper ground bars.

1. One bar (NEC required) shall be bonded to the panel or panel frame or back-plate and to the facility grounding system.

2. Second (signal) ground bar shall be mounted on insulated stand-offs and shall be bonded to the panel ground bar only at one point.

B. Signal circuits, signal cable shields, and low-voltage DC power supply commons shall be bonded to the signal ground bar.

C. Field analog wiring shields shall only be grounded at the signal ground bar. Test to verify that single ground point at panel signal ground bar.

D. Surge protectors and separately derived AC power supplies shall be bonded to the frame ground bar.

E. Panels exceeding 36-inches width shall contain ground bars shall be 1/4- by 1-inch copper bars extending the entire length of the panel interior at the bottom of the panel.

2.8 PANEL DRAWING PROTECTION

A. Provide wiring diagrams in accordance with Section 01300. Provide a panel-wiring diagram and schematic for each panel in a plastic bag or plastic container to avoid water damage and aging.

2.9 DIRECT-CURRENT POWER SUPPLIES

A. Nominal 24-volt direct-current instrumentation and control power supply:

1. Redundant

2. Convection-cooled linear type or switching type.

3. Line regulation: 0.4 percent for line variations from 105 to 132 volts

4. Load regulation: 0.4 percent for load variations from 0 to full load.

4. Ripple and noise: Not exceed 100 mV peak-to-peak.

5. Hold-up time at maximum load: Not less than 16 milliseconds.

6. Continuous duty from 0 to 50 degrees C at rated load.

7. Output electronically current limited.

8. Over-voltage crowbar shutdown.

9. Output voltage:

   a. Rated 28 Vdc

   b. Adjustable plus or minus 5 percent

   c. Set to provide 26.4 volts to the panel direct current bus.

10. Power Supply: SOLA HD, or equal.

2.10 UNINTERRUPTIBLE POWER SYSTEM (UPS)

A. The UPS shall be on-line, computer-grade with electrical isolation including output neutral. UPS shall be packaged for panel enclosure mounting using a back-panel bracket or holder:

   1. Nominal input voltage: 120Vac.

   2. Nominal output voltage: 120Vac.

B. The online UPS system shall be provided with integral sealed no maintenance batteries, sized to provide full capacity backup power for 10 minute minimum at connected load with integral battery charger.

C. The panel supplier shall calculate the required kVA rating at 150 percent of connected load. Submit load calculations, schematic diagrams, and wiring connection diagrams. Provide battery cabling and other required cabling for a complete system.

D. The UPS shall be mounted within the panel on a pedestal or tray with stainless-steel legs to provide space for wire entry and passage.

E. Uninterruptible power supply systems shall be as manufactured by Best Power Technology, Inc., Necedah, American Power Conversion, Wisconsin, or equal.

2.11 SPARE PARTS

A. The following spare parts shall be provided:

   1. Ten each of each type of light bulb used in the panels.

   2. Five each of each type and rating of fuse used in the panels.

2.12 PRODUCT DATA

A. The following data shall be provided in accordance with Section 01300:

1. Manufacturer's operation and maintenance information as specified in Section 01730. Manual shall include final reviewed submittal and separate record of all final configuration, jumper, and switch settings.

2. Test results as specified in Section 13305-Part 2.

3. Manufacturer's certification for the performance of features of the specified equipment that cannot be readily inspected.

4. Special requirements for delivery of the information such as time, manner, place, or quantity.

5. Installation and training forms specified in Part 3.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide panels with the Record As-built schematic, connection, and interconnection diagrams mounted behind plexiglass holder on the inside of the door. Place documentation in a water proof clear bag in the panel document holder.

3.2 OUTDOOR PANEL SHADE COVERS

A. Provide Sun/Rain covers per Electrical Detail for outdoor vendor, manufacture, and custom panels. Fabricate based upon known panel dimensions or accepted submittal drawing dimensions.

3.3 PANEL POWER SUPPLY

A. Power supply and conditioning equipment shall be mounted and connected in compliance with the manufacturer's instructions.

B. Line side disconnect switches shall be provided for power supply and conditioning equipment. Line and load side overcurrent protection shall be provided for power supply and conditioning equipment in compliance with NFPA 70. Disconnect switches shall comply with Section 16175.

C. Small power supply and conditioning equipment may be mounted in the panel served. Larger units shall be mounted adjacent to the equipment served. Where unconditioned power is brought into control panels, it shall be enclosed in metallic raceways within the panel.

D. Power supply and conditioning equipment larger than 5 kVA load capacity supported from surfaces other than concrete shall be provided with sound isolators.

E. Final raceway connections shall be a flexible conduit in compliance with Division 16.

3.4 FACTORY TESTING

A. The control panel shall be assembled, interconnected, and functionally tested at the assembly shop prior to shipment. The Owner/Engineer shall have the option of witnessing the functional shop test. The Contractor shall notify the Owner/Engineer at least two (2) weeks in advance prior of the scheduled functional shop test.

3.5 FIELD TESTING

A. Field verify the following for Instrument and Control Panels:

1. Control circuits grounded with one terminal of each load device connected to the grounded conductor.

2. Control contacts installed in the ungrounded side of the circuit.

3. Signal and control wiring installed in separate wireways.

4. Barriers between the power wiring and the signal and control wiring.

5. Connected to the plant grounding system, as specified.

6. Center-line of wall-mounted panels shall be 48 inches above the floor.

7. Inner door contains a copy of the Record elementary and wiring diagrams.

8. Inner door contains a protected drawing holder.

9. Drawings enclosed in a transparent, protective jacket.

10. Functions as specified.

11. Mounted with stainless steel unistrut, fittings, and fasteners.

12. Tested in accordance with Section 16030 and Section 13305.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 13375

PROGRAMMABLE LOGIC CONTROLLER

PART 1--GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section specifies requirements for programmable logic controllers (PLC) designed to execute discrete and continuous control logic with high reliability in industrial applications. Enclosures and components are specified in Section 13370 – Instrument and Control Panels.

2. All PLCs provided for this project shall comply with the requirements of this Section. PLCs are provided by the Systems Integrator per Section 13300.

B. Plc Schedule:

Panel No.	PLC Size	Testing	Spares
M-03-LCP-002	Small	Factory Acceptance	Not Required

C. General Requirements: General requirements shall be as specified in Sections 13300 and 13370. PLC assemblies provided by Equipment Manufacturers may be provided by firms other than the Systems Integrator.

1.2 QUALITY ASSURANCE

A. References:

1. This Section contains references to the following documents or documents listed in Sections 16000, 13300, and 13370. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).

3. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

4. Where document dates are given in the following listing, references to those

documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEC 61131-3	Programmable Controllers – Part 3: Programming Languages
NEMA IA 2.2	Programmable Controllers – Equipment Requirements and Tests
NEMA IA 2.3	Programmable Controllers – Programming Languages

B. Systems Integrator: Responsibilities and qualifications shall be as specified in Section 13300.

C. Factory Acceptance Tests:

1. Factory Acceptance Tests are specified in Section 13305 and scheduled in Paragraph 1.01 B.

a. Submit factory test forms for approval prior to tests.

b. Provide all expenses for one Owner staff member and one Engineer staff member to witness factory testing. Travel shall be during business hours on weekdays.

c. After Factory Acceptance Testing, complete programmable logic controllers including chassis, I/O modules, associated cabling, and miscellaneous hardware shall be turned over to the Owner during construction to facilitate coordination of Owner furnished programming and configuration of the DCS.

1.3 SUBMITTALS

The following information shall be provided in accordance with Sections 01300 and 13300:

A. Shop Drawings: Submit under Section 13370, including:

1. A copy of this Specification Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements. A check mark shall denote full compliance with a paragraph as a whole.

2. If deviations from the Specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

3. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications. *Failure to include a copy of the marked-up Specification Sections,*

along with justification(s) for any requested deviations to the Specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Submittal requirements per Section 13370 for the equipment specified herein.

5. PLC Input/Output (I/O) loop diagram drawings.

6. Internal power distribution schematic diagram drawings.

7. PLC power supply loading calculations.

8. List of spare parts to be provided.

B. Factory Acceptance Test Schedule and Forms: Submit under Section 13305 and per the requirements of this Section.

C. Operating and Maintenance Information: Operating and maintenance information shall be provided in accordance with Section 01730, including the following for the PLC system:

1. Manufacturer, Representative, and Supplier contact information.

2. Manufacturer instruction manuals shall include only the following as applicable to the PLC system:

   a. Safety Precautions.

   b. Environmental Conditions.

   c. Troubleshooting guides and diagnostic techniques.

   d. Component connection diagrams.

   e. Removal and replacement instructions.

3. Warranty information.

4. Final reviewed submittal.

5. As-built drawings with record of switch and jumper settings for all components.

6. List of spare parts provided.

PART 2--PRODUCTS

2.1 GENERAL

A. Manufacturer: The Owner and Construction Manager require the specified Manufacturer to provide the equipment and/or products to be furnished under this Section. The Owner and Construction Manager believe the Manufacturer is capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed to mean that the named Manufacturer's standard product will comply with the requirements of this Section.

B. Materials: Equipment and/or products shall be new and unused at the time of system assembly.

C. Controller conforming to NEMA IA 2.2, and with required memory and functional capacity to perform specified sequence of operation with scheduled input and output points.

1. RFI/EMI Susceptibility: MIL STD 461B CS02.
2. Showering Arc Test: NEMA Pub No ICS2-230.42.
3. Surge Withstand: ANSI C37.90a.
4. RFI Immunity: IEC 801-3.
5. Ground Continuity: IEC 801-5.
6. Electrostatic Discharge: IEC 801-2.
7. Electromagnetic Field: IEC 61000-4-3.
8. Fast transients: IEC 61000-4-4.

2.2 PROGRAMMABLE LOGIC CONTROLLER - SMALL

A. Manufacturer:

1. Allen-Bradley CompactLogix .

Commented [GE1]: I think AB has new CompactLogix models- the 1769 has been discontinued. Verify.

a. 1769-L33ER (minimum)
b. NEMA IA 2.3 and IEC 61131-3 compliant program editor with program written in Ladder Logic. Program to be written using the same type of software as is specified below.
c. Networking Connections: Provide all communication interfaces, network cables, taps, terminators, power supplies, and accessories for a complete operating network.
d. Ethernet/IP.

B. Processor:

1. With dual Ethernet ports and USB port dedicated solely for programming use, 2 MB RAM for IEC 1131 control programs, battery-backed. 1 GB SD card for program backup. Provide additional serial communications adapters required for other serial interfacing. Include real-time clock.

C. Input and Output Modules:
   1. Discrete Inputs: 120 Vac, 16 channel.
   2. Discrete Outputs:
      a. 120 Vac, 8 channel.
         1) Provide interposing relays.
   3. Analog Inputs:
      a. 4-20 mAdc/1-5 Vdc, isolated channel-to-channel, 4 channel.
   4. Spare Input/Outputs: The greater of a minimum one channel or 15 percent of each type provided per control panel.

D. Power Supplies: 24 Vdc. Refer to Section 13300 for power supply.

E. Remote I/O Cabinets: Remote I/O shall be CompactLogix.

F. Miscellaneous: Provide all cables, taps, terminators, power supplies, and accessories for a complete operating PLC system.

2.4 PROGRAMMING SOFTWARE

The following software shall be provided by the Systems Integrator for this project.

G. Programmable Logic Controller

1. Manufacturer: Allen-Bradley RSLogix 5000, RSLinx, and network module software.

2. Licenses: Provide 1 License. Request Owner / City licensee information prior to ordering for registration. Provide one PC to PLC programming cable for each license B.

2.05 SPARE PARTS

The following spare parts shall be provided

H. Programmable Logic Controller - Small

1. One of each unique processor card.

2. One for each ten, minimum of one for each unique I/O card.
3. One of each unique power supply.

4. One of each unique pre-fabricated cable.

2.6 CONTROL PANEL FABRICATION

A. Refer to Section 13370.

B. Detail shop drawings showing field connections and any terminal block jumping required.

C. Terminate all used and spare I/O wiring to terminal blocks.

D. Create wire markers with “to-from” component name, PLC slot/base, or terminal column number and terminal number information identical at each end.

E. Provide terminal Blocks for field connections to PLC Discrete Inputs:

1. One fused terminal with LED for each group of 8 inputs, connected to control power.

2. Fused terminal connected to eight terminal blocks to provide power to each field input circuit.

3. One terminal per PLC input.

4. One common terminal for each group of 8 inputs, connected to control power common.

F. Provide terminal Blocks for field connections to PLC Discrete Outputs:

1. One fused terminal with LED for each output, connected to control power.

2. Two terminals per PLC relay output. Provide interposing relay for each solid-state PLC output. Connect output and control power common to relay coil. Provide two terminals for relay contact, normally opened unless otherwise noted.

3. One common terminal for each output, connected to control power common.

G. Provide terminal Blocks for field connections to PLC Analog Inputs:

1. One fused terminal with LED for each input, connected to +24 Vdc.

2. Two terminals per PLC input.

3. One common terminal for each input, connected to 24 Vdc common.

4. One ground terminal for each input shield, connected to signal ground bus.

5. Two surge protecting terminals for each field mounted instrument or equipment, grounded to the frame ground bus.

H. Provide terminal Blocks for field connections to PLC Analog Outputs:

1. One fused terminal with LED for each output, connected to +24 Vdc.

2. Two terminals per PLC output.

3. One common terminal for each output, connected to 24 Vdc common.

4. One ground terminal for each output shield, connected to signal ground bus.

5. Two surge protecting terminals for field mounted equipment, grounded to the frame ground bus.

2.7 PRODUCT DATA

A. The following Product Data shall be provided in accordance with Section 01300.

B. Factory Acceptance Test Results: Submit under Section 13305 and per the requirements of this Section.

C. Operating And Maintenance Information: Operating and maintenance information shall be provided in accordance with Section 01730, including the following.

1. Manufacturer, Representative, and Supplier contact information.

2. Manufacturer instruction manuals shall include only the following as applicable to the PLC system:

a. Safety Precautions.

b. Environmental Conditions.

c. Troubleshooting guides and diagnostic techniques.

d. Component connection diagrams.

e. Removal and replacement instructions.

3. Warranty information.

4. Final reviewed submittal.

5. As-built drawings with record of switch and jumper settings for all components.

6. List of spare parts provided.

D. PLC Program – Systems Integrator: Provide the as-built programmable controller program in native format prepared using the software type specified in Part 2 and per Section 13300 and Section 13301.

PART 3--EXECUTION

3.1 INSTALLATION

A. Refer to Section 13370.

B. Connect input and output devices to the PLC via control panel terminal blocks, not directly to the PLC.

3.2 FIELD INSPECTION AND TESTING

A. Refer to Section 13370.

B. Equipment Manufacturer And Systems Integrator: The supplier of each PLC system shall provide a qualified service representative to perform the following:

1. Inspect the PLC installation including I/O and network systems, hardware configuration switch and jumper settings.

2. Monitor all PLC system diagnostic indicators, both hardware and software, and certify that the PLC system performance meets or exceeds the Manufacturer's published specifications.

3. Assist in all testing. The Systems Integrator will provide a minimum of 1 man-weeks on-site for each PLC I/O rack.

4. Modify PLC programs as required.

5. Certify in writing to the Construction Manager that the PLC system has been installed and configured in accordance with the Manufacturer's published guidelines. Equipment Manufacturer certification requirements are per the associated equipment Specification.

C. Contractor: Fault or trouble conditions shall be investigated and resolved by the Contractor to the satisfaction of the PLC supplier.

3.3 TRAINING

A. Operations and Troubleshooting: Systems Integrator training is specified in Section 13301. The Systems Integrator shall conduct application program maintenance, modification, and re-loading training conforming to the requirements of Section 01664. A minimum of four man-hours on-site including training materials and expenses shall be provided for three *maintenance personnel.*

3.4 PROGRAMMABLE LOGIC CONTROLLER I/O SUMMARY

A. The Programmable Logic Controller (PLC) I/O Summary provides a listing of the assigned input/output points to the specified PLC system.

Commented [GE2]: If we are not providing IO list, I would suggest modifying this part and refer to dwgs.

B. The detailed assignment of I/O to specific points is provided for information only and will be revised and modified throughout the project. Final assignments shall be coordinated between the Contractor, the System Integrator, and the Owner during Construction.

C. Clarification of Headings:

1. SIGNAL: The signal number consists of a two or three letter prefix (indicating the I/O point function) followed by a number identifying the process loop with which the I/O point is associated.

2. DESCRIPTION: Provides an abbreviated description of the function of the I/O point.

3. SOURCE: Identifies field device that I/O point is connected to.

4. DRAWINGS: Identifies the Drawings on which the I/O point is referenced.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 13400

FIBER OPTIC
COMMUNICATION EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. Provide the fiber optic appurtenances required to complete the fiber optic cabling system. Section 16124 specifies requirements for fiber optic data communication cables including installation, terminations, and testing.

1.2 QUALITY ASSURANCE

A. References: Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/ICEA S-87-640	Standard for Optic Fiber Outside Plant Communications Cable.
BELLCORE GR-20-CORE	Generic Requirements for Optical Fiber and Optical Fiber Cables
BELLCORE GR-409-CORE	Generic Requirements for Intrabuilding Fiber Cable
BELLCORE GR-487-CORE	Generic Requirements for Electronic Equipment Cabinets
BELLCORE GR-771-CORE	Generic Requirements for Fiber Optic Splice Closures
ISO-9001	Quality Management Systems
NFPA 70	National Electric Code (NEC)
TIA/EIA-455-86	FOTP-86 Fiber Optic Cable Jacket Shrinkage
TIA/EIA-455-107A	FOTP-107 Determination of Component Reflectance or Link/System Return Loss Using a Loss Test Set
TIA/EIA-492AAAC	Detail Specification for 850 nm Laser-Optimized, 50µm Core Diameter/125 µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers
TIA/EIA-598-B	Standard for Optical Fiber Cable Color Coding

1.3 SUBMITTALS

The following information shall be submitted for review in accordance with Section 01300:

A. Product Literature, submit complete under Section 13370:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

2. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. A copy of the contract document drawings showing fiber optic system terminations and appurtenances, marked to show specific changes necessary for the supplied equipment.

3. If no changes are required, the drawings shall be marked "*No Changes Required."*

4. Manufacturer's catalog literature and catalog data sheets for the following items, marked to indicate products proposed, as applicable to the project:

   a. Fiber optic patch cords

   b. Fiber optic termination panels

5. Shop drawings:

   a. Termination panel fabrication and layout drawings with complete list of materials and nameplate engraving list.

   b. Interconnection cable diagrams for the complete system, showing each fiber and color in each cable. Each termination point shall be clearly marked.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLE PATCH CORDS

A. General:

1. Provide preparation for the connections including polishing, connectors, hardware, cleaving tool, continuity tester, visual fault locator, and supplies for

installation of connectors. Terminations shall be ST type. Fusion-spliced pigtails are not acceptable.

2. Fiber optic cable connections shall be provided with ceramic ferrules, polycarbonate not acceptable.

B. Single Mode Patch Cord Characteristics: Patch cords shall be 8.3 µm single 125 µm coated duplex fiber with jacket and connectors on both ends. Attenuation shall be a maximum of 0.2 dB. Provide length required for connection from patch panel to equipment. Color: Yellow.

2.2 FIBER OPTIC PANELS

A. General: Fiber optic patch panels shall consist of a system of components for routing, supporting, and terminating the fiber optic cables specified herein. Terminations shall be ST type. Fiber optic cable connections shall be provided with ceramic ferrules, polycarbonate not acceptable.

B. Description: Provide the following:

1. Wall mounted type fiber optic patch panels constructed of aluminum or steel with removable hinged metal doors.

2. Mounting hardware, cable clamps and grommets, cable routers, storage decks, connector racks, and items for a complete system.

3. Cable routers and storage decks to retain cables' minimum bending radius.

4. Sufficient quantity of ports to terminate the number of fiber strands specified and blank covers for unused port spaces.

5. One port for each fiber in accordance with the specified cable type.

6. Panel shall be Corning Cable Systems or equal.

2.3 NETWORK SWITCH

A. Industrial Managed Ethernet Ring Switch: network Ethernet switch to provide connectivity between the control system network components. The switches shall be configured in a self-healing ring as shown on the System Architecture drawing. Provide the switch with the following minimum features:

1. Fan-less steel industrial-strength enclosure

2. DIN rail mounted

3. Minimum of six (6) shielded RJ-45 ports with auto-negotitation and auto-MDI/MDIX

4. Rapid Spanning Tree Protocol (RSTP) ring management

5. Link Standby redundancy

6. Bandwidth control

7. Virtual cable test (VCT) utility

8. Dual firmware, software management

9. MODBUS TCP support

10. 10 / 100 / 1000 Mbps operation

11. SFP type ports with auto speed detection

12. SNMP monitoring

13. Dry contact for local network health monitoring, or generation of alarm

14. Hirschmann BOBCAT series, Perle IDS-509-2SFP-XT, or equal

2.4 PRODUCT DATA

A. The following information and product data specified under individual specification sections shall be provided in accordance with Section 01300.

1. Manufacturer's operation and maintenance information as specified in Section 01730. Manual shall include final reviewed submittal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Patch panels and patch cords shall be installed in accordance with the manufacturer's instructions.

** END OF SECTION**

SECTION 14600

HOISTS AND CRANES, GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall furnish, install, and place in satisfactory operation the hoisting equipment and appurtenances complete with all necessary safety equipment, in accordance with the requirements of the Contract Documents.

B. The Contractor shall furnish and install all appurtenances necessary for winch crane.

1.2 RELATED SECTIONS

A. Section 01300, Submittals

B. Section 11000, Equipment General Provisions

C. Section 14650, Davit Crane

1.3 REFERENCES

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards.

1. Commercial Standards:

AISC	Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.
AGMA	American Gear Manufacturers Association.
ASME B30.16	Standard Specifications for the Construction, Installation, Operation, Inspection, Maintenance, and Safe Use Safety of Overhead Hoists (Underhung)
ASTM A 36	Specification for Structural Steel.
CMAA	Crane Manufacturer's Association of America.

1.4 SUBMITTALS

A. The following submittals shall be made in accordance with Section 01300.

1. Shop Drawings: The Contractor shall submit complete shop drawings of all hoist and crane equipment in accordance with the Section 01300, paragraph 1.2. Such shop drawings shall include all weights, dimensions, and clearances required, and the manufacturer's installation instructions.
2. Owner's Manual: The Contractor shall submit an eight (8) part owner's manual in accordance with Section 01300, paragraph 1.5.

B. The Contractor shall furnish one year's supply of lubricants for each piece of equipment requiring lubrication. The Contractor shall furnish a complete set of spare parts as recommended by the manufacturer, such as bearings, washers, rings, and any other parts subject to wear or frequent replacement. All parts shall be properly labeled and identified with the name and number of the equipment to which they belong.

C. The Contractor shall submit one complete set of special wrenches or other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality and furnished in labeled tool boxes of suitable design.

1.5 QUALITY ASSURANCE

A. Inspection and Testing Requirements: After erection, the Contractor shall inspect and test all hoists and crane systems in the presence of the manufacturer's service representative, for proper operation and conformance with the Specifications.

B. Acceptance Criteria and Tolerances: The ENGINEER reserves the right to reject any equipment not conforming with the tolerances, deflections, and lateral stiffness specified.

1.6 MANUFACTURER'S SERVICE REPRESENTATIVE

A. The Contractor shall have the equipment manufacturer for each piece of equipment provide the services of a trained, qualified representative for at least one-half day after the unit is put in proper working order, or as otherwise specified, for the purpose of inspecting the installation and instructing the OWNER'S operating personnel.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor shall furnish and install the specified hoist and crane equipment.

B. All components of the davit crane—including (but not limited to) mast, hoist, cable, and bases—shall be supplied by a single manufacturer.

C. The capacity of the hoist shall be permanently marked in a conspicuous manner on the equipment. The wire rope weaving shall be of the two-part double, cross mounted or similar appropriate type, to provide a true, vertical lift without drift, unless otherwise specified.

D. The Contractor shall verify all dimensions and clearances in the field prior to erection and shall be responsible for the proper fitting and operation of the equipment.

2.2 MATERIALS

A. All materials used must be new and of the best commercial grade. Where materials are not specified, the Contractor shall have the manufacturer use the most suitable selection for the given application and environment.

2.3 FACTORY FABRICATED ITEMS

A. All fabrication, assembly, and welding shall be carried out by factory-trained specialists and certified welders.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All hoist and crane equipment shall be installed in strict accordance with the manufacturer's printed instructions and the Contractor shall arrange to have all installation performed under the guidance of the manufacturer's field representative.

3.2 WORKMANSHIP

A. The workmanship shall be in accordance with the referenced standards and codes.

3.3 INSTALLATION; CONSTRUCTION; APPLICATION; ERECTION; ETC.

A. Care shall be taken, that the structural integrity of walls, floors, and roofs will be maintained at all times.

3.4 EXECUTION OF TEST PROCEDURES; VALIDATION; ETC.

A. After completion of the WORK, the Contractor shall test all hoist and crane equipment in the presence of the manufacturer's field representative, who shall certify in writing that the equipment meets all applicable standards and specifications.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 14650

DAVIT CRANE

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The Contractor shall furnish and install a davit crane with winch hoist for lifting equipment at the roof of the pump station wet well.

B. Design Requirements: Davit crane shall be a portable, manually operated, socket-mounted crane with boom adjustable for span and a hand winch hoist.

1. The rated capacity at maximum boom reach shall be 1,000 lbs.

2. The rated capacity at minimum boom reach shall be 1,600 lbs.

3. The maximum boom reach shall be 82 inches.

4. The minimum boom reach shall be 45 inches.

5. The maximum lift distance below the base shall be 40 feet.

6. Contractor to confirm the cables provided by the pump manufacturer are of sufficient length to reach the winch hoist and of compatible diameter to be used with proposed winch hoist.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11000, Equipment General Provisions

B. Section 14600, Hoists and Cranes, General

1.3 SUBMITTALS

A. Submittals shall be made in accordance with Sections 01300 and 14600.

1.4 QUALITY ASSURANCE

A. Comply with applicable parts of Sections 11000, and 14600.

1.5 SPECIAL WARRANTY

A. Provide manufacturer's 2-year unlimited warranty against defects in materials or fabrication, or failure due to corrosion.

PART 2 - PRODUCTS

2.1 GENERAL

A. All components of the davit crane including (but not limited to) mast, boom, hoist, and bases shall be supplied by a single manufacturer.

2.2 MANUFACTURERS

A. Davit crane shall be the following, or equal: Thern Inc., Commander 2000 – 5PT20, M3, modified to provide the specified features and to meet the specified material selections.

2.3 MATERIALS

A. Davit crane shall be fabricated of type 304 stainless steel. Boom height shall be adjustable to at least four (4) different positions.

B. Base:

1. Crane shall be supported in a flush-mounted 304 stainless steel socket base.

2. Two bases shall be furnished and installed as shown on drawings M-101 and M-102. Crane shall rotate 360 degrees in a sleeve bearing in the base.

C. Manual Hoist:

1. The hoisting mechanism shall be a type 304 stainless steel hand winch. Hoist gearing shall be spur gears cut from solid steel, oil or grease lubricated. The hoist shall contain an automatic mechanical brake designed for long life and positive stopping

2. The hoist shall be fitted with appropriate connection hardware to facilitate the connection and use of the pump lifting cables provided by the pump manufacturer. Sheaves shall be properly guarded and shall be heavy pattern, deep flanged and properly grooved. Sheaves shall be either bronzed bushed or fitted with ball bearings and supported on fixed pins

D. Wire Rope: Confirm pump lifting cables provided by the pump manufacturer are compatible with the submitted davit crane and hoist assembly.

E. Fasteners: All fasteners shall be type 304 stainless steel.

2.4 ANCHORAGE

A. Anchor bolts and connecting bolts for all assemblies supported as furnished under this Section shall be designed in accordance with Sections 11000 and 14600. Anchorage and seismic calculations shall be signed and sealed by a Registered Civil/Structural Engineer in the State of California.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Davit crane and winch hoist shall be installed in accordance with approved procedures submitted with the shop drawings and as shown, unless otherwise approved.

B. General installation requirements shall be as specified for “Execution” in Section 14600; Hoists and Cranes, General.

C. Before erection and installation of equipment specified in this section, the Contractor shall verify dimensions on the drawings with field conditions at the start of the WORK and check continuously during construction.

D. Assemblies and components specified in this Section shall be installed in strict accordance with the manufacturer's instructions and recommendations and shall comply with the requirements of Cal-OSHA.

E. The Contractor shall furnish oil, grease, and lubricants required for initial operation. The grades of oil, grease, and lubricants shall be as recommended by the manufacturer

3.2 TESTING

A. After completion of installation, the davit crane and hoist shall be tested at 100 percent of the rated load to ensure compliance with the operating requirements as specified. As a minimum, testing shall be by operating the equipment through a complete lift and lowering cycle at each boom reach to determine that the equipment performs smoothly and safely without failure. Such tests shall be carried out with the hoisting equipment loaded as near to the specified capacity as possible. Any defects shall be corrected or replaced immediately by the Contractor and at no expense to the OWNER. All testing shall be at the Contractor’s expense.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 15000

PIPING COMPONENTS

PART 1 GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing fittings, hangers, supports, anchors, expansion joints, flexible connectors, insulation, lining and coating, testing, disinfection, and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02630 Ductile Iron Pipe
2. Section 02646 PVC Pressure Pipe
3. Section 09800 Protective Coating
4. Section 11000 General Requirements for Equipment
5. Section 15020 Hanger and Supports for Process Piping

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. Uniform Mechanical Code
2. Uniform Plumbing Code
3. Uniform Fire Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following applies to the WORK of this Section:

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
ANSI/ASME B31.1	Power Piping
ANSI/AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
ANSI/AWWA C150	Thickness Design for Ductile Iron Pipe
ANSI/AWWA C153	Ductile Iron Compact Fittings, 3 in through 24 in and 54 in through 64 in for Water Service
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in. through 144 in.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in through 12 in for Water Distribution
ANSI/AWWS C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 in through 36 in
ANSI/AWS D10.9	Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing
ASTM A123	Specification for Zinc Coatings on Iron and Steel Products
ASTM A536	Ductile Iron Castings
ASTM D792	Test Methods for Specific Gravity and Density of Plastics by Displacement
ASTM D2000	Classification System for Rubber Products in Automotive Applications

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings showing dimensions and details of pipe joints, fittings, fitting specials, valves and appurtenances.
2. Detailed layout, spool, or fabrication drawings showing pipe spools, spacers, adapters, connectors, fittings, and pipe supports.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's product data.
2. Manufacturer's installation instructions.
3. Manufacturer's certification of compliance.
4. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.
5. Outline of Quality Control Program

1.7 INSPECTION AND TESTING

A. Inspection: Products shall be inspected at the manufacturer's plant.

B. Tests: Materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.

1.8 FACTORY TESTING

A. Product Testing: Products shall be tested at the factory for compliance with the indicated requirements.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. Storage: Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 PRODUCTS

2.1 GENERAL

A. Pipe Supports: Pipes shall be properly supported in accordance with Section 15020.

B. Coating: Pipes above ground or in structures shall be field-painted in accordance with Section 09800.

C. Pressure Rating: Except as otherwise indicated, piping systems shall be designed for 150 percent of the maximum indicated pressure.

D. Grooved Piping Systems: Grooved couplings on buried piping must be bonded. Grooved fittings, couplings, and valves shall be from the same manufacturer.

2.2 PIPE FLANGES

A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-lb class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-lb class. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-lb class. Flanges shall be attached to the pipe in accordance with ANSI/AWWA C207.

B. Blind Flanges: Blind flanges shall comply with ANSI/AWWA C207. Blind flanges for pipe sizes 12 inches and larger shall include lifting eyes in form of welded or screwed eye bolts.

C. Flange Coating: Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: Bolts and nuts shall comply with Section 05502. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs may be used only on valve flange connections where space restrictions preclude the use of regular bolts.

E. Insulating Flanges: Insulated flanges shall have bolt holes 1/4-inch diameter greater than the bolt diameter.

F. Insulating Flange Sets: Insulating flange sets shall be provided where indicated and shall consist of insulating gaskets, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2-inch or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2-inch, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic. Steel washers shall comply with ASTM A 325. Insulating gaskets shall be full-face.

G. Flange Gaskets: Gaskets for flanged joints shall be full-face, 1/16-inch thick sheets of virgin graded teflon, suitable for temperatures to 550 degrees F, a pH of 0 to 14, and pressures to 1400 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted.

2.3 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, and couplings shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are indicated.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties suitable for the service and loading conditions indicated.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General: Cast mechanical-type couplings shall be provided where shown. Bolts and nuts shall conform to Section 05502. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations suitable for the highest pressure indicated.

2.5 SLEEVE-TYPE COUPLINGS

A. Construction: Sleeve-type couplings shall be installed where indicated and shall include steel bolts, without pipe stop, and shall be sized to fit the pipe and fittings indicated. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7 inches long for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to Section 05502. Buried sleeve-type couplings shall be epoxy-coated at the factory.

B. Pipe Preparation: The ends of the pipe, where indicated, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall comply with the following:

1. Color – Jet Black
2. Surface – Non-blooming
3. Durometer Hardness – 74 ± 5
4. Tensile Strength – 1000 psi Minimum
5. Elongation – 175 percent Minimum

D. The gaskets shall resist deterioration caused by impurities normally found in water or wastewater. Gaskets shall comply with ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as otherwise indicated. Gaskets shall be compatible with the piping service and fluid utilized.

E. Insulating Couplings: Where insulating couplings are indicated, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to insulate coupling metal parts from the pipe.

F. Restrained Joints:
1. Harnesses for flexible sleeve type couplings shall be in accordance with the requirements of the appropriate reference standards and standard practices.
2. Mechanical and Push-On Joints: Restraints shall be provided where shown and may be provided in lieu of concrete thrust blocks.
   a. Mechanical joint restrain mechanisms shall consist of individually activated multiple gripping devices which incorporated breakoff actuating units and permanent nuts for future disassembly. Pressure ratings shall be:
      1) Ductile Iron Pipe
      2) 3 to 6 inch diameter: 350 psi (2:1 safety factor)
         a) 18 to 48 inch diameter: 250 psi (2:1 safety factor)
      3) PVC Pipe
         a) 3 to 36 inch diameter: full pressure rating or pressure class of pipe (2.5:1 safety factor)
   b. Push-on joints for steel pipes shall be in accordance with the appropriate reference standards and standard practice.
   c. Restrained push-on joints for all other pipe materials shall be comprised of two rings with connecting rods. The restraint ring shall be on the spigot, and a plain or slit bell ring shall be on the bell. Pressure ratings shall be:
      1) Ductile Iron Pipe
         a) 3 to 16 inch diameter: 350 psi (2:1 safety factor)
         b) 18 to 48 inch diameter: 250 psi (2:1 safety factor)
      2) PVC Pipe
         a) 3 to 10 inch diameter: 200 psi (4:1 safety factor)
         b) 12 inch diameter: 150 psi (4:1 safety factor)
         c) 14 to 16 inch diameter: 235 psi (2:1 safety factor)
         d) 18 to 30 inch diameter: 165 psi (2:1 safety factor)
         e) 36 inch diameter: 125 psi (2:1 safety factor)

3) Dimensions of push-on bell restraints shall be compatible with ANSI/AWWA C150 and C900 or C905 for ductile iron or PVC pipe, respectively.

d. Restraint glands shall be of ductile iron conforming to ASTM A536. Dimensions of the glands shall be compatible with standard mechanical joint bell and tee head bolts conforming to ANSI/AWWA C111 and C153, respectively.

e. Bolts and nuts shall conform to Section 05502.

2.6 FLEXIBLE CONNECTORS

G. Flexible connectors shall be provided in all piping connections to engines, blowers, compressors, vibrating equipment, and where indicated. Flexible connectors for service temperatures up to 180 degrees F shall be flanged reinforced neoprene or butyl rubber spools, rated for working pressures of 40 to 150 psi or reinforced flanged rubberized duck, as best suited for the application. For temperatures above 180 degrees F, flexible connectors shall be flanged braided Type 316 stainless steel spools with inner corrugated stainless steel hose rated for minimum 150 psi working pressure unless indicated otherwise. Connectors shall be minimum of 9 inches face to face between flanges. Material selection shall be proposed by the manufacturer based on the application.

2.7 EXPANSION JOINTS

A. Linear Expansion Only: Use expansion loops, bellow-type expansion joints, or sliding type expansion joints of ductile iron, stainless steel monel, or rubber. Linear, Angular, and Lateral Movement: Use flexible expansion joints consisting of expansion sleeve and ball-and-socket joints in a single unit. Each unit shall be capable of minimum 15 degrees angular motion in any direction, and the expansion sleeve shall be capable of minimum 4 inches of linear travel. Joints shall be suitable for the pressure and temperature application and be ductile iron conforming to ANSI/AWWA C153. All surfaces containing pressure and sealing surfaces shall be coated with minimum 15 mils of fusion bonded epoxy conforming to ANSI/AWWA C213.

2.8 PIPE THREADS

A. Pipe threads shall comply with ANSI/ASME B1.20.

2.9 MANUFACTURERS

A. Manufacturers: Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

Insulating Flanges:	JM Red Devil, Type E Maloney Pipeline Products Co. PSI Products, Inc.
Flange Gaskets:	John Crane, Style 2160 Garlock, Style 3000
Steel Pipe Couplings:	Gustin-Bacon (banded or grooved) Victaulic Style 41 or 44 (banded) Victaulic Style 77 or 07 (grooved

Ductile Iron Pipe Couplings:	Gustin-Bacon Victaulic Style 31
Couplings for PVC Pipe:	Gustin-Bacon Victaulic Style 775
Sleeve-Type Couplings:	Dresser, Style 38 Ford Meter Box Co., Inc., Style FC1 or FC3 Smith-Blair, Style 411

PART 3 EXECUTION

3.1 GENERAL

A. Pipes, fittings, and appurtenances shall be installed in accordance with the manufacturer's installation instructions.

B. Threaded pipe ends and joints shall be epoxy coated in compliance with Section 09800.

** END OF SECTION **

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 15020

HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies hangers and supports for all piping systems specified on the drawings. This section does not include pipe supports for fire sprinkler systems, pipe anchors, guides or seismic restraints.

B. Operating Conditions:

1. The hangers and supports specified in this section are provided to resist pipe loads occurring primarily in the downward (gravity) direction. For the purpose of pipe hanger and support selection, this section establishes pipe support classifications based on the operating temperatures of the piping contents. Pipe support classifications are as follows:

   a. Hot Systems (NOT USED)

   b. Ambient Systems

      1) B. 60 degrees F to 119 degrees F

   c. Cold Systems (NOT USED)

C. Hanger and Support Selection:

1. The Contractor shall select pipe hangers and supports as specified in the project manual. Selections shall be based upon the pipe support classifications specified in this section and any special requirements which may be specified in the project manual.

2. The Contractor shall review the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the type of support to be used at each hanger point.

3. Hangers and supports shall withstand all static and specified dynamic conditions of loading to which the piping and associated equipment may be subjected. As a minimum, consideration shall be given to the following conditions:

   a. Weights of pipe, valves, fittings, insulating materials, suspended hanger components, and normal fluid contents.

   b. Weight of hydrostatic test fluid or cleaning fluid if normal operating fluid contents are lighter.

   c. Reaction forces due to the operation of safety or relief valves.

   d. Wind, snow or ice loadings on outdoor piping.

4. Hangers and supports shall be sized to fit the outside diameter of pipe, tubing, or, where specified, the outside diameter of insulation.

5. Where negligible movement occurs at hanger locations, rod hangers shall be used for suspended lines, wherever practical. For piping supported from below, bases, brackets or structural cross members shall be used.

6. Hangers for the suspension of size 2 1/2 inches and larger pipe and tubing shall be capable of vertical hanger component adjustment under load.

7. The supporting systems shall provide for and control the free or intended movement of the piping including its movement in relation to that of connected equipment.

8. Where there is horizontal movement at a suspended type hanger location, hanger components shall be selected to allow for swing. The vertical angle of the hanger rod shall not, at any time, exceed 4 degrees.

9. There shall be no contact between a pipe and hanger or support component of dissimilar metals. Prevent contact between dissimilar metals when supporting copper tubing by use of copper-plated, rubber, plastic or vinyl coated, or stainless steel hanger and support components.

10. Unless otherwise specified, existing pipes and supports shall not be used to support new piping.

11. Unless otherwise specified, pipe support components shall not be attached to pressure vessels.

12. Stock hanger and support components shall be used wherever practical.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
AISC Manual of Steel Construction	American Institute of Steel Construction, Manual of Steel Construction, Allowable Stress Design - 9th Ed.
FEDSPEC WW-H-171e-78	Hangers and Supports, Pipe
MFMA-2-91	Metal Framing Standards Publication

Reference	Title
MSS SP-69-91	Pipe Hangers and Supports - Selection and Application
MSS SP-58-93	Pipe Hangers and Supports - Materials, Design and Manufacture

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Standard pipe supports and components shall be manufactured by B-Line, Carpenter & Patterson, Kin-Line, Grinnell, Michigan, Pipe Shields Incorporated, Superstrut, Unistrut, or equal. Pipe support components shall conform to the requirements of MSS SP-69 and FEDSPEC WW-H-171e. Pipe support materials shall conform to the requirements of MSS SP-58. Metal framing system components shall conform to the metal framing manufacturers' Association Standard MFMA-2.

2.2 MATERIALS

A. General:

1. Unless otherwise specified, pipe hangers and supports, structural attachments, fittings and accessories shall be hot-dip or mechanically galvanized after fabrication. Nuts, bolts and washers shall be type 316 stainless steel.

B. Pipe Hangers and Supports:

1. Type 1 - Clevis Pipe Hanger: (NOTED USED)

2. Type 2 - "J" Pipe Hanger: (NOT USED)

3. Type 3 - Double Bolt Pipe Clamp: (NOT USED)

4. Type 4 - Adjustable Roller Hanger: (NOT USED)

5. Type 5 - Single Pipe Roll: (NOT USED)

6. Type 6 - Framing Channel Pipe Clamp: Pipe clamps shall be steel with galvanized finish and material thickness as listed below:

   a. Steel pipe (uninsulated) - Pipe size 3/8 inch and 1/2 inch shall be 16 gage; 3/4 inch through 1 1/4 inches shall be 14 gage; 1 1/2 inches through 3 inches shall be 12 gage; 3 1/2 inches through 5 inches shall be 11 gage; 6 and 8 inches shall be 10 gage; Michigan model 431, Powerstrut PS 1100, Unistrut P 1109 series, or equal.

   b. Steel pipe (insulated) - Pipe clamp shall be as described in paragraph 2.02 Steel Pipe (Uninsulated) with insulation shield.

   c. Copper (uninsulated) and plastic pipe - Pipe size 3/8 inch and 1 inch shall be 16 gage; 1-1/4 inches and 1-1/2 inches shall be 14 gage; 2 inches through 3 inches shall be 12 gage; 4 inches shall be 11 gage; clamp shall be copper-plated, plastic coated or lined with dielectric material; Michigan model 432, Powerstrut PS 1200, Unistrut P 2024C and P 2024PC series, or equal.

d. Copper pipe (insulated) - Pipe clamp shall be as described in paragraph 2.02 Steel Pipe (Uninsulated) with insulation shield.

7. Type 7 - U-BOLT: U-bolts shall be carbon steel with configuration equivalent to MSS and FEDSPEC Type 24.

   a. Steel pipe (uninsulated) - shall be Grinnell Fig. 137, B-Line B3188, or equal.
   b. Steel pipe (insulated) - shall be Grinnell Fig. 137, B-Line B3188, or equal, with insulation shield.
   c. Cast and ductile iron pipe - shall be Grinnell Fig. 137, B-Line B3188, or equal.
   d. Copper pipe (uninsulated) - shall be Carpenter & Patterson Fig. 222 CT, B-Line B3501 CT, Grinnell Fig. 137C, or equal.
   e. Copper pipe (insulated) - shall be Grinnell Fig. 137, B-Line B3188, or equal, with insulation shield.
   f. (NOT USED)

8. Type 8 - Adjustable Pipe Roll Support: (NOT USED)

9. Type 9 - Welded Pipe Stanchion: (NOT USED)

10. Type 10 - Pipe Stanchion Saddle: Saddles and yokes shall be carbon steel and comply with MSS Type 37 and FEDSPEC Type 38.

    a. Steel pipe (insulated) - shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal, with insulation shield.
    b. Steel pipe (uninsulated) - shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal.
    c. Cast and ductile iron pipe - shall be Carpenter & Patterson Fig. 125, B-Line B3090 NS, or equal.
    d. Copper pipe (uninsulated) - shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal, with insulation shield or lined with dielectric material.
    e. Copper pipe (insulated) - shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal, with insulation shield.
    f. Plastic pipe - shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal.

11. Type 11 - Offset Pipe Clamp: Pipe clamp shall be carbon steel with configuration and components as specified and shall be of standard design manufactured by a pipe hanger component manufacturer.

    a. Steel pipe (insulated) - shall be B-Line B3148, Grinnell Fig. 103, or equal, with insulation shield.
    b. Steel pipe (uninsulated) - shall be B-Line B3148, Grinnell Fig. 103, or equal.
    c. Cast and ductile iron pipe - shall be B-Line B3148 NS, Grinnell Fig. 103, or equal.
    d. Copper pipe (insulated) - shall be B-Line B3148, Grinnell Fig. 103, or equal, with insulation shield.

e. Copper pipe (uninsulated) - shall be B-Line B3148, Grinnell Fig. 103, or equal, lined with dielectric material.

f. Plastic pipe - shall be B-Line B3148, Grinnell Fig. 103, or equal.

g. Vertical pipe support applications shall be as specified above except that insulation shields shall not be used for insulated pipe.

12. Type 12 - Riser Clamp: (NOTE USED)

13. Type 13 - Framing Channel Pipe Strap: Pipe strap shall be carbon steel, with configuration equivalent to MSS Type 26.

a. Steel pipe (uninsulated) - shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal.

b. Steel pipe (insulated) - shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal, with insulation shield.

c. Copper pipe (uninsulated) - shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal, with insulation shield or lined with dielectric material.

d. Copper pipe (insulated) - shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal, with insulation shield.

e. Plastic pipe - shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal.

C. Rack and Trapeze Supports: (NOT USED)

D. Structural Attachments:

1. Type A - Malleable Iron Concrete Insert: Concrete inserts shall be malleable iron and comply with MSS and FEDSPEC Type 18. Grinnell Fig. 282, Carpenter & Patterson Fig. 108, or equal.

2. Type B - (NOT USED)

3. Type C - (NOT USED)

4. Type D - (NOT USED)

5. Type E - (NOT USED)

6. Type F - (NOT USED)

7. Type G - (NOT USED)

8. Type H - (NOT USED)

9. Type J - (NOT USED)

10. Type K - (NOT USED)

11. Type L - (NOT USED)

12. Type M - (NOT USED)

13. Type N - Pipe Stanchion Floor Attachment: Baseplate shall be carbon steel with 1/2 inch minimum thickness. Anchor bolt holes shall be 1/16 inch larger than the anchor bolt diameter. The space between the baseplate and the floor shall be filled with nonshrink grout.

E. Accessories:

1. Hanger Rods: (NOT USED)

2. Weldless Eye Nut: (NOT USED)

3. Welded Eye Rod: (NOT USED)

4. Turnbuckle: (NOT USED)

5. Framing Channel: Framing channel shall be 1 5/8 inches square, roll formed, 12-gage carbon steel. Channel shall have a continuous slot along one side with in-turned clamping ridges. Single channel: Unistrut P1000, B-Line B22, or equal. Double channel: Unistrut P1001, B-Line B22A, or equal. Triple channel: Unistrut P1004A, B-Line B22X, or equal.

2.3 THERMAL PIPE HANGER SHIELD (NOT USED)

2.4 PRODUCT DATA

A. Hanger and support locations and components shall be indicated on the piping layout drawings required by Section 15000-1.05.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT LOCATIONS

A. The Contractor shall locate hangers and supports as near as possible to concentrated loads such as valves, flanges, etc. Locate hangers, supports and accessories within the maximum span lengths specified in the project manual to support continuous pipeline runs unaffected by concentrated loads.

B. At least one hanger or support shall be located within 2 feet from a pipe change in direction.

C. The Contractor shall locate hangers and supports to ensure that connections to equipment, tanks, etc., are substantially free from loads transmitted by the piping.

D. Where piping is connected to equipment, a valve, piping assembly, etc., that will require removal for maintenance, the piping shall be supported in such a manner that temporary supports shall not be necessary for this procedure.

E. Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

3.2 INSTALLATION

A. Welded and bolted attachments to the building structural steel shall be in accordance with the requirements of the AISC Manual of Steel Construction. Unless otherwise specified, there shall be no drilling or burning of holes in the building structural steel.

B. Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.

C. The Contractor shall install items to be embedded before concrete is poured. Fasten embedded items securely to prevent movement when concrete is poured.

D. Embedded anchor bolts shall be used instead of concrete inserts for support installations in areas below water surface or normally subject to submerging.

E. The Contractor shall install thermal pipe hanger shields on insulated piping at required locations during hanger and support installation. Butt joint connections to pipe insulation shall be made at the time of insulation installation in accordance with the manufacturer's recommendations.

F. Hanger and support components in contact with plastic pipe shall be free of burrs and sharp edges.

G. Rollers shall roll freely without binding.

H. Finished floor beneath Type N structural attachments and framing channel post bases shall be roughed prior to grouting. Grout between base plate and floor shall be free of voids and foreign material.

I. Baseplates shall be cut and drilled to specified dimensions prior to welding stanchions or other attachments and prior to setting anchor bolts.

J. Plastic or rubber end caps shall be provided at the exposed ends of all framing channels that are located up to 7 feet above the floor.

3.3 ADJUSTMENTS

A. The Contractor shall adjust hangers and supports to obtain required pipe slope and elevation. Shims made of material that is compatible with the piping material may be used. Stanchions shall be adjusted prior to grouting their baseplates.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 15030

PIPING IDENTIFICATION SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies the supply and installation of permanent identification labels and markers for piping systems.

B. Requirements for the supply and installation of permanent identification tags for valves are specified in Section 15100.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 01300 – Contractor Submittals
2. Section 15100 – Valves, General

1.3 REFERENCES

A. References:

1. This section contains references to the documents listed below. They are a part of this section as specified and modified. Where a referenced document cites other standards, such standards are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, has been discontinued or has been replaced.

Reference	Title
ASME A13.1	Scheme for the Identification of Piping Systems
ANSI Z535.1	Safety Colors/APWA Uniform Color Code for Marking Underground Utilities

1.4 DEFINITIONS

A. Terminology used in this Section conforms to the following definitions:

1. Embedded/Encased piping: Piping enveloped in concrete, typically under structures or under roadways.
2. Buried: Below grade walls or roofs; locations covered and in contact with earth/soil.

1.5 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300.
2. Provide a full line product brochure showing available Piping System Marker and Detectable Warning Tape standard text and color options. Submit all text and colors proposed for use.
3. Provide manufacturer's recommended installation instructions for Detectable Warning Tape.
4. Provide product brochures and data sheets for tracer wire and splice kits. Submit all wire insulation colors proposed for use.
5. Submit proposed tracer wire access box(es) for test leads. Submit electrical continuity test results upon completion.
6. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from Section requirements.

B. Informational Submittals:

1. Procedures: Section 01300
2. Electrical continuity test results.
3. Sample of each piping identification plastic marker used.
4. Sample of each detectable warning tape used.

PART 2 PRODUCTS

2.1 PIPING SYSTEM MARKERS FOR EXPOSED PIPE

A. Identify material contained in exposed piping systems using a colored plastic marker legend system conforming to ASME A13.1.

B. For exposed piping, provide pre-coiled mechanically attached type colored markers that are easily removable. Adhesive type markers are not acceptable.

1. Resistant to petroleum based oils and grease and meet criteria for humidity, solar radiation, rain, salt, fog, leakage and fungus specified by MIL-STD-810.
2. Withstand a continuous operating temperature range of -40 to 250 degrees.
3. Manufactured and applied in one continuous length of plastic including directional arrows. Markers comprised of letters and directional arrows individually applied to the maker are not acceptable. Legends and arrows printed on polyester subsurface and over laminated with Tedlar.
4. Text size per ASME A13.1.

5. Marking Services Style MS-995, Brady Style B-689, or approved equal.

C. Each piping system marker to be color coded for identification and labelled with the Process Service Identifier and directional flow arrows indicating the direction of flow in the pipe. Piping System marker background colors for each process service to be confirmed with Owner. Except for piping system markers with an orange, yellow or white background color, provide white text and directional arrows for all piping system markers. Provide black text and directional arrows for pipe markers with an orange, yellow or white background.

2.2 DETECTABLE WARNING TAPE AND TRACER WIRE FOR BURIED PIPE

A. Refer to Section 02600 Pipeline Construction.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPING SYSTEM MARKERS

A. Provide piping system markers and direction arrows at locations conforming to ASME A13.1 and at the following locations:

1. Apply intermittent markings on straight pipe runs, close to all valves, fittings, and adjacent to all changes in direction.
2. Where pipes pass through walls, partitions, and floors, apply markings on both sides of walls, partitions, and floors.
3. At point of entry and leaving each pipe chase and/or confined space, and piping accessible at each access opening.
4. Adjacent to valves and where valves are in series at intervals of no more than 6 feet.
5. At least once in each room and at maximum spacing of 40 feet. Exception: gas piping to be identified at 6-ft intervals in ceiling plenums.
6. Spacing for markings not less than 1 foot.
7. At the beginning and end points of each run; and, at each piece of equipment in each run.

B. Visibility

1. Place identification on the bottom of the piping system for pipe systems located near ceiling or above the normal line of sight.
2. Place identification on the side of the piping systems for pipe systems located at the normal line of sight or below.
3. Place identification at approximate line of sight for vertical pipe systems.

3.2 INSTALLATION OF DETECTABLE WARNING TAPE

A. Install a continuous ribbon of Detectable Warning Tape as specified for ALL buried piping.

B. Multiple pipes less than 4 inches in diameter installed in a common trench may be provided with a single ribbon of tape per trench. If the total width of such utilities within the common trench exceeds 3 feet, provide two parallel ribbons of tape spaced equally.

C. Provide a separate detectable warning tape for each pipe that is 4 inches or greater in size.

D. Install the tape in accordance with manufacturer recommendations.

E. At end-to-end and branch connections, provide electrical continuity connectors for detectable tape to mechanically and electrically connect ends together as recommended by the manufacturer.

F. Provide a single line of tape 2.5 feet above the centerline of buried pipe. For pipelines buried 8 feet or greater below finished grade, provide a second line of tape 12 inches below finished grade, above and parallel to each buried pipe. Spread tape flat with message side up before backfilling.

3.3 INSTALLATION OF TRACER WIRE

A. Tracer wire shall be a continuous, fully functioning, and tested system to include all appurtenances including splices and wire access boxes at grade.

B. Tracer wire laid along the top of the pipe prior to backfilling. Secure in place with tape every 20 feet. Where the pipe is encased or provided with concrete collars or cut-off walls, lay the wire on top of the encasement (do not encase the wire). Do not pull the wire taut; leave sufficient slack to allow for pipe movement and future repairs.

C. Splice tracer wire using the specified silicone-filled splice kits in accordance with manufacturer recommendations. Ensure the silicone fully encapsulates un-insulated wire ends and are made watertight.

D. Pull tracer wire up into all valve boxes, cleanout access boxes, and into all utility cabinets and meter boxes installed on the pipeline. For each wire end, provide an 18-inch long length of extra wire (coiled and tucked out of the way in an accessible location) for connection to utility locating equipment.

E. Where the pipeline enters structures, vaults, tanks, or buildings, provide a wire access box at grade adjacent to the structure or building for termination of the tracer wire. Provide an 18-inch long length of extra wire (coiled and tucked into the box) for connection to utility locating equipment. Also provide boxes at each pipeline branch, cross or tee, and at intermediate spacing along the pipeline not to exceed 1,000 feet (except where pipeline valves with valve boxes provide the required wire access at those locations and intervals).

F. Upon completion and backfill of the pipeline, test and demonstrate electrical continuity of each segment of tracer wire. Submit test results to the Owner indicating the location of the tested segment. Use conductive testing method; inductive test methods are not acceptable. Repair all faulty work at no additional cost to the Owner until the system is functional and approved.

3.4 FIELD QUALITY CONTROL

A. Comply with manufacturer's handling and installation instructions.

B. Provide continuity testing of tracer wire as specified herein.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 15100

VALVES, GENERAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies the supply, installation and testing of valves. Materials and performance requirements for valves are specified in Detailed Valve Specifications. Detailed Valve Specifications are provided in Sections 15105, 15110 and 15113.

B. Determining Valve Type:

1. Drawings specify valve types (gate, plug, butterfly, check, globe, etc.) used in each pipeline. Process fluids that will be conveyed in pipelines are identified by the Process Service Identifiers shown on the Drawings.
2. Provide valves conforming to the Detailed Valve Specifications for the valve/line size, process service, and valve type specified on the Drawings.

1.2 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 11000 – General Requirements for Equipment
2. Section 01300 – Contractor Submittals
3. Section 02630 – Ductile Iron Pipe
4. Section 02646 – PVC Pressure Pipe

1.3 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title

Reference	Title
ANSI 16.10	Face-to-Face and End-to-End Dimensions of Valves
ANSI B1.20.1	Pipe Threads, General Purpose
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, and 250
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.34	Valves—Flanged, Threaded, and Welding End
API 607	Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats
ASTM A48	Gray Iron Castings
ASTM A108	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A216/A216M	Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A276	Stainless and Heat Resisting Steel Bars and Shapes
ASTM A351	Castings, Austenitic, for Pressure-Containing Parts
ASTM A516	Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A536	Ductile Iron Castings
ASTM A571	Austenitic Ductile Iron Castings
ASTM A995/A995M-13	Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts
ASTM B124	Copper and Copper Alloy Forging Rod, Bar, and Shapes
ASTM B148	Aluminum-Bronze Sand Castings
ASTM C283	Resistance of Porcelain Enameled Utensils to Boiling Acid
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D5162	Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
AWWA C500	Metal-Seated Gate Valves for Water Supply Service
AWWA C504	Rubber-Seated Butterfly Valves
AWWA C507	Standard for Ball Valves
AWWA C508	Swing Check Valves for Waterworks Service, 2 – 24 Inches NPS
AWWA C517	Resilient-Seated Cast Iron Eccentric Plug Valves
AWWA C550	Protective Interior Coatings for Valves and Hydrants
MSS SP-70	Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	Bronze Gate, Globe, Angle and Check Valves
MSS SP-81	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
MSS SP-110	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
NSF 61	Drinking Water System Components - Health Effects
UL 429	Electrically Operated Valves
UL 1002	Electrically Operated Valves for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G

1.4 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300
2. A copy of this Section, addendum updates included, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations from specification requirements. Check-marks (✓) denote full compliance with a paragraph as a whole. Underline deviations and denote with a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance on the part of the Contractor with the specifications. Include a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal will be sufficient cause for rejection of the entire submittal with no further consideration.
3. Catalog cuts and/or shop drawings for each type of valve indicating the valve type (Detailed Valve Specification Section Number), materials of construction, dimensions, operating torque, valve end connection configuration, pressure rating, and operating temperature range.
4. An amended Detailed Valve Specification for all valve types provided for this contract. Indicate with check marks where the valve supplied meets the requirements specified and with written amendments where the product differs from the specification.
5. Factory Acceptance Test results and/or Certified Statement of Proof-of-Design testing results when specified in Detailed Valve Specifications.
6. Action Submittal Items listed on Detailed Valve Specifications

B. Informational Submittals:

1. Affidavits and registration numbers as specified.
2. Operating and Maintenance data for incorporation in operation and maintenance manual, as specified in Section 01730. Include complete description of operation together with detailed drawings, a complete list of replacement and repair parts, and parts manufacturer's identifying numbers.
3. Informational Submittal Items listed on Detailed Valve Specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01600.

B. Deliver valves to site in accordance with Section 01600 and using loading methods which do not damage any valve components or coatings.

C. Tag loose valves, stating size, type, coatings and mating parts shipped loose or separate.

D. Store on site until ready for incorporation in the work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

PART 2 PRODUCTS

2.1 VALVE CONFIGURATION REQUIREMENTS

A. General

1. Provide valves of the same type, size range and service from a single manufacturer.
2. Provide new, unused valves for the work.
3. Provide valve materials free from defects or flaws, with true alignment and bores.
4. Provide valves that open by turning the valve shaft to rotate counter-clockwise unless otherwise specified in the Detailed Valve Specification Section.

B. Provide padlockable lockout feature on all valves.

C. Manual Operators

1. Provide valves with manual operators as specified in the Detailed Valve Specification.
2. For hand wheels, clearly show the direction of opening in raised lettering and symbols.
3. The maximum rim pull on a hand wheel is not to exceed 65 lb. when one side of the valve is at test pressure and the other side is at atmospheric pressure. Where a shaft mounted hand wheel would require greater force to operate, provide a torque reduction gearbox operator. Unless different operators are scheduled or specified on the Drawings, conform to the following minimum requirements.
4. Quarter turn lever operators are to be perpendicular to the pipe runs when the valves are closed.
5. The maximum pull at the end of the lever arm is not to exceed 65 lb. when one side of the valve is at test pressure and other side is at atmospheric pressure. Where greater force would be required to operate the valve with a lever, provide a torque reduction gearbox operator.
6. Provide grease lubricated, worm gear type operators for torque reduction gearbox operators. Gearbox operators equipped with a hand wheel and a visual indicator of the valve position. Provide gear operators with adjustable mechanical stop-limiting devices to prevent over travel of the disc/ball/plug in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Where gearbox operators are intended for direct bury or submergence, seal units with long life lubricant.
7. For manual valves on lines 3 inches and greater, mounted over 7.0 feet above the operating floor, provide chain wheel gear operators. Design chain wheel operators so that a force of 30 lb. is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. Provide chain pulley that positively engages the chain links. The chain will extend from the valve operator to an operating height of 4 feet above the floor or as directed by the CITY. The exact dimensions will be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.

8. Where manual operators are installed over 7.0 feet above the operating floor and the Drawings specify a vertical valve shaft, revise the gear operator and/or chain wheel position to provide a horizontal chain wheel shaft. Retain the valve orientation specified on the Drawings.

9. Provide ductile iron chain wheels. Provide galvanized steel operating chains.

D. Valve Stem Extensions and Wrench Nuts

1. Provide valve stem extensions where additional clearance is required for pipe insulation or where valve operation without the extension is difficult; and in manholes.

2. Where angle valve stem extensions are employed, they will be angle geared. Universal joint types are not permitted.

3. Wrench nuts shall comply with AWWA C500. A minimum of two operating keys, but no less than one key per every ten valves, shall be provided for operation of wrench nut operated valves.

E. Operator Appurtenances

1. Valve Boxes: Valve boxes shall be cast iron and shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put covers. Covers shall be hot-dip galvanized. Valve boxes extending to finished surfaces shall be provided for buried valves.

2. Floor Boxes: Floor boxes shall be hot-dip galvanized. Where the operating nut is in the concrete slab, the floor box shall be bronze bushed. Where the operating nut is below slab, the opening in the bottom of the box shall be sufficient for passage of the operating key. Floor boxes shall be provided for wrench operation of valves located below concrete slabs. Each floor box and cover shall be of the depth required for installation in the slab.

3. Adjustable Shaft Valve Boxes: Adjustable shaft valve boxes shall be concrete or cast iron Brooks No. 3RT, Christie G5, Empire 7-1/2 valve extension box, or equal. Box covers on water lines shall be impressed with the letter "W." Gas line covers shall be impressed with the letter "G."

2.2 VALVE IDENTIFICATION TAGS

A. Provide valve identification tags for all valves with an identification tag number on the drawings (Mechanical and PI&D drawings).

B. Match tag numbers shown on the drawings.

C. Type 316 stainless steel tags, minimum 2.5-inches x 0.75 inches, with 0.1875 inch numbers and letters. Complete tag number shall be embossed on the tag. Tags shall be attached using stainless steel wire.

PART 3 EXECUTION

3.1 PREPARATION

A. The valve and piping arrangement indicated on the Drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in the

piping to allow for discrepancies between the valve dimensions shown and those supplied for the Work.

B. Prior to installation of valves, field measure and check all equipment locations, pipe alignments, and structural installations. Ensure that the valve location and orientation provides suitable access to manual operators and that sufficient space and accessibility is available for hydraulic, pneumatic, and electric power actuators.

C. Where conflicts are identified, inform the CITY.

D. Valve coating per Section 09800.

3.2 INSTALLATION

A. Install valves in conjunction with the piping specified in the detailed piping specifications.

B. In no case install a valve with the operator below the valve.

C. Unless otherwise specified on the drawings, install butterfly valves, eccentric plug valves, and trunnion ball valves with the shaft in a horizontal orientation. Install eccentric plug valves with the plug above the valve shaft centreline when the valve is full open.

D. When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.

E. Support valves in position using temporary supports until valves are fixed in place.

F. Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.

G. Where valves are installed in plastic pipelines (PVC, CPVC, HDPE, polypropylene etc.) greater than 4-inch diameter, support valves independent of the piping and brace valves against operating loads and torque to prevent transmission of stresses to the adjacent pipework.

H. Install valves which are bubble tight in one direction to provide bubble tight seal of flow in normal direction of flow unless otherwise noted or directed by the CITY.

I. Install valves on pump discharge and suction lines with seat end towards the pump.

J. Install all valves in accordance with the manufacturer's recommendations.

K. Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tape wrap.

L. Wrench nuts shall be provided on buried valves, on valves which are to be operated through floor boxes, and where specified. Extended wrench nuts shall be provided if necessary so that the nut will be within 6 inches of the valve box cover.

3.3 FIELD QUALITY CONTROL

A. Field or Site Tests and Inspections per Detailed Valve Specifications.

B. Pressure test all valves in conjunction with the pipes in which the valves are installed at test pressures specified in the applicable Piping System Schedule.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 15105

CHECK VALVES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing check valves 2 through 12 inches of the types and sizes indicated with epoxy coating, appurtenances, and accessories. Check valves shall have a rated limit of 200 psi pressure and 125 °F temperature.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15100 Valves, General

1.3 SUBMITTALS

A. Action Submittals: Manufacturer's catalog information including dimensions, cross-sectional views, details of construction and materials list.

B. Information and Closeout Submittals: See Section 15100

PART 2 - PRODUCTS

2.1 CHECK VALVES

A. **Body:** Cast Iron; valves shall be provided with a clear opening equal to or greater than the connecting piping; surfaces intended to be in contact with water shall be epoxy coated per Section 09800

B. **Disc:** Cast Iron or Ductile Iron

C. **Seat:** Aluminum Bronze, Stainless Steel (316), or Buna-N; seats shall be threaded onto the body or fitted with an O-ring seal and locked in place with stainless steel screws or pins and shall be replaceable

D. **Hinge Shaft:** Stainless Steel (301, 303, or 304); shafts shall be provided with stuffing box and packing or O-ring seals at each end, seals shall be externally replaceable

E. **Shaft Bushing:** Bronze

2.2 VALVE CONFIGURATION

A. **Valve End/Connections:** ANSI Class 125# Flange

B. **Check Mechanism:** Swing; outside lever weight type

C. **Operator:** Air Cushion Swing Arm; swing arm shall be field convertible from right- to left-side of valve and horizontal or vertical positioning

D. **Reference Standard:** AWWA C508; only applicable for valves sizes 2 through 24 inches

2.3 CANDIDATE MANUFACTURERS

A. Golden Anderson 250D

B. APCO Series 6000

C. Crispin SWC Series

** END OF SECTION **

SECTION 15110

PLUG VALVES

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing plug valves 3 through 12 inches of the types and sizes indicated with epoxy coating, appurtenances, and accessories. Plug valves shall have a rated limit of 175 psi pressure and 125 °F temperature.

1.2 RELATED SECTIONS

A. The WORK of the following Section applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 15100 Valves, General

1.3 SUBMITTALS

A. Action Submittals:

1. Furnish three certified copies of a report from an independent testing laboratory certifying successful completion of proof-of-design testing conducted in accordance with AWWA C517, Section 5.2. In lieu of testing the valves at an independent testing laboratory, proof-of-design testing may be performed at the valve manufacturer's laboratory, but must be witnessed by a representative of a qualified independent testing laboratory, and all test reports must be certified by the laboratory representative. Proof-of-design testing shall have been performed on not less than three 6-inch diameter valves, with all three test units demonstrating full compliance with the test standards. Failure to satisfactorily complete the test shall be deemed sufficient evidence to reject all valves of the proposed make or manufacturer's model number.

2. See Section 15100 for additional requirements

B. Information and Closeout Submittals: See Section 15100

PART 2 - PRODUCTS

2.1 PLUG VALVES

A. **Body:** Cast Iron

B. **Plug:** Cast Iron or Ductile Iron

C. **Plug Facing:** Neoprene or Buna-N

D. **Seating:** Ni or Stainless Steel

E. **Packing:** Buna V-flex or TFE

F. Bearings: Stainless Steel

G. Grit Excluder: PTFE or Buna-N

2.2 VALVE CONFIGURATION

A. **Valve End/Connections:** ANSI B16.1 Class 125# Flange

B. **Pattern:** One-piece, Standard Port; provide 100% minimum port area of adjacent pipe for valves 4 inches and less, provide 80 to 85% port area of adjacent pipe for valves 6 to 24 inches,

C. **Installation:** Install with shaft in horizontal position, valve seat located upstream

D. **Operator:** Handwheel

E. **Special:** Special: upper and lower journal bearings shall be replaceable, sleeve-type, corrosion resistant, and permanently lubricated; packing shall be self-adjusting chevron type replaceable without disassembling the valve

F. **Reference Standard:** AWWA C517

2.3 CANDIDATE MANUFACTURERS

A. DeZurik PEC

B. Pratt Ballcentric

C. Val-Matic Cam-Centric

** END OF SECTION **

SECTION 15113

AIR/VACUUM VALVES FOR WASTEWATER SERVICE

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope: This Section specifies air release valves, air and vacuum relief valves, and combination valves for wastewater service.

B. Types:

1. General: Valves furnished under this specification shall be tubular in design with direct acting cylindrical hollow and solid float mechanisms designed to function efficiently in the presence of grease, fibers and particulate material commonly present in municipal and domestic wastewaters and wastewater treatment effluents. The design shall incorporate materials and geometry that provides self-flushing of the valve internals on emptying.
   a. Valve designs that employ float guide brackets, levers, springs and ball type floats are specifically prohibited. Valves furnished under this Section shall be fitted with direct vents. Main venting orifices and outlet connections shall be equal in diameter to the specified pipeline connection.
   b. Air and vacuum valve nomenclature originated with valves used in clean water service which had the three valve types listed in below. Valves for wastewater service as covered in this Section are available in the types listed below.
2. Air Release Valves: Wastewater air release valves (ARV) shall have a small venting orifice to vent the accumulation of air and other gases with the line or system under pressure. Size and capacity shall be as specified.
3. Air and Vacuum Valves: Wastewater air and vacuum valves (ARVV) shall have a dual float system with a large venting orifice to permit the release of air as the line is filling or relieve the vacuum as the line is draining or is under negative pressure. As the pipeline approaches the full condition on filling, the large orifices shall be sealed by the primary float and the secondary float shall allow the remaining air to vent at a reduced rate to prevent development of hydraulic transients. Size and capacity shall be as specified.
4. Combination Air Valves: Wastewater combination air valves (CARV) shall have operating features of both the air and vacuum valve and the air release valve. Size and minimum capacity under both air release and vacuum relief shall be as specified.
5. Combination Air Valve with Bias Spring: Wastewater combination air valves with bias springs (CARV-B) are similar to CARV units except that a bias spring is employed that causes air to vent through the smaller orifice at a reduced rate to prevent development of hydraulic transients during start-up or other venting periods (and not only at excessively high exhaust velocities as happens in CARV units).

1.2 REFERENCES

A. This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A240	Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

1.3 SCHEDULE

A. Valve size shall be as shown on drawings. Valve performance shall be as listed in Table 1 below.

Table 1. Performance Data for Manufacturer's Standard CARVs

Valve size, inches	Valve Type	Vent connection[a]	System pressure, PSIG	Pressure relief capacity, minimum, standard cubic feet/min at 0.75 PSI differential[b]	Anti-shock vent capacity, maximum, standard cubic ft/min at 14.5 PSI differential[b]	Vacuum relief capacity, minimum standard cubic feet/min at 5 PSI differential[b]
2	CARV	T	20	200	42	430

[a] F= Flange, T = Threaded connection

[b] Capacities shall be documented by an independent testing method acceptable to the Construction Manager and shall be as listed in a report detailing the testing methodology. The report shall be dated not more than two years prior, shall be specific to the model proposed, shall be signed by the test author and shall be notarized as true and correct.

1.4 SUBMITTALS

B. Submittal material, to be provided in accordance with Section 01300, shall include the following:

1. Catalog information for each size to be furnished
2. A copy of this specification Section and the referencing Section and all other applicable specification Sections governing the pump, drive and driver, supports and specified appurtenances. The specification copies shall be complete with addendum updates included, with each Paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a

Paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified Paragraph. The remaining portions of the Paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification Sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Certified performance information produced by an independent testing laboratory acceptable to the Construction Manager, current to within five years from the date of the submittal, specific to the construction details for the model proposed, confirming performance not less than that required by this specification. The test methodology may use mathematical modeling techniques to affirm specific model size performance so long as the test performance for specific size valve(s) has been spot-checked by bench tests of the valve size in question and the results show modeling performance within ± 5 percent of bench test results. The performance confirmation shall be dated, signed by the author of responsible for the test information, notarized as true and correct.
4. Materials of construction
5. Installation requirements

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. Wastewater air release valves shall be Vent-Tech SWG, as furnished by International Valve Marketing, or Vent-O-Mat RGX as produced by RF Technologies, Inc.

B. Alternative manufacturers' products will be considered, provided the following information has been submitted and accepted as proof the proposed substitution provides equal or improved performance over that of the specified product and materials. Any submittal requesting substitution shall include the information specified under paragraph 1.04 and the following:

1. Detailed construction and functional description of operation with bill of materials and detailed graphics showing construction features and step-by-step operation demonstrating compliance with the features and operational characteristics specified in this Section.
2. Certified performance (air venting and vacuum venting) curves for each size valve to be provided. Performance curves shall be certified and notarized correct by an independent testing laboratory.
3. Not less than four affidavits of performance signed by general managers or executive officers of the owning agency and notarized. The affidavits of performance shall, as a minimum, document the following:

a. Side-by-side operation with the specified Vent-Tech or Vent-O-Mat valves in unscreened wastewater service for periods of not less than 6 months.

b. During the side-by-side periods of operation, the proposed valve and the specified valves shall have been inspected for clogging and function on not less than a weekly basis and shall not have required more maintenance effort than the valves specified in this Section.

c. The affidavits shall contain unreserved acceptance of the proposed valve as a complete equal to the Vent-Tech or Vent-O-Mat valves specified herein.

2.2 MATERIALS

Component	Material
Body and cover	Stainless steel, ASTM A240, Type 316L
Hardware	Stainless Steel, Type 316
Primary and secondary floats	High density polyethylene
Seats	Nitrile or EPDM
Trim and venting orifices	Stainless steel, ASTM A240, Type 316L

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

2.3 CONSTRUCTION

A. General: All wastewater air release and vacuum valves shall have tubular elongated bodies and shall be specifically designed for operation on wastewater and wastewater applications. Valve bodies shall be certified for not less than twice the system pressure specified in paragraph 1.03 and shall have over pressure relief features to prevent catastrophic rupture of the valve body. The relief feature shall be incorporated into easily replaced components. The valve size shall be the nominal size of the valve inlet and outlet (piping connection) as herein described. All valve clearances shall be designed for unobstructed flow of air through all passages with a net cross-sectional area at least equal to that of the nominal piping connection. The valve manufacture shall be prepared to document compliance with this requirement in all respects for each component in the valve assembly.

B. Body: The valve body shall have a fused glass lining or equivalent finish. The valve body shall, be sized to assure the unobstructed annular space between the valve floats and the inner surface of the valve body exceeds the cross-sectional area of the valve's inlet and outlet connections. Valved upper and lower flushing ports (1/2 inch minimum) shall be provided. Materials for flushing ports shall be the same as the body.

C. Air Inlet/Outlet Fitting: The air inlet/outlet fitting shall have a net opening equal in cross-sectional area to the valve size and shall be screened with a high efficiency punched screen to prevent ingression of airborne debris. The connection from the air inlet cap

chamber to the valve body shall be a smooth toroidial transition, polished to facilitate movement from the cap to the body with minimal energy losses by gradual acceleration to the connection with the valve body air passages. The underside of the fitting shall be finished smooth to effect an air tight seal with the anti-surge floats. The valve shall form an airtight seal with an internal pressure of no more than 3 psig.

D. Air Outlet/Inlet Fitting: The air outlet/inlet fitting at the connection to the piping shown shall be formed to provide a smooth transition to the valve outlet in a manner equal to that described in paragraph 2.03 Air Inlet/Outlet Fitting. The connection to the piping system shall have a cross-sectional area as described in paragraph 2.03 General.

E. Floats: The anti shock float shall have not less than five tubular orifices to evenly distribute pressurized air across the face of the float. Air inlets for the tubular orifices shall be a smooth, rounded transition to reduce shock and discharged moisture as the as the float seats. The main float shall be tubular in construction, fitted with a centering guide on the upper float cap for contacting and centering on the anti-shock float.

2.4 SPARE VALVES

A. One spare valve shall be provided for each type and size of valve specified.

2.5 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Manufacturer's product data.
2. O&M instructions per Section 01730.

PART 3 EXECUTION

3.1 INSTALLATION

A. Wastewater air release and vacuum valves shall be installed in accordance with the manufacturer's recommendations. Isolation valves shall be provided below each air valve, as shown on the Contract Drawings.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 15185

POWERED ACTUATORS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies powered actuators for valves and gates and actuator appurtenances.

B. Types: For use in the gate schedule in Section 11293 and in this section, powered actuators are defined as follows:

Actuator Type (ACTUSPEC)	Service	Definition
EMTI	Isolating (Open-Close)	Electric motor multi-turn

1.2 REFERENCES

C. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

D. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM A519	Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM B584	Copper Alloy Sand Castings for General Applications
JIC P-1	Pneumatic Standards for Industrial Equipment and General Purpose Machine Tools
NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies

1.3 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each

paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
3. Manufacturer's catalog information and other data confirming conformance to design and material requirements.
4. Application sheets and schedules for each valve and actuator showing required mounting, operating torque for valve, torque capacity of actuator, and power or air pressure requirements. Valve identification (tag) number shall be clear for each application.
5. List of components being provided for each valve, actuator and positioner.

PART 2 PRODUCTS

2.1 GENERAL

A. Actuators shall be factory-mounted on the valve or gate and provided as a unit. Each valve body or actuator shall have cast thereon the word "OPEN," an arrow indicating the direction to open, and flow direction arrows.

2.2 POWERED ACTUATORS

A. General: Actuators shall be sized to produce an operating torque equal to twice the maximum required valve operating torque under the specified flow conditions. Specific requirements for each type powered actuator are specified on the actuator specification sheets in paragraph 3.04.

B. Electric Actuators

1. General: Unless otherwise specified, electric actuators shall be provided in accordance with the actuator specification sheets and the following requirements.
2. Motor: Actuator motors shall be heavy duty, specifically designed for valve or gate actuator service. Motors shall be of totally-enclosed, non-ventilated

construction. Motor shall have an internal space heater with nominal rating of 25-watts. Motors shall be rated as specified in Section 11293 and shall be or shall incorporate:

a. Four-pole 1800 RPM or provide pole-speed as required for the application.

b. Suitable for use with 460 volt, 3-phase, 60-Hertz power with +/- 10% voltage fluctuation.

c. NEMA Class F insulation.

d. Thermistor for thermal protection embedded in the motor windings.

e. Automatic motor overload relay reset.

f. Four conduit openings.

3. Enclosure: Motor and electrical enclosures shall be rated for the application and location specified:

   a. NEMA 7 Explosion Proof

4. Motor Starter: Actuator shall be provided with a three phase full voltage reversing starter rated at 30-amperes both mechanically and electrically interlocked with overload protection or elements in each of the three poles.

   a. Control Transformer shall be epoxy encapsulated and impregnated and rated at a minimum of 75VA with 120Vac secondary and other required secondary voltages of 18 Vac and 12 Vac as required, with short-circuit and overload protection.

   b. Provide lockable internal circuit breaker or internal disconnect switch where possible.

5. Disconnect Switch: Actuator shall be provided with a lockable, heavy-duty, nonfused-disconnect switch that is close-coupled to the motor actuator.

6. Gearing: Gearing shall be double-reduction, with a helical gear and pinion forming the first reduction and a worm and worm gear forming the second. The helical gear and pinion shall be fabricated from heat-treated alloy steel with hobbed and finished shaved teeth. The worm shall be fabricated from heat-treated alloy steel, ground, carburized and hardened. The worm gear shall be fabricated from high tensile strength bronze with hobbed teeth.

   a. The stem nut shall be fabricated from high tensile strength bronze and shall be the two-piece type, when possible. It shall be possible to remove the stem nut from rising stem actuators from the top without removing the actuator from the valve or gate, disconnecting any electrical wiring, or disassembling any of the gearing. All gearing shall be designed to withstand a 100 percent overload.

7. Torque Switch: Electric actuators shall be provided with a double-torque switch set to disengage motor power at 75 percent of the shaft's design torque. The torque switch shall operate in both the opening and closing directions and shall operate during the complete cycle without the use of auxiliary relays, linkages, latches, or other devices.

   a. Each side of the torque switch shall have a numbered dial for set point adjustment. A calibration tag shall be mounted near each switch for correlating the dial settings with output torque.

8. Manual Actuator: Electric actuators shall be provided with a handwheel for manual operation. The handwheel shall not rotate during motor operation nor

shall a locked motor prevent manual operation. Motor or manual selection shall be accomplished by a positive declutching knob or lever which will disengage the motor and motor gearing mechanically but not electrically. Prohibit manual and motor simultaneously operation. Hand operation shall not require more than 100 pounds of rim effort at maximum torque.

9. Hammer Blow Device: Electric actuators shall be provided with a built-in lost-motion device that allows sufficient travel of the worm gear, prior to engaging the stem nut, for the motor to reach full speed. This action shall impart a "hammer blow" to start the valve or gate in motion in either direction. The load shall be shared equally by two lugs cast integrally on the drive sleeve.
10. Conduit Openings: Electric actuators shall be provided with the largest available: power conduit opening; control conduit opening; and instrument conduit opening.

C. Pneumatic Diaphragm Actuators: Not Used

D. Pneumatic Cylinder Actuators: Not Used

2.3 ACTUATOR APPURTENANCES

A. Tubing: Unless otherwise specified, copper tubing shall be furnished with powered actuators.

B. Tube Fittings: Unless otherwise specified, plastic tube fittings shall be furnished with powered actuators.

C. Air Pressure Filter Regulators: Not Used

D. Identification Tags: Each powered actuator shall be provided with a 16-gage stainless steel identification tag that bear the equipment description and tag number of the actuator, as specified. Characters shall be 1/4 inch, die-stamped. Identification tags shall be securely attached to the actuator in a readily visible location using stainless steel screws or wire.

2.4 PRODUCT DATA

A. The following information, and technical data for all equipment specified in this section shall be provided in accordance with Section 01300.

1. Testing procedures and forms specified in paragraph 3.02 General Requirements.
2. Operating and maintenance data in conformance with Section 01730.
3. Final reviewed submittal, with product literature/specifications included, and final actuator configuration settings.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

1. Installation shall be as specified herein. Valve actuators shall be located so that they are readily accessible for operation and maintenance and mounted for unobstructed access.
    a. Valve actuator mounting shall not obstruct walkways.
    b. Valve actuator support systems shall not be attached to handrails, process piping, or mechanical equipment.
    c. Valve actuators mounting shall not be located where shock or vibration will impair their operation.

B. Powered Actuators:
1. General: Powered actuators shall have their manual operating accessory, where possible, located between 48 inches and 60 inches above the floor or a permanent work platform
2. Identification Tags: Tags shall be located in a clearly visible location on the valves. If necessary, reposition and reattachment with stainless steel screws or wire.
3. Electrical Power Wiring: Electric power wiring and equipment shall be in compliance with Division 16.
4. Signal Wiring: Electrical signal wiring and equipment shall be in compliance with Division 16
5. Instrument Supply And Signal Air Connections: Instrument supply and signal air connections shall comply with Division 13.

3.2 TESTING

A. General Requirements:
1. Testing shall be performed in accordance with Section 01680, and this section. No required test shall be applied without prior notice to the Construction Manager to witness any test. At least 14 days before the commencement of any testing activity, a detailed step-by-step test procedure, complete with forms for the recording of test results shall be provided. All equipment necessary to perform the required tests shall be provided.

B. Piping Testing:
1. Liquid Piping Systems: Liquid piping systems shall be tested for leaks in compliance with piping schedule in the drawings.

3.3 TRAINING

A. Operation and maintenance training for the equipment provided under this section shall be provided for the Owner's personnel in accordance with Section 01730.

3.4 ACTUATOR SPECIFICATION (ACTUSPEC) SHEETS

The following ACTUSPEC sheets are included in this section: EMTI

Actuator Type:	EMTI – 460 Vac, 3-Phase, 60-Hertz
Description:	Electric Multi-turn Isolation gate actuator
Construction:	Actuators shall be Limitorque Type L120 or electronic model MXA; EIM Series 2000; or Rotork IQ; modified as necessary to provide the specified features and to meet the specified operating requirements.
Controller:	Unfused disconnect type combination starter in compliance with NEMA ICS.
Controls:	Control power shall be provided by an integral 120 volts AC, single-phase control transformer unless a separate power source is shown on the electrical drawings. The transformer shall be sized to operate at not more than 80 percent of rating with the connected load shown. The transformer shall have protective secondary fusing. Actuators shall be provided with an integral control station that includes a “LOCAL/REMOTE” swith and an "OPEN" pushbutton, a "CLOSE" pushbutton, and a "STOP" pushbutton. Momentary operation of the "OPEN" or "CLOSE" pushbutton shall cause the actuator to drive the valve or gate to the appropriate limit. Momentary operation of the "STOP" pushbutton shall cause the actuator to stop. Terminals for remote "OPEN" and "CLOSE" pushbuttons shall be provided.
Position Switches:	Actuators shall be provided with a minimum of two rotor-type switch assemblies containing a minimum of 8 contacts. When shown on the electrical drawings, the actuator shall have 16 contacts, 4 on each of 4 rotors. Position switches shall be

heavy-duty, open-contact type, with rotary wiping action. Contacts shall be rated at 3 amps at 120 volts AC.

Position switches and gearing shall be an integral part of the actuator. Position switch gearing shall be of the intermittent type and allow switch set points to be set at any point of travel between fully open and fully closed. Switches shall not be subject to breakage or slippage due to over-travel. The position switch assembly shall be enclosed in its own housing.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16000

GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1--GENERAL

1.1 DESCRIPTION

A. Scope: This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section. The electrical drawings and schedules included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.

B. Definitions:

1. Elementary or Schematic Diagram: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

2. One-Line Diagram: A one-line diagram shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

3. Block Diagram: A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

4. Wiring Diagram or Connection System: A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram shall be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) a panel layout diagram showing the physical location of devices plus the elementary diagram.

5. Interconnection Diagram: Interconnection diagrams shall show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable.

a. Each wire identification as actually installed shall be shown. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as

actually installed and identified in the equipment complete with individual terminal identification.

b. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Wires or jumpers shown on the equipment connection diagrams shall not be shown again on the interconnection diagram. Signal and DC circuit polarities and wire pairs shall be shown. Spare wires and cables shall be shown.

6. Arrangement, Layout, or Outline Drawings: An arrangement, layout, or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.2 QUALITY ASSURANCE

A. REFERENCES:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NECA-1	National Electrical Contractors Association – Standard Practices for Good Workmanship in Electrical Contracting
NFPA	National Fire Protection Association
NFPA-70	National Electrical Code (NEC)
NFPA-70E	National Electrical Safety Code (NESC)
ACI 318	Building Code Requirements for Structural Concrete

B. Identification Of Listed Products:

1. Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are

Underwriters Laboratories (UL), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

2. When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority, to undergo inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

C. Factory Tests: Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

1.3 SUBMITTALS

A. The following submittals shall be provided in accordance with Section 01300:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. Catalog cuts of equipment, devices, and materials requested by the individual specification sections. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc. Catalog cuts shall be edited to show only the items, model numbers, and information which apply. Catalog cuts shall be assembled in a folder. Each folder shall contain a cover sheet, indexed by item, and cross-referenced to the appropriate specification paragraph.

3. Interconnection diagram: The Contractor shall prepare interconnection diagrams depicting all cable requirements together with their actual terminations as specified in paragraph 16000-1.01 B.

4. Conduit layout drawings indicating size, location, and support, for all conduits other than single runs of 1-inch diameter or less cast in concrete construction.

a. Conduit layout drawings shall illustrate a system which conforms to the requirements of paragraph 16000-3.01-B.

b. For layouts that do not conform to 16000-3.01 B, provide engineering design and calculations signed and sealed by a Professional Engineer registered in the state of the project. Engineering design and calculations shall demonstrate that the proposed layout does not impair or significantly reduce the design structural strength.

5. Safety disconnect switch list including legend with equipment tag, equipment description, and power feeder circuit source and location information.

1.4 DRAWINGS

A. Where the Contractor is required to provide information on drawings as part of the specified work, such drawings shall be prepared on **22-inch by 34-inch** drafting media complete with borders and title blocks clearly identifying project name, equipment and the scope of the drawing.

B. Drawing quality and size of presentation shall be such as to permit 50 percent reduction of such drawings for insertion in operation and maintenance manuals.

1.5 PROJECT/SITE CONDITIONS

A. General: Unless otherwise specified, equipment and materials shall be sized and derated for an ambient temperature of **40** degrees C at an elevation ranging from sea level to **3000** feet without exceeding the manufacturer's stated tolerances.

B. Corrosive Areas: The following areas are designated as corrosive:

1. Submersible pump area

2. Electrical equipment area

C. Hazardous (Classified) Areas: The following areas are designated as hazardous (classified) in accordance with the NEC:

Area	Hazardous Classification
[Wetwell]	Class 1 Div. 1 Group C and D
[1.5’ high x3’ extending around edges of wetwell hatches]	Class 1 Div. 2

D. Seismic: Electrical equipment, supports, and anchorage shall be designed and installed in accordance with the seismic design requirements specified in Section 01734.

1.6 STORAGE OF MATERIALS AND EQUIPMENT

A. Materials and equipment shall be stored as specified in paragraph 01650-2.05. Equipment and materials to be located indoors shall be stored indoors and sealed with plastic film wrap.

1.7 ELECTRICAL NUMBERING SYSTEMS

A. Raceway Numbers:

1. Raceways shall be tagged at all terminations. Contractor shall assign raceway numbers in accordance with the following system where raceway numbers have not been assigned:

Raceway Prefix	Type of Function
C	Control or power - 120V or less
H	Power above 600V
N	Pneumatic tubing
P	Power 208V to 600V
S	Signal - data communication or instrumentation
X	Spare

2. Prefixes shall be followed by a 4-digit number. Add a letter suffix to distinguish the raceways where more than one raceway is routed to a particular piece of equipment.

Example:

Raceway number = P3109A where:

P = conduit contains power

3109 = unique 4-digit number

A = letter to distinguish raceways to same equipment

B. Conductor Numbers:

1. Conductors shall be identified with numbers at both ends. Conductor tag numbers shall consist of the equipment number followed by a dash followed by the conductor number specified on the control diagram. Example:

2. Equipment Tag number = 1900 - L1
where:
1900 = cable number
L1 = conductor number

3. Conductors in parallel or in series between equipment shall have the same conductor number. Neutral conductors shall have the same conductor number. Wherever possible, the conductor number shall be the same as the equipment terminal to which it connects.

4. Where factory-wired equipment has terminal numbers different than the conductor numbers shown on the control diagrams:
5. Both shall be shown on the interconnection diagram
6. Include a copy of the interconnection diagram inside of the equipment cabinet.

1.8 INDICATING LAMP COLORS

A. Refer to Section 16175 – Local Control Panels for indicating lights colors for process and electrical equipment.

1.9 ARC FLASH MITIGATION METHODS

A. In addition to Section 16431, refer to the following mitigation method requirements which shall apply to all power distribution and utilization equipment supplied for any products supplied on the project and applies to all equipment divisions in the Contract Documents. Refer to the NFPA-70 (NEC), and NFPA-70E (NESC) for equipment labeling requirements.

1.10 EQUIPMENT LABELS:

A. Equipment labels shall be installed on the outside of the electrical equipment enclosure, cabinet, and panels to avoid opening the equipment to access the manufacture's data or the equipment ratings.

1.11 POWER AND CONTROL EQUIPMENT SEPARATION:

A. Provide separation between power equipment within an enclosure, cabinet, or panel by the uses of barriers, separate access doors, or by other means.

B. Provide separation barriers between main breaker feeders coming into equipment and other termination points or bussing on the load side of the main breaker.

PART 2--PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. General: Equipment and materials shall be new and free from defects. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

B. Equipment Finish: Unless otherwise specified, electrical equipment shall be painted by the manufacturer as specified in Section 09800.

C. Galvanizing: Where specified, galvanizing shall be in accordance with Section 09800 paragraph 3.03I

2.2 WIRE MARKERS

A. Each power and control conductor shall be identified at each terminal to which it is connected. Conductors size No. 10 AWG or smaller shall have identification sleeves. Conductors No. 8 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

B. Conductors shall be identified in accordance with paragraph 16000-1.07 B. Adhesive strips are not acceptable.

C. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink with figures 1/8 inch high. Sleeves shall be yellow or white tubing and sized to fit the conductor insulation. Shrink the sleeves with hot air after installation to fit the conductor.

D. Conductor and Wire Marker Manufacture:

1. TMS Thermofit Marker System by Raychem Co
2. Sleeve style wire marking system by W. H. Brady Co.
3. or equal.

2.3 RACEWAY MARKERS

A. Raceway markers tags shall be:

1. Solid brass with 0.036-inch minimum thickness.
2. Raceway number stamped in 3/16-inch minimum height characters
3. Attached to the raceway with 316 stainless steel wire.

2.4 NAMEPLATES

A. Nameplates shall be made from laminated phenolic plastic.

1. Nominal size: 3/4 inch high by 2 inches long.
2. Black backgrounds with 3/16-inch white letters.
3. Fastened using self-tapping stainless steel screws.

B. Abbreviations shall be submitted to the Construction Manager prior to manufacture because of space limitations. Nameplate adhesives will not be permitted on the outside of enclosures.

2.5 TERMINAL BLOCKS

A. Unless otherwise specified, terminal blocks shall be panhead strap screw type. Terminals shall be provided with integral marking strips that permanently identify with the connecting wire numbers as shown on the drawings:

1. Terminal blocks for P-circuits (power 208-600 volts)
   a. Rated not less than the conductor current rating
   b. Rated less than 600 volts AC.
2. Terminal blocks for C-circuits and S-circuits:
   a. Rated not less than 20 amperes

b. Rated less than 600 volts AC.

3. Terminals shall be tin-plated.

4. Insulating material shall be nylon.

2.6 PRODUCT DATA

A. The following information and product data specified under individual specification sections shall be provided in accordance with Section 01300.

1. Applicable operation and maintenance information on an item-by-item basis in accordance with Section 01730. Operation and maintenance information shall be provided at the time of equipment, device, or material site delivery, or at a certain stage of project completion as required by Section 01730, whichever is the earlier. Full-size drawings shall be reduced to 11 x 17 inches.

2. Test results for motors and electrical systems on the forms specified in Section 16030. A file of the original test results shall be maintained by the Contractor. Prior to acceptance of work, the resulting file shall be provided to the Construction Manager.

3. Description of functional checkout procedures specified under paragraph 16000-3.02 C shall be provided **15** days prior to performing functional checkout tests.

4. Record documents specified in Section 01720 and paragraph 16000-3.3.

PART 3--EXECUTION

3.1 GENERAL

A. Construction:

1. The work under Division 16 shall be performed in accordance with these specifications.

2. Refer to the National Electrical Contractors Association's (NECA) National Electrical Installation Standards (NEIS) for Standard Practices for Good Workmanship in Electrical Contracting (NECA-1) as a minimum baseline of quality and workmanship for installing electrical products and systems that defines what is meant by "neat and workmanlike" as required by the National Electrical Code Section 110-12. Specified requirements supersede NECA practices.

3. Electrical layout drawings are diagrammatic, unless otherwise detailed or dimensioned. The Contractor shall coordinate the location of electrical material or equipment with the work.

4. Major electrical openings may compromise the structural integrity of the slab and wall elements. Major electrical openings are defined as openings or penetrations greater than two times the wall thickness in any dimension, and include duct

bank transitions into a building through structural elements. Major electrical openings shall be constructed according to standard details on the drawings, up to an opening dimension of three feet. For opening dimensions greater than three feet, construct walls and slabs as specifically detailed on the drawings for that case. Major electrical openings proposed by the Contractor shall be submitted to the Structural Engineer of Record for the project for review.

5. Minor changes in location of electrical material or equipment made prior to installation shall be made at no cost to the Owner.

B. Conduits in Concrete Construction: Conduits for power, control and instrumentation may be embedded in and pass through concrete construction subject to the limitations in this paragraph. Where concrete strength or serviceability requirements prevent the direct embedment of conduit, provide adequate support, bracing, and serviceability details:

1. Concrete strength shall not be impaired significantly by the embedment of conduits in or through structural sections.

2. Conduit layout shall conform to the requirements of ACI 318, Sections 3.3 – Aggregates and 6.3 – Conduits and Pipes Embedded in Concrete.

3. Conduits shall be treated similarly to reinforcing steel for purposes of clearance. In general, code sections require conduit spacing the greater of:

   a. 1.33 times the maximum concrete aggregate size, clear

   b. Three diameters center to center

   Alternate spacing and layout shall be as reviewed and accepted by the Engineer.

4. Conduit and raceway penetrations through walls and slabs where:

   a. one side is a conditioned or an occupied space and the other side not, or

   b. one side has liquid or groundwater contact and the other not, shall be detailed and constructed to prevent liquid and moisture penetration through the wall or slab section for each conduit.

C. Housekeeping:

1. Electrical equipment shall be protected from dust, water and damage. Motor control centers, switchgear, and buses shall be wiped free of dust and dirt, kept dry, and shall be vacuumed on the inside within 30 days of acceptance of the work.

2. Before final acceptance, the Contractor shall touch up any scratches on equipment as specified in paragraph 09800-3.03 H.

3. Electrical equipment temporarily exposed to weather, debris, liquids, or damage during construction shall be protected as specified in paragraph 01605-3.0 F.

D. Electrical Equipment Labeling:

1. Electrical equipment shall have field marked signs and labeling to warn qualified persons of the potential electric arc flash hazards per NEC Article 110.16 Flash Protection.

2. Electrical equipment shall have NFPA 70E labels installed stating the results of the Arc Flash analysis specified in Section 16431 Short Circuit and Protective Device Coordination Study Report.

3. Electrical distribution equipment and utilization equipment shall be field labels to identify the power source and the load as specified. Refer to NEC Article 110.22 for Identification of Disconnecting Means installation criteria. Specific information is required such as the equipment tag number and equipment description of both the power source and the load equipment.

E. Safety Disconnect Switches:

1. Heavy duty fused and non-fused disconnect switches with current range of 30 to 600 amperes shall be provided as shown on the drawings with the enclosure type matching the area rating. Provide lock-off provision for a hasp padlock. Provide visible knife blades through a cover viewing window. Provide shielded or insulated line terminals with quick-make / quick-break switch operator. Provide internal barrier kit for additional personnel barrier from accidental contacts with live parts. Provide a legend plate with equipment tag, equipment description, and power feeder circuit source and location identification.

2. Disconnects shall include one auxiliary contact that operates with the power switch blades. The auxiliary contact shall be wired as shown on the drawings for remote status monitoring of the disconnect position where shown or for disconnecting motor space heater where shown.

3. Fuse clips shall be Class R rejection type and sized for UL Class R, one-time, time-delay fuses. Fuse assembly shall have a minimum short circuit capacity of 100,000 amps symmetrical. Provide fuses as shown and one set of spare fuses with each switch.

F. Motor Connections: Verify that the motors are purchased with the correct size motor termination boxes for the circuit content specified as shown on the power single line diagrams or submit custom fabrication drawing indicating proposed motor termination box material, size, gasket, termination kit, grounding terminal, motor lead connection method, and motor terminal box connection/support system. Verify the motor termination box location prior to raceway rough-in.

H. Conductor Installation: An enclosure containing disconnecting means, overcurrent devices, or electrical equipment shall not be used as a wireway or raceway for conductors not terminating within the enclosure. Provide wireways, raceways, termination boxes, or junction boxes external to the enclosure for the other conductors.

3.2 TESTING

A. General: Prior to energizing the electrical circuits, insulation resistance measurements tests shall be performed using a 1000-volt megohmmeter to verify the conductor is acceptable for use on the project. The test measurements shall be recorded on the specified forms and provided in accordance with paragraph 16000-1.03.

B. Insulation Resistance Measurements:

1. General: Insulation resistance measurements shall be made on conductors and energized parts of electrical equipment. Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, NEMA or ANSI standards for the equipment or material being tested, unless otherwise specified. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

   a. Insulation resistance measurements shall be recorded in a format similar to Form 16000-A, contained in Section 01999. Insulation with resistance of less than 10 megohms is not acceptable.

2. Conductor And Cable Tests: The phase-to-ground insulation resistance shall be measured for all circuits rated 120 volts and above except lighting circuits. Measurements may be made with motors and other equipment connected. Solid state equipment shall be disconnected, unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.

3. Motor Tests: The Installed Motor Test Form, 16000-B, specified in Section 01999, shall be completed for each motor after installation.

   a. Motors shall have their insulation resistance measured before they are connected. Motors 50 HP and larger shall have their insulation resistance measured at the time of delivery as well as when they are connected. Insulation resistance values less than 10 megohms are not acceptable.

C. Pre-Functional Test Checkout: Functional testing shall be performed in accordance with the requirements of Section 16030. Prior to functional testing, all protective devices shall be adjusted and made operative.

1. Submit a description of the proposed functional test procedures prior to the performance of functional checkout.

2. Prior to energization of equipment, perform a functional checkout of the control circuit. Checkout:
   Energizing each control circuit.
   Operating each control device, alarm device, or monitoring device.
   Operate each interlock to verify that the specified action occurs.

   Verify motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation or momentary energization.

3.3 RECORD DOCUMENTS

A. Contract documents shall be maintained and annotated by the Contractor during construction.

** END OF SECTION **

SECTION 16030

ELECTRICAL ACCEPTANCE TESTING

PART 1--GENERAL

1.1 DESCRIPTION

A. This section specifies the acceptance testing of electrical materials, power distribution and utilization equipment and circuits. Contractor shall provide all labor, tools, material, power, and other services necessary to provide the specified tests.

1.2 REFERENCES:

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NETA ATS	Acceptance Testing Specifications for Electric Power Distribution Systems
NFPA-70	National Electrical Code (NEC)

1.4 SUBMITTALS

A. Functional testing and checkout procedures and schedule shall be provided in accordance with Section 01300.

PART 2--PRODUCTS

2.1 TEST EQUIPMENT AND MATERIALS

A. Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.

2.2 PRODUCT DATA

A. In accordance with Section 01300, the Contractor shall submit the completed test report forms 16000-A and 16000-B as specified in Part 3 herein.

PART 3--EXECUTION

3.1 TESTING

A. General:

1. The following specified tests, including correction of defects where found and the subsequent re-testing, shall be completed prior to energization of the equipment or systems. Submit all completed test report forms in a 3-ring binder type notebook at the project Substantial Completion date.

2. A megohmmeter shall be used for insulation resistance measurements.

B. Insulation Resistance Measurements:

1. GENERAL: Insulation resistance measurements shall be made on conductors and electrical equipment that will carry current. Minimum acceptable values of insulation resistance shall be in accordance with the applicable NETA-ATS, ICEA, NEMA, or ANSI standards for the equipment or material being tested. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

2. CONDUCTOR AND CABLE TESTS: The phase-to-ground insulation resistance shall be measured for all circuits 120 volts and above except lighting circuits. Measurements may be made with motors and other load equipment connected. Insulation resistance measurements shall be recorded in a format similar to Form 16000-A contained in Section 01999, and submitted for acceptance. Insulation with resistance of less than 10 megohms is not acceptable.

3. MOTOR TESTS: The Installed Motor Test Form, 16000-B, contained in Section 01999, shall be completed for each motor after installation and submitted for acceptance. All motors shall have their insulation resistance measured before they are connected.

a. Verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation.

4. Power Distribution Equipment: panelboards and other power distribution equipment shall have their insulation resistance measured phase-to-phase and phase-to-ground.

5. Power Utilization Equipment: Test receptacles and power outlets using a device to verify polarity, grounding, and the correct wiring connections.

C. Functional Testing:

1. Contractor shall submit a description of proposed functional test and checkout procedures conforming to the following requirements, including a schedule for conducting these procedures, not less than 30 days prior to the performance of functional testing.

2. Prior to functional testing, all protective devices shall be adjusted and made operative.

3. Prior to energization of associated equipment, perform a functional checkout of all electrical and instrumentation control circuits as specified in the following and in Division 17. Checkout shall consist of energizing each control circuit and operating each control, alarm, safety device, and each interlock, in turn, to verify that the specified action occurs.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing the following:

1. Raceways, Fittings and Supports
2. Concrete Pads, Underground Ducts, and Pull-Boxes
3. Conductors, Wire and Cable
4. Wiring Devices
5. Electrical Identification
6. Cabinets and Enclosures

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 02200 Earthwork
2. Section 03300 Cast-In-Place Concrete
3. Section 05502 Anchor Bolts
4. Section 09800 Protective Coating
5. Section 13300 General Requirements for Instrumentation and Control
6. Section 13400 Fiber Optic Communication Equipment
7. Section 16030 Electrical Acceptance Tests
8. Section 16170 Grounding System
9. Section 16175 Miscellaneous Electrical Devices
10. Section 16485 Local Control Panels

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090.

1.4 CODES

A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:

1. Uniform Building Code

2. National Electrical Code

1.5 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. Federal Specifications:

a. FS W-S-896E/GEN(1): Switches, Toggle (Toggle and Lode), Flush Mounted (ac)

b. FS WW-C-581E: Conduit, Metal, Rigid, And Intermediate; And Coupling, Elbow, and Nipple, Electrical Conduit: Steel, Zinc Coated

c. WW-C-581EZ: Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated

2. Commercial Standards:

a. ANSI B16.5: Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy, and Other Special Alloys

b. ANSI C80.1: Rigid Steel Conduit, Zinc Coated, Specification For

c. ANSI Z55.1 Gray Finishes for Industrial Apparatus and Equipment

d. ANSI C80.1: Rigid Steel Conduit-Zinc Coated

e. NEMA ICS 6: Enclosures for Industrial Controls and Systems

f. NEMA 250: Enclosures for Electrical Equipment (1000 volts maximum)

g. JIC EMP-1-67: Electrical Standards for Mass Production Equipment

h. ASTM B3: Soft or Annealed Copper Wire

i. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

j. ASTM B33 Tinned Soft or Annealed Copper Wire for Electrical Purposes

k. ASTM B189: Lead Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes

l. ASTM A193/A193M: Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service

m. UL 44: Rubber-Insulated Wires and Cable

n. UL 83: Thermoplastic-Insulated Wires and Cable

o. UL 67: Underwriters Laboratories, Electric Panelboards

p. UL 489: Molded-Case Circuit Breakers and Circuit Breaker Enclosures

q. UL 50: Cabinets and Boxes

1.6 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. General:

a. Shop drawings including the following:

1) Front, side, and rear elevations and top views.
2) Location of conduit entrances and access plates.
3) Identification of conductors not indicated on drawings.
4) Identification numbers of conductors.
5) Manufacturers' equipment drawings.
6) Component data.
7) Connection, terminal and internal wiring diagrams, and conductor sizes.
8) Layout drawings indicating arrangement, dimensions and weights.
9) Methods of anchoring.
10) Finish.
11) Nameplates.
12) Temperature limitations, as applicable.

b. Manufacturer's product data including the following:

1) Catalogue cuts, bulletins, brochures, or photocopies of applicable pages for mass produced, non-custom manufactured products stamped to indicate the project name, applicable Specification section and paragraph, model number, ratings and options.

c. Lists of the following:

1) Materials, equipment, apparatus and fixtures proposed for use; with the list including sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

d. Test reports of the following: Factory-fabricated products.

2. Lighting and Power Distribution Panelboards

a. Manufacturer's data as follows: Quantity and rating of circuit breakers provided with each panelboard.

1.7 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's installation instructions.

2. Manufacturer's maintenance procedures.

1.8 PROJECT RECORD DRAWINGS

A. The following shall be included in the PROJECT RECORD DRAWINGS in compliance with Section 01300:

1. Accurate location of conductors including depths and routing of concealed below-grade electrical WORK.

2. Accurate location of electrical WORK (raceway and conductors) where the location differs substantially from the locations indicated.

1.9 AREA DESIGNATIONS

A. **General:** For purposes of delineating electrical enclosure and installation requirements, certain areas are classified as defined below. Electrical installations within these areas shall conform to the indicated code requirements for the area indicated.

B. **General Purpose Locations**: WORK installed in areas which are not otherwise specifically classified shall be "General Purpose." Enclosures shall comply with the requirements of these Specifications and shall be NEMA Type 1.

C. **Outdoor Locations**: In outdoor locations, raceway shall be rigid galvanized steel conduit; entrances shall be threaded; and fittings shall have gasketed covers. Fittings and conduit shall be drained. Threaded fastening hardware shall be stainless steel. Mounting brackets shall be galvanized. Attachments or welded assemblies shall be galvanized after fabrication. Instruments and control cabinets, panels, switchboards and motor control centers shall be "Weatherproof NEMA Type 4X." Enclosures shall be mounted 1/4-inch from walls to provide an air space unless specifically shown otherwise.

D. **Damp Location**: Locations which are indoors and 2 feet below grade elevation or which are indicated as damp locations on the Drawings shall have electrical installations which conform to the requirements for outdoor locations; except, that the air space from walls may be less than 1/4-inch and enclosures shall be NEMA Type 4. "Damp locations" shall include pipe galleries, tunnels, and basements. Rooms housing liquid handling equipment are also classified as damp locations regardless of grade elevation.

E. **Splash Locations**: Areas indicated as "splash-proof" locations shall have electrical installations as described for "outdoor locations"; except, that NEMA Type 4 enclosures

shall be provided for instruments and controls, panels, switchboards, and motor control centers.

F. **Corrosive Locations**: Areas indicated as "corrosive" locations shall have stainless steel threaded hardware; electrical hardware, fittings, and raceway systems shall be PVC-coated. Enclosures shall be NEMA Type 4X of fiberglass and reinforced polyester or equal. Corrosive locations include all exposed areas, above and below grade, at the storm drain diversion pump station.

G. **Hazardous Locations**: NEC "Hazardous (Classified) Locations" shall be as indicated and shall comply with NFPA 820.

1.10 FACTORY TESTING

A. **Product Testing**: Products shall be tested at the factory for compliance with the indicated requirements and as follows:

1. Cabinets and Enclosures: Each motor control center shall be completed, assembled, wired, and tested at the factory. All buses and wiring shall be given a dielectric test in accordance with the latest IEEE and NEMA Standards.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.11 FIELD TESTING

A. **Testing:** Products shall be field-tested for compliance with the indicated requirements.

B. **Witnesses:** The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness field tests.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials**: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements. Products shall not be damaged, marred, or splattered with water, foam, plaster, or paint. Moving parts shall be kept clean and dry.

C. **Replacement**: Damaged materials or equipment, including face plates of panels and switchboard sections, shall be replaced or refinished by the manufacturer at no expense to the OWNER.

1.13 REGULATORY REQUIREMENTS

A. In addition to other indicated regulatory requirements, the WORK of this Section shall comply with the requirements of SSPWC Subsection 209-1.

PART -- PRODUCTS

2.1 GENERAL

A. **Listing:** Electrical equipment and materials shall be listed for the intended purpose by an independent testing laboratory including Underwriters Laboratories (UL), [Canadian Standards Association (CSA)], and [Electrical Testing Laboratories (ETL)]. Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

B. **Unlisted Products:** When a product is not available with a testing laboratory listing for the intended purpose, special testing (if any) required by the authority having jurisdiction shall be included in the original contract price.

C. **Project/Site Conditions:** Unless otherwise indicated, equipment and materials shall be sized and rated for the ambient conditions in San Diego but not less than an ambient temperature of 40 degrees C at sea level without exceeding the manufacturer's stated tolerances.

D. **Product Qualifications**: Equipment and materials shall be new and shall bear the UL label, where UL requirements apply. Equipment and materials shall be the products of reputable manufacturers specializing in the products indicated in this Section. Similar items in the project shall be products of the same manufacturer. Equipment and materials shall be of industrial grade and standard of construction and shall be of sturdy design and manufacture; and shall be capable of reliable, trouble-free service.

2.2 RACEWAY, FITTINGS AND SUPPORTS

A. **Raceway**: Raceway shall comply with the following:

1. Rigid Steel Conduit: Raceway shall be rigid steel conduit complying with ANSI C80.1 unless otherwise indicated. Rigid steel conduit shall be full weight, mild steel, hot-dip galvanized and bichromate coated inside and outside after galvanizing.

2. Fittings: Locknuts shall be extra heavy electrogalvanized steel for sizes through 2 inches. Locknuts larger than 2 inches shall be electrogalvanized malleable iron. Bushings shall be electrogalvanized malleable iron with insulating collar. Grounding bushings shall be locking type and shall include a feed-through compression lug for securing the ground cables. Unions shall be electrogalvanized ferrous alloy type. Threadless fittings are not acceptable. Gaskets shall be made of neoprene.

   a. Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4-inch movement in any direction.

3. Plastic Coated Rigid Steel Conduit and Fittings: Plastic coated conduit shall be rigid steel conduit with PVC jacket and shall conform to Federal Specification WW-C-581E, ANSI C80.1, and to Underwriter's Laboratories specifications. The zinc surfaces of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit through the preparation and application processing. A PVC coating shall be bonded to the galvanized outer surface of the conduit. The

bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 40 mils. A PVC jacketed coupling shall be provided with each length of conduit. A PVC sleeve equal to the OD of the conduit shall extend 1-1/2 inches from each end of coupling.

a. Fittings used with plastic coated conduit shall be similarly coated to the same thickness as the conduit and shall be provided with type 304 stainless steel hardware. Conduit and fittings shall be manufactured by the same company. Minimum size shall be 3/4 inch.

4. Liquidtight Flexible Steel Conduit: Liquidtight flexible steel conduit shall be formed from spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover. Minimum size shall be 1/2 inch. Fittings for liquidtight conduit shall have cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral and O-ring seals around the conduit, box connection and insulated throat. Forty-five and 90-degree fittings shall be used where applicable.

5. Explosionproof Flexible Conduit: Explosionproof flexible conduit shall be suitable for use in Class I, Division 1, Groups C and D hazardous areas complying with NEC and shall be watertight.

6. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be NEMA TC2, type EPC-40-PVC, or EPC-80-PVC high impact, polyvinylchloride (PVC). Fittings used with PVC conduit shall be PVC solvent weld type. Nonmetallic conduits shall be UL listed for applications indicated. Minimum size shall be 1 inch.

7. Wireways: Wireways and auxiliary gutters shall be JIC EMP-1 sectional flanged oiltight type with hinged covers and shall be 8 inches by 8 inches in cross section unless otherwise indicated.

B. **Boxes and Fittings:** Boxes and fittings shall comply with the following:

1. Cast Ferrous Alloy Boxes: Boxes shall be hot-dip galvanized cast ferrous alloy unless otherwise indicated. Integrally cast threaded hubs or bosses shall be provided for conduit entrances and shall provide for full 5-thread contact on tightening. Drilling and threading shall be done before galvanizing. A full body neoprene gasket shall be included with the cover. Type 304 stainless steel screws shall be provided for covers. Where two or more devices are located together, outlet and device boxes shall be gang type. Cover plates shall be hot-dip galvanized cast ferrous alloy unless the particular device requires a cover that is not manufactured in this material

2. Welded Sheet Steel Boxes: Large boxes shall be fabricated from welded steel and shall be hot-dip galvanized after fabrication. Before finish is applied, a grounding pad drilled for two bolted grounding lugs or a grounding stud shall be welded to the inside of the box. Hardware shall be 304 stainless steel. Boxes shall, as a minimum, meet NEMA 12 and JIC EMP-1 requirements.

3. Explosionproof Boxes and Seal Fittings: In areas specified as Class I, Division 1

or 2, hazardous, boxes and fittings shall be NEMA 7, Groups C and D, explosionproof. Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy. Sealing compound shall be hard type and UL listed for explosionproof sealing fittings.

4. Hubs: Threaded hubs for connection of conduit to junction, device or terminal boxes shall be made of cast ferrous alloy, electroplated with zinc and shall have insulated liner and insulating bushings. The hubs shall utilize a neoprene O-ring and shall ensure a watertight connection.

C. **Raceway Supports**: Raceway supports shall comply with the following:

1. Conduit Supports: Hot-dip galvanized framing channel shall be used to support groups of conduit. Individual conduit supports shall be one-hole galvanized malleable iron pipe straps used with galvanized clamp backs and nesting backs where required. Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated clamps or PVC conduit wall hangers.

2. Ceiling Hangers: Ceiling hangers shall be adjustable galvanized carbon steel rod hangers. Straps or hangers of plumber's perforated tape are not acceptable. Unless otherwise indicated hanger rods shall be 1/2-inch full-threaded rods and shall meet ASTM A193. Hanger rods in corrosive areas and those exposed to weather or moisture shall be stainless steel.

3. Structural Attachments (Racks): Structural attachments shall be constructed from hot-dip galvanized framing channel as specified. Field cuts shall be treated with zinc enriched paint.

2.3 CONCRETE PADS, UNDERGROUND DUCTS, MANHOLES AND PULL-BOXES

A. **General:** The WORK of this Section includes concrete pads, manholes, pull-boxes and concrete required for encasement, installation, or construction and shall be 2500-psi concrete conforming to the requirements of Section 03300 and the following:

1. Consolidation of encasement concrete around duct banks shall be by hand puddling, and no mechanical vibration will be permitted.

2. A workability admixture consisting of a hydroxylated carboxylic acid type in liquid form shall be used in encasement concrete, Admixtures containing calcium chloride shall not be used.

3. Concrete for encasement of conduit or duct banks shall contain an integral red-oxide coloring pigment in the proportion of 8 pounds per cubic yard of concrete.

B. **Concrete Pads:** Concrete housekeeping pads shall be provided for floor-standing electrical equipment. Housekeeping pads shall be 3 inches above surrounding finished floor or grade and shall be 3 inches larger in both dimensions than the supported equipment unless otherwise indicated.

C. **Concrete-Encased Ducts:** Where an underground distribution system is indicated, it shall be constructed of multiple runs of single bore non-metallic ducts, concrete encased, with steel reinforcing bars, with underground manholes and pullboxes.

2.4 CONDUCTORS, WIRE AND CABLE

A. **General**: The type, size and number of conductors shall comply with the indicated requirements. Number and types of communication, paging, and security cables shall be as required for the particular equipment provided.

1. Conductors, including ground conductors, shall be copper. Insulation shall bear the manufacturer's trademark, type, voltage rating, and conductor size.

B. **Color Coding:** Color coding shall comply with the following:

1. Control Conductors: Control conductors color coding shall be manufacturer's standard.

2. Power Conductors: Single-conductor power conductors shall have the following colors for 600V or less:

	120/208V	**480/277V**
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Ground	Green	Green
Neutral	White	Grey

a. Color coding tape shall be used where colored insulation is not available. Branch circuit switch shall be yellow. Insulated ground wire shall be green, and neutral shall be gray. Color coding and phasing shall be consistent throughout the site, but bars at panelboards, switchboards, and motor control centers shall be connected Phase A-B-C, top to bottom, or left to right, facing connecting lugs.

b. General purpose ac control conductors shall be pink. General purpose dc control conductors shall be blue.

c. Cables sized No. 4 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end. The cables shall be tagged at terminations and in pull boxes, handholes and manholes.

C. **Lighting and Receptacle Branch Circuit Conductors:** Lighting conductors shall be stranded except for No. 12 AWG which shall be solid.

1. Conductors shall comply with the following characteristics:

a. Voltage: 600 volts.

b. Conductor: Bare annealed copper; stranded in accordance with ASTM B8.

c. Insulation: THWN/THHN, 90 degree C dry, 75 degree C wet, polyvinylchloride (PVC) per UL 83.

d. Jacket: Nylon.

e. Flame resistance: UL 83.

D. **Power and Control Conductors and Cable, 600 Volts:** Conductors and cable shall comply with the following:

1. Single Conductors: Single conductor cable shall be stranded and shall be installed in conduits for power and control circuits.

a. Conductors shall comply with the following characteristics:

1) Voltage: 600 volts.
2) Conductor: Coated, Class B, stranded, annealed copper per ASTM B8.
3) Insulation: XHHW, 90 degrees C dry, 75 degrees C wet, composite of ethylene propylene rubber (EPR) and chlorosulfonated polyethylene (CSPE) per ICEA UL 44 and NEMA WC-7.
4) Jacket: Chlorosulfonated polyethylene (CSPE).
5) Flame resistance: IEEE 383.

2. Multiconductor Cable: Multiconductor cable shall be used for power and control circuits installed in cable tray. Cables shall be UL labeled, Type TC, designed for cable tray installation in accordance with NEC 340. The type of insulation, number of conductors, and size of conductor shall comply with the indicated requirements.

a. Multiconductor power cable shall contain three or four conductors, as indicated, plus an equipment grounding conductor.

b. Multiconductor power cables shall comply with the following:

1) Voltage: 600 volts.
2) Conductors: Annealed copper, stranded, per ASTM B8, coated per ASTM B33.
3) Insulation: THWN/THHN, 90 degrees C dry, 75 degrees C wet, ethylene propylene rubber (EPR) or a composite of EPR and chlorosulfonated polyethylene (CSPE) per ICEA S-68-516 and UL 44.
4) Jacket: Polyvinylchloride (PVC).
5) Flame resistance: IEEE 383.

c. Unless otherwise indicated, multiconductor control cable shall be size 14 AWG and shall comply with the following:

1) Voltage: 600 volts.
2) Conductors: Annealed copper, stranded, per ASTM B8, coated per ASTM B33.
3) Insulation: THWN/THHN, 90 degrees C dry, 75 degrees C wet, ethylene propylene rubber (EPR) or a composite of EPR and chlorosulfonated polyethylene (CSPE) per ICEA S-68-516 and UL 44.
4) Jacket: Polyvinylchloride (PVC).

5) Flame resistance: IEEE 383.

E. **Signal Cables:** Signal cables shall comply with the following:

1. General: Signal cable shall be provided for instrument signal transmission, alarm, communication and any circuit operating at less than 100 volts. Cables shall be color coded black and white for pairs or black, white and red for triads. Circuit shielding shall be provided in addition to cable shielding.

2. Single Circuit: Cable shall consist of one pair or triad, No. 16 AWG conductors with 15 mils of 90 degree C polyvinylchloride (PVC) insulation, 4 mils nylon conduit or jacket, twisted on a 2-inch lay, and covered with a 100 percent 1.35 mil aluminum-Mylar tape shield with No. 18 AWG 7-strand tinned copper drain wire and a 45 mil PVC jacket overall. Cable shall be UL listed, Type TC, rated 600 volts.

3. Multiple Circuit: Cable shall consist of four or more pairs or triads which are made up of No. 18 AWG conductors with 15 mils of 90 degree C PVC insulation, 4 mils nylon jacket, twisted on a staggered lay 1-1/2 to 2-1/2 inches, and covered with a 100 percent 1.35 mil aluminum-Mylar tape shield with No. 22 AWG 7-strand tinned copper drain wire. Overall cable shield shall be 2.35 mil aluminum-Mylar tape with a No. 20 AWG 7-strand tinned copper drain wire. Cable shall be UL listed, Type TC, 600 volts.

F. **Portable Cord:** Portable cord shall be UL listed, Type SO for sizes No. 10 AWG and smaller. Cords with conductors larger than No. 10 AWG shall be UL listed, Type G. Cords shall contain an equipment grounding conductor.

1. Cables shall comply with the following:

a. Conductors: Flexible rope stranded per ASTM B189 and B33. Conductors shall be coated except ground conductors may be uncoated.

b. Insulation: Insulation shall be ethylenepropylene (EPR) as per ICEA S-68-516 and rated for continuous operation at 90 degrees C.

c. Jacket: Heavy-duty neoprene as per ICEA S-68-516.

G. **Splicing and Terminating Materials:** Splicing and terminating materials shall comply with the following:

1. 600 Volt Conductor and Cable Connectors: Connectors shall be compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Connectors for wire sizes No. 10 AWG and smaller shall be nylon self-insulated, ring tongue or locking-spade terminals. Connectors for wire sizes No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable.

a. In-line splices and taps shall be used only where indicated, or shown on the shop drawings. When used, they shall be of the same construction as other connectors. Splices shall be compression type, made with a

compression tool die designed for the purpose. Splice shall be covered with a heat-shrinkable sleeve or boot.

2. Portable Cable Fittings: Portable cable fittings for terminating the cable shall provide a watertight seal between the cord and the terminator and between the terminator and mounting hub. The cable terminator shall include neoprene liner which grips the cord jacket when the back nut on the fitting is tightened.

2.5 WIRING DEVICES

A. **General:** Wiring devices shall be UL approved for the current and voltage indicated and shall comply with NEMA WD-1. Devices shall contain provisions for back wiring and side wiring with captively held binding screws.

1. Devices shall be brown, except those located in finished areas shall be ivory.

2. Special purpose devices shall be the color indicated.

3. Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively, and the indicated standards.

B. **Receptacles and Plugs:** Receptacles and plugs shall comply with the following:

1. General: Receptacles shall be grounding type.

2. 120V Receptacles: Receptacles indicated for indoor use in clean areas shall be duplex 20 amp, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plug caps.

Receptacle indicated for use outdoors or in process or corrosive areas shall be duplex, 20 ampere, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plug caps. Receptacle and plug caps shall be corrosion resistant, marine duty with yellow polycarbonate weatherproof lift covers.

3. Ground Fault Interrupter Receptacles: Receptacles shall be NEMA 5-20R configured and shall mount in a standard outlet box. Units shall trip at 5 milliamperes of ground current and shall comply with NEMA WD-1-1.10 and UL 943. GFI receptacles shall be capable of individual as well as "downstream" operation.

C. **Switches:** Switches shall comply with the following:

1. General Purpose (Indoor, Clean Areas): General purpose switches shall be quiet AC type, specification grade, and shall comply with rated capacities as required. Switches shall match receptacles in color.

2. Switches For Hazardous Areas: Switches for control of lighting and small single-phase power loads in hazardous areas shall consist of a factory assembled and sealed combination general purpose type switch in an explosion-proof housing. The switch shall be rated in accordance with NEC for the area in which it is to be installed. The external operating mechanism shall consist of a wing-type handle having the "ON" and "OFF" positions visible from the front.

3. Switches For Outdoor and Corrosive Areas: Switches shall be 20 amp press switch type with weatherproof/ corrosion resistant neoprene plate.

D. **Device Plates:** Device plates shall be provided with switches. In noncorrosive indoor areas, receptacle device plates shall be made of sheet steel, zinc electroplated with chrome finish.

1. Device plates in corrosive or outdoor areas shall be corrosion-resistant/marine-duty type. Device plates for explosionproof equipment shall be factory provided with the equipment.

2. Device plates shall include engraved laminated phenolic nameplates with 1/8-inch white characters on black background.

3. Nameplates for switches shall identify panel and circuit number and area served.

4. Nameplates for receptacles shall identify circuit and voltage if other than 120 volts, single phase.

2.6 DISCONNECT SWITCHES

A. Disconnect switches shall be externally operated with quick-make/quick-break mechanisms. The handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be lockable in the "off" position. Switches shall have nameplates with manufacturer, rating, and catalog number. Heavy-duty switches shall have arc suppressors, pin hinges, and shall be horsepower rated at 600-volts. Heavy-duty switches shall be provided for all motor circuits above 3 horsepower. In smaller motor circuits switches shall be general duty. Switch enclosure shall be NEMA 4.

2.7 ELECTRICAL IDENTIFICATION

A. **Nameplates:** Nameplates shall be fabricated from white-center, black-face laminated plastic engraving stock. Nameplates shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style of adequate size to be read easily at a distance of 6 feet with no characters smaller than 1/8-inch high.

B. **Conductor and Equipment Identification**: Conductor and equipment identification devices shall be either imprinted plastic-coated cloth marking devices or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place.

C. **Identification Tape (Buried)**: Identification tape for protection of buried installation shall be a 6-inch wide green polyethylene tape imprinted "CAUTION - ELECTRIC UTILITIES BELOW".

2.8 CABLE NUMBERING

A. The first two characters denote the facility or area number.

B. The second group of characters identifies the device being served.

C. The third section uses one of the four suffixes in the table below. Where muliple circuits of the same type are routed to the same endpoint, the suffix will be P1, P2, as required.

D. At each device or termination point, the circuit identifiaction number is appended with the individual wire number. For Direct-Current (DC) circuits only, wire polarity is shown in parentheses as (+) or (-).

E. Spaces are not allowed, and letters are not case-sensitive, and written in upper case.

SUFFIX	CIRCUIT TYPE	EXAMPLE
(A)	24 v dc analog (4-20 mA)	01FIT022(A)-1(+)
(C)	120 volt AC control	05P320(C)-2
(D)	24 v DC digital status or control	55LSH2019D)-1(+)
(P)	Power (120 v, 480 v, 5 kV, etc)	01MCC6101(P)-2

2.9 CABINETS AND ENCLOSURES

A. **General:** The WORK of this Section includes the following requirements for control compartments of motor control sections, for control cabinets of lighting panelboards, and for separate terminal and control cabinets:

1. Terminal Cabinets: Terminal cabinets located indoors shall be NEMA 12. Cabinets located outdoors and in corrosive areas shall be NEMA 4X. Cabinets shall be provided with hinged doors. Cabinets shall be provided with channel mounted terminal blocks rated 30 amperes, 600 volt AC. Terminals shall be No. 8 minimum strap-screw type, suitable for ring tongue or locking spade terminals. Sufficient terminal blocks to terminate 25 percent more conductors than are indicated shall be provided.

2. Components: Compartments of motor control centers containing terminal blocks and control components shall be isolated from other compartments of the control center and shall have a separate hinged door with locking handle. Internal control components shall be mounted on a removable mounting pan.

3. Relay and Control Cabinets: Relay and control cabinets shall comply with NEMA 12 for enclosures. Floor-standing cabinets shall have locking handles with 3-point catches. Bottom conduit entrances shall be located accurately and cut to the conduit diameter using a circle cutter (not a torch). Interiors of relay and control compartments shall be finished white.Terminal block requirements shall comply with the requirements for Terminal Cabinets.

B. **Wiring:** Wiring of terminal cabinets and control cabinets shall be accomplished with stranded copper conductor rated for 600-volts and UL listed as Type MTW. Wires for annunciator and indication circuits shall be No. 16 AWG. Other wiring shall be No. 14 AWG. Color coding shall comply with the indicated requirements. Incoming wires to terminal or relay cabinets shall be terminated on a master set of terminal blocks. All wiring from the master terminals to internal components shall be factory-installed and shall be contained in plastic raceways with removable covers. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals.

C. **Engraving:** Nameplates shall comply with the indicated requirements.

2.10 MANUFACTURERS

A. Products of the type or model number indicated shall be manufactured by one of the below listed manufacturers (or equal):

1. Unions:

a. Appleton UNF or UNY

b. Crouse-Hinds UNF or UNY

2. Device Boxes:

a. Appleton FD

b. Crouse-Hinds FD

3. 3. Sealing Compound: Chico A

4. Watertight Seals:
a. O.Z. Gedney Co., Type CSMC

b. Thunderline Corp.

c. Link Seal

5. Lighting and Receptacle Branch Circuit Conductors: Okoseal-N, Series 116-67-XXXX

6. Single Power and Control Conductors and Cable, 600V:

a. Okonite-Okolon, Series 112-11-XXXX

b. Anaconda

c. Durasheath EP

7. Multiconductor Cables:

a. Okonite-Okolon, Series 202-11-3XXX

b. Anaconda

c. Durasheath EP

8. Single Circuit Signal Cable: Okoseal-N Type P-OS

9. Multiple Circuit Signal Cable: Okoseal-N Type SP-OS

10. Portable Cords: Okocord

11. Compression Tool Die For Splicing: Thomas and Betts Corp.

12. Heat Shrinkable Moisture Seal Caps: Raychem Corp. "Thermofit"

13. 120V Receptacles (Indoor, Clean Areas):
    a. Hubbell IG-5362

    b. Arrow-Hart 6766

    c. .E. 4107-1 (Brown)

14. 120V Receptacles (Outdoor, Process or Corrosive Areas):

    a. Hubbell 53CM62/53CM21

    b. General Electric GE5262-C

15. 240V Duplex Receptacles (Gray):

    a. Hubbell 5462

    b. General Electric G.E. 4188-9

16. 240V Single Receptacles (Black):
    c. Hubbell 9308
    d. General Electric G.E. 4138-3

17. Three Phase Receptacles (60 amps):

    a. Crouse-Hinds Catalog No. AREA 6424

    b. Hubbell Hubbellock

18. Three Phase Receptacles (30 amps):

    a. Meltric DS Type Model #MB31MP333-38043-LP

    b. Crouse-Hinds Catalogue No. AREA 3423

    c. Bryant Cat. 7223FR

    d. Russell Stoll No. JRFA6344

19. Toggle Switches:

	Hubbell	**Bryant**	**Hubbell**	**Bryant**
Single Pole	1221 (brown)	4901 (brown	1221I (ivory)	4901I (ivory)
Three Way	1223	4903	1223I	4903I
Double Pole	1222	4902	1222I	4902I
Momentary	1556	4821	1556I	4821I

20. Switches (Hazardous Areas):

    a. Crouse-Hinds EFSC2129

    b. Appleton EFSC175-F1

21. Electrical Identification:

    a. Nameplates: Formica Type ES-1

22. Imprinted Plastic Coated Cloth

    a. Brady

    b. Thomas & Betts

23. Device Plates:

    a. Crouse-Hinds

    b. Appleton

24. Flexible Conduit:

    a. American Brass

    b. Anaconda

    c. Electroflex

25. Compression Connectors:

    a. Burndt "Hi Lug"

    b. Thomas & Betts "Shure Stake"

26. Spring Connectors (Wire Nuts):

    a. 3M "Scotch Lok"

    b. Ideal "Wing Nuts"

27. Insulating Tape:

    a. Scotch No. 33

    b. Plymouth "Slip knot"

28. High Temperature Insulating Tape (Polyvinyl):

    a. Plymouth

    b. 3M

29. Pre-Insulated Fork Tongue Lugs:

    a. Thomas & Betts RC Series

    b. Burndy

30. Epoxy Resin Splicing Kits:

    a. 3M Scotchcoat 82 Series

    b. Burndy "Hy Seal"

31. Stainless Steel Covers:

    a. Sierra S-line

    b. Hubbell

32. Products For Cast Boxes:

    a. Switches at outdoor locations
        1) Crouse-Hinds DS 128
        2) Mackworth Rees Style 3845
        3) Joy Flexitite
    b. Switches at damp locations
        1) Mackworth Rees Style 3496
        2) Joy Flexitite
    c. Switches at dry locations
        1) Crouse-Hinds DS 32G
        2) Pyle National SCT-10k
    d. Receptacles at outdoor locations
        1) Crouse-Hinds
        2) Hubbell
    e. Receptacles at damp or dry locations
        1) Crouse-Hinds DS 23G
        2) Pyle National N-1
    f. Receptacles at corrosive locations
        1) Crouse-Hinds "Ark Gard"
        2) Appleton DTQ
        3) Hubbell 52CM21 or 5221

33. Power Outlet Boxes:

    a. Hubbell Cat. No. SC-3098

    b. Steel City Cat. No SFH40RG

34. Insulated Bushings:

    a. O-Z Type A and B

    b. Thomas & Betts

c. Steel City
d. Appleton

e. Efcor

f. Gedney

35. Insulated Grounding Bushings:

a. O-Z Type BL

b. Thomas & Betts

c. Steel City

d. Efcor

e. Gedney

36. Erickson Couplings:

a. Appleton Type EC

b. Thomas & Betts

c. Steel City

d. Efcor

e. Gedney

37. Liquid-tight Fittings:

a. Appleton Type ST

b. Thomas & Betts

c. Crouse-Hinds

d. Efcor

e. Gedney

38. Hubs:

a. Appleton Type HUB

b. Thomas & Betts

c. Myers Scrutite

d. Efcor

39. Sealing Fittings:

    a. Appleton Type EYS
    b.
    c. O-Z Type FSK

40. Expansion Couplings:

    a. O-Z Type D

    b. Crouse-Hinds Type

PART -- EXECUTION

3.1 GENERAL

A. **Field Control of Location and Arrangement**: The Drawings diagrammatically indicate the location and arrangement of outlets, conduit runs, equipment, and other items. Exact locations shall be determined in the field based on the physical size and arrangement of equipment, finished elevations, and obstructions. Locations shown on the Drawings shall be adhered to as closely as possible. Omissions or conflicts on Drawings or between Drawings and Specifications shall be brought to the attention of the CONSTRUCTION MANAGER for clarification before proceeding with the WORK.

B. **Installation:** The CONTRACTOR shall make all necessary provisions throughout the site to receive the work as construction progresses and shall furnish and install adequate backing, supports, inserts, and anchor bolts for the hanging and support of all electrical fixtures, and conduit, and shall furnish and install sleeves through walls, floors, or foundations where electrical lines are required to penetrate.

1. Conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear. Fixtures, switches, convenience outlets, and similar items shall be located within finished rooms, as shown. Where the Drawings do not indicate exact locations, locations of concealed conductors shall be as indicated on the shop drawings.

C. **Workmanship:** Materials and equipment shall be installed in accordance with printed recommendations of the manufacturer. The installation shall be accomplished by workmen skilled in this type of work and installation shall be coordinated in the field with other trades so that interferences are avoided.

D. **Tests:** The WORK of this Section includes tests required by the authority having jurisdiction. Tests shall be performed in the presence of the CONSTRUCTION MANAGER. The WORK includes testing equipment, replacement parts and labor necessary to repair damage resulting from damaged equipment or from testing and correction of faulty installation. The following tests shall be performed:

1. Insulation resistance tests.

2. Operational testing of equipment.

E. **Field Quality Control**: Conduit shall be provided with a number tag at each end and in each **manhole** and pullbox.

3.2 RACEWAY, FITTINGS AND SUPPORTS

A. **General**: Except as otherwise indicated, conduit installed in direct contact with earth and in concrete slabs on grade shall be corrosion-protected.

1. Conduit shall be left exposed until inspected by the CONSTRUCTION MANAGER.

2. Raceways shall be installed as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for the purpose intended. Factory elbows shall be used for all 3/4-inch conduit. Bends in larger sizes of metallic conduit shall be accomplished by field bending or by the use of factory elbows.

3. Conduit may be cast integral with horizontal and vertical concrete slabs, providing one-inch clearance is maintained between conduit surface and concrete surface. If said clearance cannot be maintained, the conduit shall be installed exposed below elevated slabs; provided, that in the case of slabs on grade, conduit shall be installed below the slab and shall be encased with a minimum cover of 3 inches of concrete.

4. Non-metallic conduit may be cast integral with horizontal slabs with placement criteria as stated in the previous paragraph. Non-metallic conduit may be run beneath structures or slabs on grade, without concrete encasement. In these instances conduit shall be placed at least 12 inches below the bottom of the structure or slab. Non-metallic conduit may be buried 24 inches minimum below grade, with a 3-inch concrete cover, in open areas or where otherwise not protected by concrete slab or structures. Top of concrete cover shall be colored red. Non-metallic conduit shall be permitted only in concealed locations as described above. The use of direct burial thinwall duct will be permitted only as indicated for underground ducts.

5. Where a run of concealed PVC conduit becomes exposed, a transition to rigid steel conduit is required. Such transition shall be accomplished by means of a factory elbow or a minimum 3-foot length of rigid steel conduit, either terminating at the exposed concrete surface with a flush coupling. Piercing of concrete walls by non-metallic runs shall be accomplished by means of a short steel nipple terminating with flush couplings.

6. Flexible conduit may be used in lengths required for the connection of recessed lighting fixtures; otherwise the maximum length of flexible conduit shall be 18 inches.

7. Application: Galvanized rigid steel shall be installed in the locations indicated:

a. Embedded or encased in non-Schedule 40 PVC hazardous areas

b. Exposed in corrosive areas: Plastic coated, rigid steel

c. Exposed in outdoor and damp Rigid Galvanized steel

d. Direct buried lighting and Schedule 80 PVC
e. receptacle raceways in non-hazardous areas

f. Final raceway connections to Flexible metallic lighting fixtures, equipment and pressure switches subject o vibration-DRY AREAS

g. Final raceway connections to Liquidtight, flexible metallic equipment

8. Conduit Runs Between Boxes: The number of directional changes of the conduit shall be limited to total not more than 270 degrees in any run between pull boxes. Conduit runs shall be limited to 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction. Bends and offsets shall be avoided where possible but, where necessary, shall be made without flattening or kinking, or shall be factory preformed bends. Turns shall be made with cast metal fittings or conduit bends. Welding, brazing or otherwise heating of conduit is not acceptable.

9. Junction and Pull Boxes: Cast junction or pull boxes shall be installed where required for pulling cable and as necessary to meet the indicated requirements. Pull boxes used for multiple conduit runs shall not combine circuits of different motor control centers, switchboards, or switchgear.

10. Conduit Terminations: The WORK of this Section includes conductors required to interconnect incoming annunciator, control and instrumentation except as otherwise indicated.

a. Two- and 3-conductor shielded cables installed in conduit runs which exceed 2,000 feet may be spliced in pullboxes. These cable runs shall have only one splice per conductor.

b. Control conductors shall be spliced or terminated only at the locations indicated and only on terminal strips or terminal lugs of vendor furnished equipment. 120/208-volt and 480-volt branch circuit conductors may be spliced in suitable fittings at locations required.

c. Solid conductors shall be terminated at equipment terminal screws such that conductor is tightly wound around screw and does not protrude beyond screw head. Stranded conductors shall be terminated directly on equipment box lugs such that all conductor strands are confined within lug. Use forked-tongue lugs where equipment box lugs have not been provided.

d. Splices in 600-volt wire which are not pre-insulated shall be insulated with three layers of tape each half lapped except that splices in below grade pull boxes or in any box subject to flooding shall be made watertight using an epoxy resin splicing kit.

e. Splices to motor leads in motor terminal boxes shall be taped with varnished cambric tape and with high temperature tape on the exterior.

f. Control devices, such as solenoid operated valves, that are normally

supplied with conductor pigtails, shall be terminated as described for control conductors.

g. Conduit entering NEMA 1 type sheet steel boxes or cabinets shall be secured by locknuts on both the interior and exterior of the box or cabinet and shall have an insulating grounding or bonding bushing installed over the conduit end. Conduit entering other boxes shall be terminated with a threaded hub. Cast boxes and nonmetallic enclosures shall have threaded hubs. Joints shall be made with standard couplings or threaded unions. Metal parts of nonmetallic boxes and plastic coated boxes shall be bonded to the conduit system. Running threads shall not be used in lieu of conduit nipples, nor shall excessive thread be used on any conduit. The ends of conduit shall be cut square, reamed, and threaded with straight threads. Rigid steel conduit shall be made up tight and without thread compound. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

h. PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O-ring. Joints shall be made with standard PVC couplings.

i. Conduit entering field equipment enclosures shall enter the bottom or side of the box. Where conduit comes from above, it shall be run down beside the enclosure and a tee conduit and drip leg installed.

11. Matching Existing Facilities: When new conduit is added to areas which are already painted, the conduit and its supports shall be painted to match the existing facilities. Where new conduit is used to replace existing conduit, the existing conduit and supports shall be removed, resulting blemishes shall be patched and repainted to match original conditions. Similarly, if existing conduits are to be reused and rerouted, resulting blemishes shall be corrected in the same manner. Coating system shall comply with Section 09800.

12. Conduit Support: Exposed rigid steel or plastic coated conduit shall be run on supports spaced not more than 10 feet apart and shall be constructed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceiling. Exposed PVC conduit shall be run on supports spaced not more than 3 feet apart for conduits up to 1 inch, 5 feet apart for conduits 1 1/4 inches to 2 inches and 6 feet apart for conduits 2 1/2 inches and larger. No conduit shall approach closer than 6 inches to any object operating above 30 degrees C. PVC conduit shall not be provided where it will be damaged by heat.

Conduit rack and tray supports shall be secured to concrete walls and ceilings by means of cast-in-place anchors. Individual conduit supports shall use cast-in-place anchors, die-cast, rustproof alloy or expansion shields. Wooden plugs, plastic inserts or gunpowder-driven inserts are not acceptable.

13. Conduit Penetrations: Unless otherwise indicated, conduit routed perpendicular through floors, walls or other concrete structures shall pass through cast-in-place openings wherever possible. In cases where cast-in-place openings are not possible, appropriate size holes shall be bored through the concrete to

accommodate the conduit passage. The size and location of the holes shall not impair the structure's integrity. After completion, grout or calk around conduit and finish to match existing surroundings. Unless otherwise protected, conduits that rise vertically through the floor shall be protected by a 3 1/2-inch high concrete pad with a sloping top.
Wherever conduits penetrate outdoor concrete walls or ceilings below grade, watertight seal shall be installed.

14. Conduit Separation: Signal conduits shall be separated from AC power or control conduits. The separation shall be a minimum of 12 inches for metallic conduits and 24 inches for nonmetallic conduits.

15. Conduit Seals For Hazardous or Corrosive Areas: Conduit passing from a hazardous or corrosive area into a nonhazardous or noncorrosive area shall be provided with a sealing fitting which shall be located at the boundary in accordance with NEC.

    Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy. Sealing compound shall be hard type and shall be UL listed for explosionproof sealing fittings. Sealing compound shall be nonhardening type for corrosive areas. Sealing compound shall not be poured in place until electrical installation has been otherwise accepted.

16. Plastic Coated Conduit: Plastic coated conduit shall be made up tight with strap wrenches. Conduit threads shall be covered by a plastic overlap which shall be coated and sealed in accordance with manufacturer's recommendations. Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.

17. Liquidtight Flexible Conduit: The length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit. The length of liquidtight conduit shall not exceed 36 inches.

18. Conduit Fittings: Fittings shall comply with the same requirements as the raceway with which they will be used. Fittings having a volume less than 100 cubic inches for use with rigid steel conduit, shall be cast or malleable non-ferrous metal. Fittings larger than one inch shall be "mogul size." Fittings shall be of the gland ring compression type. Covers of fittings, unless in "dry" locations, shall include gaskets. Surface-mounted cast fittings, housing wiring devices in outdoor and damp locations, shall have mounting lugs.

    Erickson couplings shall be used at all points of union between ends of rigid steel conduits which cannot be coupled. Running threads and threadless couplings shall not be used. Couplings shall be 3-piece type.

    Transition fittings to mate steel to PVC conduit, and PVC access fitting, shall be as furnished or recommended by the manufacturer of the PVC conduit.

3.3 CONDUCTORS, WIRE AND CABLE

A. **General:** Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the cable insulation. Soapstone, talc or UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed.

Whenever a cable leaves a raceway, a cable support shall be provided.

When flat bus bar connections are made with unplated bar, the contact areas shall be "scratch-brushed" before connection. Bolts shall be torqued to the bus manufacturer's recommendations.

B. **600 Volt Conductor and Cable:** Conductors in panels and electrical equipment, No. 6 AWG and smaller, shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Lacing is not necessary in plastic panel wiring duct. Conductors crossing hinges shall be bundled into groups not exceeding 12 and shall be so arranged that they will be protected from chafing when the hinged member is moved.

Slack shall be provided in junction and pull boxes, handholes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls of the box. Amount of slack shall be equal to largest dimension of the box. Where plastic panel wiring duct is installed for wire runs, lacing is not required. Plastic panel wiring duct shall not be used in manholes and handholes.

Stranded conductors shall be terminated. Conductors shall be terminated directly on the terminal block. Compression lugs and connectors shall be installed using manufacturer's recommended tools.

Lighting and receptacle circuits may be in the same conduit in accordance with derating requirements of the NEC. However, lighting and receptacle circuits shall not be installed in conduits with power or control conductors.

Solid wire shall not be lugged nor shall electrical spring connectors be used on any except for solid wires in lighting and receptacle circuits. Lugs and connectors shall be installed with a compression tool.

Terminations at 460 volt motors shall be made by bolt-connecting the lugged connectors. Connections shall be insulated and sealed with factory-engineered kits. Motor connection kits shall consist of heat-shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends. Bolt connection area shall be kept free of mastics and fillers to facilitate rapid stripping and re-entry. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations.

In-line splices and tees shall be made with tubular compression connectors and insulated as for motor terminations, except that conductors No. 10 AWG and smaller may be spliced using self-insulating connectors. Splices and tees in underground handholes or pull boxes shall be insulated using Scotch-cast epoxy resin splicing kits. Terminations at devices with 120V pigtail leads, at solenoid valves, 120 volt motors, and other devices furnished with pigtail leads shall be made using self-insulating tubular compression connectors.

Conductor and cable markers shall be provided at splice points.

C. **Signal Cable:** Circuits shall be installed as individually shielded twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required. Terminal blocks shall be provided at instrument cable junctions, and circuits shall be identified at such junctions unless otherwise indicated. Signal circuits shall be installed without splices between instruments, terminal boxes, or panels.

Shields are not acceptable as a signal path, except for circuits operating at radio frequencies and utilizing coaxial cables.

Common ground return conductors for two or more circuits are not acceptable.

Unless otherwise indicated, shields shall be bonded to the signal ground bus at the control panel and isolated from ground and other shields at other locations. Terminals shall be installed for running signal leads and shield drain wires through junction boxes.

Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes. Shield drain wires for spare circuits shall not be grounded at either end of the cable run.

Terminal boxes shall be installed at instrument cable splices. If cable is buried or in raceway below grade at splice, an instrument stand shall be provided as specified with terminal box mounted approximately 3 feet above grade.

Cable for paging, telephone, and security systems shall be installed and terminated in compliance with the manufacturer's recommendations.

D. **Portable Cord**: Portable cord feeding permanent equipment, such as pendant cords, pumps, cranes, hoists, and portable items shall have a wire mesh cord grip of flexible stainless steel wire to take the tension from the cable termination. Connection of portable cords to permanent wiring shall be accomplished with the use of terminals. In-line taps and splices shall be used only where indicated.

E. **Testing: Testing** shall comply with the requirements of Section 16030 and the following:

1. Signal Cable: Each signal pair or triad shall be tested for electrical continuity. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory without further test. For pairs with greater than 50 ohm loop resistance, the expected loop resistance shall be calculated considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.

2. Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad.

3. Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

4. Instruments used for continuity measurements shall have a resolution of 0.1 ohms and

an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500 volt megohmmeter shall be used for insulation resistance measurements.

3.4 WIRING DEVICES

A. **General**: Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

Unless otherwise indicated, receptacles and switches installed in sheet steel boxes shall be flush mounted and shall be located 18 inches above the floor unless otherwise indicated.

Switch boxes and receptacles installed in cast device boxes shall be mounted 48 inches above the floor.

B. **Application of Boxes and Covers**: Boxes and covers shall be installed as follows:

1. Outlet, switch, and junction boxes for flush-mounting in general purpose locations shall be sheet metal or cast ferrous alloy.

2. Outlet, switch, and junction boxes where surface mounted in exposed locations shall be cast alloy ferrous boxes with mounting lugs, zinc or cadmium plating, and enamel finish. Surface mounted boxes in concealed locations may be welded sheet steel boxes.

3. Outlet, control station, and junction boxes, including covers, for installation in corrosive locations shall be fiberglass-reinforced polyester and shall include mounting lugs.

4. Sheet metal or cast ferrous alloy boxes for flush-mounting in concrete shall include with cast, malleable box covers and gaskets. Covers for pressed steel boxes shall be one-piece pressed steel, cadmium plated, except that boxes for installation in plastered areas shall be stainless steel over plaster rings.

5. Outlet boxes shall be used as junction boxes wherever possible. Where separate pullboxes are indicated, they shall include screw covers. Outdoors boxes shall be galvanized and shall be provided with gasketed covers and threaded hubs. Indoor boxes shall be painted.

3.5 CABINETS AND ENCLOSURES

A. The installation of cabinets and enclosures shall comply with the following:

1. Cabinets: Cabinets shall be set plumb at an elevation such that the maximum circuit breaker height shall be less than 5 ft 6 inches. Top edge of trim of adjacent panels shall be at the same height. Panels which are indicated as flush mounted shall be set so cabinet is flush and serves as a "ground" for plaster application.

2. Connections: Factory bus and wire connections shall be made at shipping splits, and all field wiring and grounding connections shall be made after the assemblies are anchored.

3. Finishes: Enclosures shall be finished in accordance with the manufacturer's standard procedures. Finish color shall be No. 61 complying with ANSI Z55.1 unless otherwise noted.

3.6 EQUIPMENT ANCHORING

A. Freestanding or wall-hung equipment shall be anchored in place by methods that will meet seismic requirement in the area where project is located. Wall-mounted panels that weigh more than 500 pounds or which are within 18 inches of the floor shall be provided with fabricated steel support pedestal(s). Pedestals shall be of welded steel angle sections. If the supported equipment is a panel or cabinet and enclosed with removable side plates, it shall match supported equipment in physical appearance and dimensions. Transformers hung from 4-inch stud walls and weighing more than 300 pounds, shall have auxiliary floor supports.

B. Anchoring methods and leveling shall comply with the printed recommendations of the equipment manufacturers.

3.7 CONDUCTOR AND EQUIPMENT IDENTIFICATION

A. The completed electrical installation shall include adequate identification to facilitate proper control of circuits and equipment and to reduce maintenance effort.

B. Control and instrumentation wire and cable shall be assigned a unique identification number. Numbers shall be assigned to conductors having common terminals. Identification numbers shall appear within 3 inches of conductor terminals. "Control" shall be defined as any conductor used for alarm, annunciator, or signal purposes or any connect switch or relay contacts or any relay coils.

1. Multiconductor cable shall be assigned a number which shall be attached to the cable at intermediate pull boxes and at stub-up locations beneath free-standing equipment. It is expected that the cable number will form a part of the individual wire number. All individual control conductors and instrumentation cable shall be identified at pull points as described above.

2. The instrumentation cable numbers shall incorporate the loop numbers shown.

C. Spare conductors shall be terminated on terminal screws and shall be identified with a unique number as well as with destination.

D. Nameplates shall be provided for panelboards, panels, starters, switches, and pushbutton stations. In addition to the name plates indicated, control devices shall be equipped with standard collar-type legend plates, as required.

E. Terminal strips shall be identified by imprinted, varnished, marker strips attached under the terminal strip.

F. Three-phase receptacles shall be consistent with respect to phase connection of receptacle terminals. Errors in phasing shall be corrected at the bus, not at the receptacle.

G. Toggle switches which control loads out of sight of switch, and all multi-switch locations

of more than 2 switches, shall have suitable inscribed finish plates.

H. Empty conduits shall be tagged at both ends to indicate the destination at the far end. Where it is not possible to tag the conduit, destination shall be identified by marking an adjacent surface.

I. Identification tape shall be installed directly above buried raceway. Tape shall be installed 8 inches below grade and parallel with raceway. Identification tape shall be installed for buried raceway not under buildings or equipment pads except identification tape is not required for protection of street lighting raceway.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16110

RACEWAYS, BOXES, AND SUPPORTS

PART 1 -- GENERAL

1.1 SCOPE

A. This section covers the furnishing and installation of electrical conduits, wireways, pull boxes, manholes, handholes, cable trays, fittings and supports. Raceways shall be provided for lighting, receptacles, power, control, instrumentation, signaling and grounding systems.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
JIC EMP-1	Electrical Standards for Mass Production Equipment
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA VE1	Cable Tray Systems
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NFPA 70	National Electrical Code (NEC)

Reference	Title
NFPA 79	Electrical Standards for Industrial Machinery
IBC	International Building Code
UL 1	Flexible Metal Electrical Conduit
UL 6	Rigid Metal Electrical Conduit
UL 360	Liquid Tight Flexible Electrical Conduit
UL 514	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
UL 651	Rigid Nonmetal Electrical Conduit
UL 797	Electrical Metallic Tubing
UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
UL 884	Underfloor Raceways and Fittings
UL 886	Outlet Boxes and Fittings for Hazardous (Classified) Locations

1.3 SUBMITTALS

The following information shall be provided in accordance with Section 01300:

A Products:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

   A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. Manufacturer's descriptive literature for materials.

3. Certification that Contractor has been trained to work on PVC-coated conduit systems.

B. Underground Conduit Raceway System:

1. A copy of this specification section Part 3, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to

indicate requested deviations from specification requirements. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

2. A copy of the Electrical Standard Detail drawings applicable to underground conduit systems, boxes, and manholes; with addendum updates included, and all referenced and applicable sections, with addendum updates included, check-marked to indicate specification compliance or marked to indicate requested deviations from specified requirements.

3. Failure to include a copy of the marked-up specification sections and drawings, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Underground conduit raceway system drawings

PART 2 -- PRODUCTS

2.1 RACEWAYS AND FITTINGS

A. General requirements for raceway materials specified in this section are listed in the RACESPECS sheets at the end of this section. The type of raceways and raceway fittings to be used for any given area and application shall conform to the requirements in this section.

2.2 BOXES, GUTTERS, TERMINAL CABINETS, MANHOLES, AND HANDHOLES

A. Provide Type 316L (low carbon), 317, or Type 316 stainless products where specified. Enclosure constructed of mild sheet steel shall be hot-dipped galvanized after fabrication. Hinges shall be continuous type and for NEMA-4X cabinets hinges shall be stainless steel.

B. Table A specifies the electrical enclosure material and rating for the location and application.

Table A

Location	Electrical Enclosure Material and NEMA Rating
Indoor	NEMA 12: Steel
Outdoor: Corrosive Area	NEMA 4X: Stainless Steel
Hazardous Area: Class I Division 2	NEMA 4X: Stainless Steel
Hazardous Area: Class I Division 1	NEMA 7: Galvanized Malleable Iron or Aluminum

C. Pull Boxes And Wiring Gutters: Indoor boxes and enclosures larger than FD boxes shall be constructed of sheet steel and galvanized after fabrication. Outdoor boxes and enclosures shall be provided with neoprene gaskets on the hinged doors or removable covers. Box and gutter sizes, metal thickness, and grounding shall comply with the National Electrical Code. Bolt-on junction box covers 3 feet square or larger, or heavier than 25 pounds, shall have a rigid handle. Covers larger than 3 x 4 feet shall be split.

D. Terminal Cabinets: Terminal cabinets shall be provided with adjustable terminal strip mounting, back-panels for equipment mounting, print pockets in the doors, continuous door hinges, and three-point lockable latches. Terminal cabinets located indoors shall be NEMA 12. Terminal cabinets located outdoors and in corrosive areas shall be modified NEMA 4X with stainless steel door hinge, three-point latch, and filtered ventilation, if required. Sec shall conform to Section 16000.

E. MANHOLES: (Not used)

F. Handholes:

1. Handholes shall be precast concrete with checker plate, galvanized, traffic covers designed for H 20 loading. Handholes shall be provided with precast solid concrete slab bottoms with sumps. Handholes shall be constructed of 3000 psi reinforced concrete. Handhole cover shall be engraved "ELECTRICAL" or "SIGNAL" as applicable.

2. Dimensions shall be as specified on the drawings. Handhole walls shall be provided with boxouts, as specified for manholes.

G. Manhole and Handhole Cable Supports:

1. Provide heavy-duty, non-metal cable racks for support of conductors. Racks shall be UL listed glass-reinforced nylon consisting of slotted wall brackets for support arms designed for a minimum of a 400-pound load. Each support bracket shall from the top to the bottom and the arms shall be adjustable and installed on 24-inch centers. Use ½-inch stainless steel bolts, hardware, inserts, and fasteners. Cables supports, clamps or racks shall be provided to support the cable at minimum 2 foot intervals. Concrete inserts shall be embedded on 24-inch centers in walls and ceiling.

2. Cable Support Products or equal:

a. Underground Devices Incorporated Type RA arms with CR36 support brackets.

b. Unistrut Power-Rack F20N-STA33 Stanchions with F20N-ARM14 Arms.

H. Ground Bus: Provide a ground bus in concrete manholes, handholes, and electrical pullboxes with dimension of 3-foot width x 3-foot length x 3-foot depth and larger. Provide a NEMA threaded 4-hole grounding plate for connecting two to four-1-hole

ground connectors that enter the enclosure from two to four duct banks. Products: Burndy, T&B, or equal.

2.3 RACEWAY SUPPORTS

A Conduit Supports:

1. Framing channel with end caps and straps shall be provided to support groups of conduit. Individual conduit supports shall be one-hole pipe straps used with clamp backs and nesting backs where required. Material as specified herein.

2. Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated rigid steel clamps or oversized stainless steel clamps.

B Ceiling Hangers: Ceiling hangers shall be adjustable steel rod hangers and fittings. Provide j-type conduit support for single conduit. Straps or hangers of plumber's perforated tape are not acceptable. Unless otherwise shown, hanger rods shall meet astm a193 and be sized as 3/8-inch up to 2-inch conduit and shall be 1/2 inch all-thread rod over 2-inch conduit. Material as specified herein.

C Suspended Raceway Supports And Racks:

1. Suspended raceway supports shall consist of concrete inserts, steel rod hangers, and jamb nuts supporting framing channel or lay-in pipe hangers as required. Framing channel shall be a minimum of 12-gauge. Material as specified herein.

2. Hanger rods shall be 1/2-inch diameter all-thread rod and shall meet ASTM A193. Suspended raceway supports and racks shall be braced for seismic forces as specified in Section 16000.

D Materials:

1. Table B specifies the type of raceway supports required for each location and application.

Table B

Location	Framing Channel	Threaded Rod, Hardware, & Fittings
Indoor, (general)	Steel	Steel
Outdoor, Corrosive Area (general)	Stainless Steel	Stainless Steel

HDG = Hot Dip Galvanized Finish
PVC = PVC COATED

2.4 CONCRETE ENCASED DUCT BANKS

A. Concrete used for duct banks shall be Class E with red color added and a minimum 28-day compressive strength of 2,000 psi as specified in the Cast-in-Place Concrete Section 03300.

2.5 UNDERGROUND MARKING TAPE

A. Underground detectable marking tape shall be for early warning protection of digging around direct buried cables, conduits, and concrete duct banks. Tape shall be OSHA approved.

B. Marking tape example: Low density polyethylene plastic, nominally 6 inches wide and 4 mil thickness with metallic lined tape with red polyethylene film on top and clear polyethylene film on the bottom. Tape shall be imprinted with a warning continuously along the length similar to: "CAUTION - STOP DIGGING - BURIED ELECTRIC LINE BELOW."

C. Tape Products: Brady "Identoline"; Services and Materials "Buried Underground Tape"; Somerset (Thomas & Betts) "Protect-A-Line"; or equal.

2.6 NAMEPLATES

A. Nameplates shall be provided for boxes in accordance with the requirements of Section 16000. Nameplate wording shall be as shown on the drawings. Provide the functional description of the device on the nameplate, where wording is not specified

2.7 FIRESTOPS

A. Firestops and seals shall be Flamemastic 77, Vimasco No. 1-A, or equal, and shall be applied in accordance with manufacturer's recommendations. Products which are affected by water are not acceptable.

2.8 RACEWAY IDENTIFICATION

A. Raceway number tags shall conform to the requirements of raceway markers, Section 16000.

2.9 ELECTRICAL SEALANT

A. Electrical sealant putty shall be non-hardening, non-oxidizing, non-corrosive, non-poisonous, and non-injurious to human skin with service temperature range of 30 to 200 degrees Fahrenheit. Product shall be used to seal against the entrance of water.

2.10 HAZARDOUS AREA AND CORROSIVE AREA CONDUIT SEALS

A. Sealing compound shall be non-hardening type for corrosive areas. Seal fittings for conduit systems in hazardous atmosphere locations shall be hot-dip galvanized cast ferrous alloy or aluminum alloy. Seal fittings shall be 40-percent fill type.

B. Sealing compound shall be hard type installed in UL listed for explosion-proof sealing fittings after the conductors are installed, tested, and accepted.

C. Provide PVC-coated seal fittings used for PVC-coated conduit with 40-mil factory coating. Seal fitting and sealing compound manufacture: Appleton, Crouse-Hinds, or equal.

2.11 PULLING LINE

A. Pulling line shall be polyethylene type, mildew and rot resistant with minimum of 200-pound tensile strength and minimum 1/4-inch diameter. Install in all “future” raceways. Manufacture: Greenlee, Ideal, or equal.

2.12 CONDUIT THREAD LUBRICANT

A. Thread lubricant shall be conductive with anti-seize and anti-corrosion properties, compatible with steel and aluminum conduit materials. Manufacture: T&B CP8 KOPR-Shield; Robroy Threadcompound; or equal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Table C specifies the type of raceway required for each location and application by RACESPEC sheet. Unscheduled conduit shall be galvanized, rigid steel, RACESPEC type GRS.

Table C

Location	Application/Condition	RACESPEC
Indoor	Exposed	GRS
Outdoor	Exposed (other)	PGRS
Concealed	Power circuits embedded in concrete structure or beneath slab-on-grade	PVC4
Concealed	Instrumentation, communications and data signals encased in concrete, duct bank	PVC4
Underground	Power circuits encased in concrete, duct bank	PVC4
Underground	Instrumentation, communications and data signals directly buried	PVC4
Nonhazardous	Final connection to equipment and light fixtures	LFS
Hazardous corrosive	Exposed	PGRS
Hazardous	Final connection to equipment	XPFS

3.2 CONDUIT

A. General: the conduit systems, installation, and hazardous location fittings are specified herein.

B. Indoor and outdoor conduit systems: in general, contractor shall be responsible for determining conduit routing that conforms to the specified installation requirements:

1. Conduits for lighting and outlets: concealed

2. Conduits for process equipment: concealed

3. Conduit inside structures: exposed

4. Conduit concealed inside water chambers slabs and walls

C. Conduit installation shall conform to the requirements of the racespec sheets and the following specified installation requirements:

1. Exposed conduit: Install parallel or perpendicular to structural members and surfaces. Install conduit horizontally and allow minimum headroom of 7 feet.

2. Route two or more exposed conduits in the same general routing parallel with symmetrical bends.

3. Space exposed conduit installed on supports not more than 10 feet apart. Space multiple conduits in parallel and use framing channel.

4. Comply with the requirements of Section 16000 and herein, where conduits are suspended from the ceiling.

5. Secure conduit rack supports to concrete walls and ceilings with cast-in-place anchors or framing channel concrete inserts.

6. Install conduits at least 6 inches from high temperature piping, ducts, and flues with temperatures higher than 90 degree C.

7. Install conduits between the reinforcing steel in walls or slabs that have reinforcing in both faces.

8. Place conduits under the reinforcement in slabs with only a single layer of reinforcing steel. Separation between conduits, conduits and reinforcement, and conduits and surfaces of concrete shall be maintained in accordance with UBC.

9. Route conduit clear of structural openings and indicated future openings.

10. Provide conduits with flashed and watertight seals routed through roofs or metal walls.

11. Grout conduits into openings cut into concrete and masonry structures.

12. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as “future”, “spare”, or “empty” and include a pulling line accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.

13. Determine concealed conduit stubup locations from the manufacturer's shop drawings. Terminate concealed conduit for future use in specified equipment.

14. Install conduit flush with structural surfaces with galvanized couplings and plugs. Caps and plugs shall match the conduit system.

15. Provide concealed portions of conduits for future equipment where the drawings indicate future equipment. Match the existing installation for duplicate equipment.

16. Terminate conduits that enter enclosures with fittings that match the NEMA rating of the enclosure.

17. Underground metallic or nonmetallic conduit that turn out of concrete, masonry or earth: Install a 90-degree elbow of PVC-coated rigid steel conduit before emergence above ground.

18. Provide O-Z Gedney "Type DX" or Crouse-Hinds "Type XD" bonded, weathertight expansion and deflection fitting for the conduit size where conduit across structural joints that allows structural movement.

D. Underground conduit system: excavation, backfilling, and concrete work shall conform to respective sections of these specifications. Underground conduit shall conform to the following requirements:

1. Underground conduits shall be reinforced concrete encased that are not shown otherwise on the drawings.

2. Concrete encased conduit shall have minimum concrete thicknesses of 2 inches between conduits, 1 inch between conduit and reinforcing, and 3 inches between reinforcing and earth, unless shown otherwise in an electrical detail.

3. Concrete encasement on exposed outdoor conduit risers shall continue to 3 inches above grade, with top crowned and edges chamfered.

4. Underground conduit bend radius shall be not less than 2 feet minimum at vertical risers and shall be not less than 3 feet elsewhere.

5. Where conduit and concrete encasement are terminated underground, the conduit and reinforcing shall both extend at least 2 feet past the concrete. Conduits shall be capped and threads protected. Steel surfaces shall be given two coats of epoxy paint.

6. Underground conduits and conduit banks shall have 2 feet minimum earth cover unless otherwise shown.

7. Underground conduit banks through building walls shall be cast-in-place or installed with concrete into boxouts with waterstops on all sides of the boxout. Water-stops shall be as specified in the Cast-in-Place Concrete section. Extend the horizontal reinforcement from the duct bank into the boxout terminating with J-hook bends.

8. Conduits not encased in concrete and passing through walls with one side in contact with earth shall be sealed watertight with special rubber gasketed sleeve and joint assemblies or with sleeves and modular rubber sealing elements.

9. Thoroughly swab conduits and raceways on the inside, immediately upon completion of pouring concrete.

10. Label raceways in accordance with Section 16000.

11. After the concrete has set and before backfilling, pull a mandrel through each conduit. The mandrel shall have a diameter equal to the nominal conduit inside diameter minus 1/2 inch and shall not be less than 4 inches long.

12. If the mandrel showed signs of protrusions on the inside of the conduit, the conduit shall be repaired or replaced.

13. Provide manufactured plastic conduit spacers anchored to prevent movement during the concrete pour. Manufacture: Carlon, PW Pipe, Underground Devices, or equal.

14. Form the concrete pour ten feet from the wall, manhole, or handhole and form to allow for future conduit entry.

15. Backfill duct banks with clean fill compacted to 90-percent in 6-inch lifts after concrete has cured. Refer to Section 03300 for concrete requirements including minimum 7 days of cure time prior to backfill over duct banks.

16. Allow and provide for two offsets per conduit and raceway for each 100- linear feet to account for unexpected field conditions including for excavation and backfill limited to three feet of extra width and/or depth. Include these specified provisions in the bid price.

17. Provide PVC threaded adapter with female threads where PVC conduit is joined to steel conduit. Procedure:

    a. Before assembly: Double coat steel conduit with Red-Robroy, Green-Permacote, Blue-Ocal or equal product.

    b. After assembly: Seal with 65-mil thick, 2-inch wide mastic sealing tape to ½-inch beyond threads. Procucts: 3M Scotch 2228; Plymouth 02625; or equal.

    c. Cover with 20-mil corrosion protection tape applied in ½-lap layers to 2-inch beyond threads. Products: 3M Scotchwrap 51; Plymouth Plywrap 12; or equal.

18. Where reinforced concrete duct banks enter the side of a building, manhole, or handhole and the reinforcement cannot be brought into a window and be terminated, then drill the structure and embed the reinforcement in epoxy to minimum of 3-inches depth.

19. Provide PVC conduit with bell ends where duct banks terminated at walls, manholes, or handholes. Install bell ends flush with finished concrete.

20. Provide PVC conduit with bell ends where conduit rise below grade into a floor mounted electrical panel, electrical cabinet, MCC, switchboard, or switchgear.

21. Separate power conduits from signal conduit within the same ductbank by 12” or greater separation, as shown. Refer to the drawings or schedules for signal to be installed in metal conduits instead of PVC ducts.

22. Separate high voltage ductbanks from low voltage ductbanks, as shown.

23. Provide wireways for transition from underslab conduits rising into wall-mounted panels where the number of conduits exceed the NEC allowable panel space in the bottom of the panel. Provide conduit sleeves or fitting for panel transition. Continuous thread or all-thread is prohibited.

24. The Contractor shall provide detailed layout drawings or sketches for the underground conduit raceway systems. Make take-offs of the circuits and underground raceways required between electrical power and control equipment, process equipment, instrumentation, area lighting, receptacles, heat tracing, and eye-wash stations to assure all circuit are included prior to system construction.

    Drawings shall show plan view routing, pullboxes and manholes, consideration of other underground systems and structures, approximate system cover depths and widths, and section views showing sizes of conduits and circuits. Submit the underground conduit raceway systems drawings or sketches.

E. Conduit in Block Walls

1. Install multiple runs of conduit that stub-up into a block wall and connect to recessed electrical panels with adequate space for the conduit. Coordinated the electrical work with the structural work and block installers to provide a chase to install the conduit. Install conduit in the cells that do not contain structural reinforcement. Install conduits in the center of the cell to avoid affecting the structural integrity of the wall.

2. Avoid conduit and electrical boxes installation that blocks the cell from being grouted or that blocks the cell reinforcing bars from being grouted. Avoid conduit in the first cell adjacent to doors, windows, corners and wall intersections and install conduits in the center of the first available cell a minimum of 1’-0” from the edge of these openings.

3. Where solid grouting of masonry walls is specified, install conduit and electrical boxes so as to provide sufficient space for grout to flow pass the boxes and conduit in order to fully fill the space beneath and behind. Where boxes need to be held in place, secure the boxes from the face of the block wall. Do not place items behind or next to electrical boxes to hold in place.

4. Coordinate split-face, slump and scored block installation with the masonry contractor to supply smooth face block at the location of receptacles and switches so that the device covers install flush to the wall. Install translucent weather-proof sealing material under device covers on outdoor or wet area locations.

F. Conduit Seal-Off Fittings:

1. Conduits passing:

    a. Between Class I, Division 1 area and Class I, Division 2 area; provide sealing fittings located at the boundary in accordance with NEC Article-500.

b. From hazardous or corrosive area into a non-hazardous or non-corrosive area.

2. Install the seal-off material in the conduit seal-off fittings after inspection.

G. Conduit and Innerduct Sealing Material:

1. Provide HYDRA-SEAL® Handi-Polyurethane-Foam or equal product to seal conduits and innerducts.

2. Sealing product required features:

a. Compatible with common cable jacket materials.

b. ASTM E-84 flame spread requirements and UL Classified.

c. Pre-pressurized, portable, one-component closed-cell foam sealing system.

d. Dries tack-free within 15 minutes and cures within 24 hours.

e. Reacts with applied moisture or with ambient humidity.

f. Remove over-spray with acetone and remove cured foam mechanically

3. Application Criteria:

a. Apply in ambient temperatures between 60° to 100° F.

b. Apply bead onto clean surface.

3.2 MANHOLES AND HANDHOLES

A. Unless otherwise specified, manhole and handhole installation shall be as follows:

1. Manholes, handholes, and pull boxes shall be set on a minimum of 6 inches of crushed rock on top of undisturbed or compacted earth.

2. Manholes and handholes shall be set plumb so that water shall drain to the sump.

3. Manhole covers shall be 36-inches in diameter and set at 2 inches above finish grade with surrounding pavement sloping away from the manhole cover.

4. Metallic hardware inside manholes and handholes shall be bonded to the ground plate or ground bus using bolted connections, bonding jumpers and grounding bushings.

3.3 RACEWAY NUMBERING

A. Each new and reused conduit shall be provided with a number tag at each end and in each manhole, handhole, or pull box. Cable trays shall be identified by stencils at intervals not exceeding 50 feet, at intersections, and at each end to identify power cable tray voltage, control cable tray, or instrument cable tray.

3.4 RACEWAY SCHEDULE

A. Unscheduled Raceway:

1. Raceway shall be provided as specified on the one-line diagrams. Raceway not shown on the one-line diatrams is unscheduled and shall be provided as specified below.

2. Unscheduled **lighting** and receptacle raceways shall be sized by the Contractor in accordance with the NEC. Minimum size shall be 3/4 inch for exposed and 1 inch for embedded raceway.

3.5 RACESPEC SHEETS

A. The following RACESPECS are included in this section:

RACEWAY IDENTIFICATION:	GRS
Description:	Galvanized Rigid Steel Conduit (GRS)
Compliance:	ANSI and UL
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Manufacturers:	Allied Tube and Conduit Corp., Wheatland Tube Co., or equal.
Minimum size:	Unless otherwise specified, 3/4 inch for exposed, 1 inch for embedded, encased, or otherwise inaccessible.
Fittings:	
Locknuts, Rings, Hubs:	Hot-dip galvanized insulated throat with bonding locknut or ring,. The hubs shall utilize a neoprene "O" ring and provide a watertight connection. O-Z Gedney, CHM-XXT, or equal
Unions:	Electro-galvanized ferrous alloy type Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or equal. Threadless fittings are not acceptable.
Conduit Bodies:	Oversized conduit bodies: Ferrous alloy type with screw taps for fastening covers to match the conduit system. Gaskets shall be made of neoprene.
Boxes:	
Indoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.
Outdoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.

RACEWAY IDENTIFICATION:	GRS (CONTINUED)
Corrosive:	NEMA 4X stainless steel or nonmetallic, as specified.
Hazardous:	NEMA Class 7 cast ferrous.
Elbows:	
(3/4" thru 1-1/2")	Factory fabricated or field bent.
(2" thru 6")	Factory fabricated only.
Conduit Bodies (Oversized):	
(3/4" thru 4")	Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for conduit entrances.
(5" and 6")	Electro-galvanized iron or cast iron box.
Expansion Fittings:	Expansion fittings in embedded runs shall be watertight with an internal bonding jumper. The expansion material shall be neoprene allowing for 3/4-inch movement in any direction.
Manufacturers:	Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or equal.
Installation:	Rigid steel conduit shall be made up tight and with conductive thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot-dip galvanized malleable iron straps with nesting backs or framing channel. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

RACEWAY IDENTIFICATION:	LFS
Description:	Liquidtight Flexible Steel Conduit
Application:	Final connection to equipment subject to vibration or adjustment.
Compliance:	UL 360
Construction:	Spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover.
Minimum size:	3/4 inch
Fittings:	Cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral. O-ring seals around the conduit and box connection and insulated throat. Provide forty-five and ninety degree fittings where applicable. Provide PVC coated flexible conduit and fittings where the conduit system is PVC coated.
Installation:	Length of flexible liquidtight conduit shall not exceed 15 times the trade diameter of the conduit and not exceed 36 inches in length. Use conductive thread compound.

RACEWAY IDENTIFICATION:	PGRS
Description:	Rigid Steel Conduit, Corrosion-Resistant, Polyvinyl Chloride (PVC) Coated. Provide factory made and coated elbows.
Compliance:	ANSI, ETL and UL. The PVC coated rigid galvanized steel conduit shall be stamped with the ETL Verification Mark "ETL Verified to PVC-001".
Finish:	PGRS shall be hot-dip galvanized rigid steel conduit as specified in 16110-3.03 GRS, with a PVC Coating. The PVC coating shall be gray, minimum 40 mils thick, bonded to the outside and continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes. Thread protectors shall be used on the exposed threads of the PVC coated conduit. A 2-mil coat of urethane enamel coating shall be bonded to the inside. Coating shall be free of pinholes. Bond strength shall exceed the tensile strength of the PVC coat.
Minimum size:	3/4 inch
Fittings:	Similarly coated to the same thickness as the conduit and provided with Type 316 stainless steel hardware. Conduit and fittings shall be manufactured by the same company Conduit and fittings shall be coated by the same company. Male threads on elbows and nipples, and female threads on fittings or conduit couplings shall be protected by application of urethane coating.
Covers:	PVC coated covers shall have V-groove seal and stainless steel hardware.
Hubs:	Hubs for connection of conduit to junction, device, or terminal boxes shall be threaded cast ferrous alloy. Hubs shall have the same PVC coating as the conduit and insulating grounding bushings. Hubs shall utilize a neoprene "O" ring and shall provide a watertight connection.

RACEWAY IDENTIFICATION:	PGRS (CONTINUED)
Boxes:	
Nonhazardous:	NEMA Class 4X stainless steel or nonmetallic.
Hazardous:	NEMA Class 7 cast ferrous.
Manufacturers:	PVC coated conduit that bears the ETL Verified PVC-001 label by Robroy Industries, Plasti-Bond, Perma-Cote, KorKap or equal.
Installation:	Plastic coated conduit shall be made up tight, threaded, and installed using tools approved by the PVC-coated conduit manufacturer. Exposed conduit threads shall be covered by a plastic overlap coated and sealed per manufacturer's recommendations. Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable. PVC coated conduit shall be supported away from the structure using PVC coated conduit wall hangers or PVC coated conduit mounting hardware. Damaged work shall be replaced
Training:	Installers shall be trained and certified in the proper installation techniques provided by the PVC-coated conduit system manufacture. Proof of certification shall be provided under paragraph 16110-1.03.

RACEWAY IDENTIFICATION:	PVC4
Description:	Rigid Nonmetallic Conduit.
Application:	Heavy wall thickness for direct bury, concrete encasement or surface mounting where not subject to physical damage.
Compliance:	NEMA TC2, UL 651
Construction:	Schedule 40, high-impact, polyvinylchloride (PVC)
Minimum size:	3/4 inch exposed; 1 inch embedded or encased
Fittings:	PVC solvent weld type
Boxes:	
Indoor:	NEMA Class 4, nonmetallic
Outdoor and corrosive:	NEMA Class 4X, nonmetallic
Installation:	PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O ring. Joints shall be made with standard PVC couplings. PVC conduit shall have bell ends where terminated at walls and boxes.

RACEWAY IDENTIFICATION:	PVC8
Description:	Rigid Nonmetallic Conduit
Application:	Extra heavy wall thickness for locations including direct bury under roadways where not exposed to traffic damage and surface mounted in corrosive areas.
Compliance:	NEMA TC2, UL 651
Construction:	Schedule 80, high-impact, polyvinylchloride (PVC)
Minimum size:	3/4 inch exposed; 1 inch embedded or encased
Fittings:	PVC solvent weld type
Boxes:	
Indoor:	NEMA Class 4X, nonmetallic
Outdoor and corrosive:	NEMA Class 4X, nonmetallic
Installation:	Exposed PVC conduit shall be run on supports spaced:

a. 3 feet apart for conduits up to 1 inch.

b. 5 feet apart for conduits 1-1/4 inches to 2 inches.

c. 6 feet apart for conduits 2 1/2 inches and larger.

d. PVC conduit not provided where damaged by heat.

e. Bell ends where terminated at walls, boxes and electrical cabinets and control panels.

RACEWAY IDENTIFICATION:	WW
Description:	Wireway and Auxiliary Gutter: Match the conduit or raceway system specified and shown on the drawings. Minimum: Flanged, oiltight type with hinged covers
Application:	As shown on the drawings.
Compliance:	JIC EMP-1
Sizes as shown:	4 inch by 4 inch, 6 inch by 6 inch, 8 inch by 8 inch
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Indoor non-corrosive area:	NEMA-1, NEMA-12, NEMA-4 or as shown on the drawings.
Outdoor and corrosive area:	NEMA-3R, NEMA-4X or as shown on the drawings.

RACEWAY IDENTIFICATION:	XPFS
Description:	Explosion-proof Flexible Steel Conduit
Application:	XPFS Conduit coupling shall be used for final connections to motors and other equipment subject to vibration or adjustment in Class I Division 1 hazardous areas and shall be watertight.
Size:	1/2 inch – 4-inch
Length:	4-inch – 36-inch

END OF SECTION

SECTION 16120

600 VOLT CONDUCTORS, WIRE, AND CABLE

PART 1- GENERAL

1.1 DESCRIPTION

A. This section specifies stranded copper cables, conductors, and wire rated 600 volts insulation used for power; lighting, analog, digital, or pulse signals and control circuits.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to document shall mean the documents in effect at the time of Advertisement for bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire
NEMA WC7	Cross-Linked-Thermosetting Insulated Wire and Cable for the Transmission and Distribution of Electric Energy
NFPA 70	National Electric Code (NEC)
UL 44	Rubber-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables

1.3 SUBMITTALS

A. The following information shall be provided in accordance with Section 01300.

1. Submittals specified in Section 16000.

2. Complete catalog cuts for all conductors, wire, and cable.

PART 2- PRODUCTS

2.1 GENERAL

A. Unscheduled Conductors and Cables:

1. Where not specified on the Drawings, conductors and cables shall be sized in accordance with the National Electrical Code for the particular equipment served with the minimum size as specified herein.

2. Unscheduled conductor with insulation shall be provided in accordance with the following:

a. CABLESPEC "XHHW" for single conductors

B. Cable Specification Sheets (CABLESPEC): General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets in paragraph 16120-3.06.

2.2 COLOR CODING

A. Control Conductors: Single-conductor control conductors shall have the following colors for the indicated voltage:

Control Conductor	120V
Power (AC)	Black
Control (AC)	Red
Neutral	White
Ground	Green
Foreign Voltage (DC)	Blue/White
Foreign Voltage (AC)	Yellow
Power (DC)	Blue
Control (DC)	Violet

B. Power Conductors:

1. Power conductors shall have the following colors for the indicated voltage:

Power Conductor	480V	208/120V
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Ground	Green	Green
Neutral	Gray	White

2. Cables may be black with colored 3/4-inch vinyl plastic tape applied at each cable termination. Tape shall be wrapped with 25 percent overlay to provide 3 inches minimum coverage.

C. Signal Conductors: Signal cable conductors shall be color coded black and white for pairs or black, white, and red for triads. Each conductor and each group of conductors shall be numbered.

2.3 POWER AND CONTROL CONDUCTORS AND CABLE, 600 VOLT

A. Single Conductor: Provide stranded conductors for all cable or wires. Provide minimum conductor size of 12 AWG for power and lighting circuits and minimum conductor size of 14 AWG for control circuits.

2.04 SIGNAL CABLES

A. General:

1. Factory cable between manufactured instrument system components shall be provided in compliance with the instrument manufacturer's recommendations.

2. Signal cable shall be provided for instrument signal transmission. Single instrument cable (SIC) and multiple-circuit instrument cable (MIC) shall be provided in accordance with the following examples:

a. CABLESPEC “SIC”:

b. Cable designation: 1PR#16S shielded twisted pair (STP)

c. Cable designation: 1TR#16S triad (STT)

B. Communication, Paging, And Security System Cables: Voice communication, paging, and security system cables shall be specified in their respective specification sections.

2.5 PORTABLE CORD

A. Portable cord shall be provided in accordance with CABLESPEC "CORD," unless otherwise specified. Cords shall contain an equipment grounding conductor.

2.6 SPLICING AND TERMINATING MATERIALS

A. Connectors shall be tool applied compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Wire nuts for a splice is prohibited.

B. Signal and control conductors shall be connected to terminal blocks and field devices and instruments shall be terminated with conductor terminals as specified in paragraph 16000-2.02.

C. Connectors for wire sizes No. 8 AWG and larger shall be compression tool installed one-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable. In-line splices and taps shall be used only by written consent of the Construction Manager.

D. Power conductor splices shall be compression type, made with a compression tool die approved for the purpose, as made by Thomas and Betts Corp., or equal. Splices shall be covered with electrical products designed for the application, insulated, and covered with a heat-shrinkable sleeve or boot, as specified elsewhere.

E. Motor connection kits shall consist of heat-shrinkable, polymeric insulating material over the connection area and high dielectric strength mastic to seal the ends against ingress of moisture and contamination. Motor connections may use the Tyco Electronics removable boot product line.

F. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations. Connection kits shall be independent of cable manufacturer's tolerances. Refer to the electric motor specification Section 11176.

2.7 CORD GRIPS

A. Cord grips shall be provided where indicated on the Drawings to attach flexible cord to equipment enclosures. Cord grips shall consist of a threaded aluminum body and compression nut with a neoprene bushing and stainless steel wire mesh for strain relief. Cord grip shall provide a watertight seal at enclosure interface and sized to accommodate the flexible cord.

PART 3- EXECUTION

3.1 GENERAL

A. Conductors shall be identified at each connection terminal and at splice points. The identification marking system shall comply with Section 16000.

B. Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the insulation or jacket. Manufacture recommended and UL Listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable.

C. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed. Where wire or cable exits a raceway, a wire or cable support shall be provided.

D. Provide tin-plated bus bar. Scratch-brush the contact areas and tin plate the connection where flat bus bar connections are made with un-plated bar. Bolts shall be torqued to the bus manufacturer's recommendations.

3.2 600 VOLT CONDUCTOR AND CABLE

A. Conductors in panels and electrical equipment shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Cable ties shall be tensioned and cut off by using a tool specifically designed for the purpose such as a Panduit GS2B. Other methods of cutting cable ties are unacceptable.

B. Conductors crossing hinges shall be bundled into groups not exceeding 10 to 15 conductors and protected using nylon spiral flexible covers to protect conductors. Provide oversized plastic panel wiring duct within panels and panelboards.

C. Slack shall be provided in junction and pull boxes, handholes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls. Amount of slack shall be equal to largest dimension of the enclosure. Provide dedicated electrical wireways and insulated cable holders mounted on unistrut in manholes and handholes.

D. Raceway fill limitations shall be as defined by NEC and the following:

1. Lighting and receptacle circuits may be in the same conduit in accordance with de-rating requirements of the NEC. Lighting and receptacle circuits shall not be in conduits with power or control conductors. Signal conductors shall be in separate conduits from power conductors. Motor feeder circuits shall be in separate conduits including small fan circuit unless combination fan-light fixture.

2. Power conductors derived from uninterruptible power supply systems shall not be installed in raceways with conductors of other systems. Install in separate raceways.

3. Slices and terminations are subject to inspection by the Construction Manager prior to and after insulating.

4. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors.

5. In-line splices and tees, where approved by the Construction Manager, shall be made with tubular compression connectors and insulated as specified for motor terminations. Splices and tees in underground handholes or pull boxes shall be insulated using Scotch-cast epoxy resin or Raychem splicing kits.

6. Terminations at solenoid valves, 120 volt motors, and other devices furnished with pigtail leads shall be made using self-insulating tubular compression connectors within the termination box.

7. Terminations at valve and gate motor actuators shall be made directly into the actuator where possible. Power termination shall be made in the actuator power disconnect. Control and signal cable may be routed to a termination box near the

actuator on 20-ampere rated terminal strips with label identification for the control and signal conductors. Single wire control conductors and analog cable (SIC) then installed in flexible conduit to the actuator control and signal termination compartments.

3.3 SIGNAL CABLE

A. Provide terminal blocks at instrument cable junctions within dedicated terminal boxes provided by the installer. Signal circuits shall be run without splices between instruments, terminal boxes, or panels.

B. Circuits shall not be made using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required.

C. Shields are not acceptable as a signal path, except for circuits operating at radio frequencies utilizing coaxial cables. Common ground return conductors for two or more circuits are not acceptable.

D. Shields shall be bonded to the signal ground bus at the control panel only and isolated from ground at the field instrument or analyzer and at other locations. Shields or drain wires for spare circuits shall not be grounded at either end of the cable run. Terminals shall be provided for running signal leads and shield drain wires through junction boxes.

E. Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes.

F. Where instrument cable splicing is required, provide an instrument stand with terminal box rated for the area and environment and mounted approximately 3 feet above grade for instrument cable splices with the circuits and individual conductors provided with label as specified in Section 16000.

G. Cable for paging, security, voice communication, and telephone systems shall be installed and terminated in compliance with the manufacturers and the Utilities recommendations.

3.4 PORTABLE CORD

A. Portable power cords feeding permanent equipment, such as pendant cords feeding motors for pumps, cranes, hoists, and portable items shall have a wire mesh cord grip of flexible stainless-steel wire to relieve the tension from the cable termination. Connection of portable cords to permanent wiring shall be accomplished with dedicated boxes and terminals blocks.

3.5 TESTING

A. The Contractor shall test conductors, wire, and cable in accordance with Section 16030.

3.6 CABLE SPECIFICATION SHEETS (CABLESPEC)

A. General: Conductor, wire, and cable types for different locations, service conditions and raceway systems are specified on individual cable specification sheets. Scheduled and unscheduled conductors, wires, and cables shall be installed in accordance with the CABLESPEC SHEETS.

B. Cablespec Sheets: The following CABLESPEC sheets are included in this section:

Type	Volt	Product	Purpose
DC1	300	RS-422: 4-PAIR, 24-AWG UNSHIELDED JACKETED PREMISE WIRE	DATA COMMUNICATION FAST ETHERNET: 100 BASE T CABLE, VIDEO, CCTV
SIC	600	P-OS: 1-PR#18 or 16SH or 1-TR#18 or 16SH	CABLE TRAY RATED INSTRUMENT CABLE
XHHW	600	XLP INSULATED INDUSTRIAL GRADE CONDUCTOR	POWER, CONTROL, LIGHTING, & RECEPTACLES

3.7 CABLE SPECIFICATION SHEET—CABLESPEC

Cable System Identification:	DC1
Description:	Premise Cable: IEC Category 5 UTP; NEMA WC-63.1 Category 6; Fast Ethernet: 100 Base TX; 4 pair, #24 AWG Cable
Voltage:	600 V RMS -
Conductor Material:	Solid Bare copper
Insulation Material:	FRPO - Flame Retardant Polyolefin / FEP -Fluorinated Ethylene Propylene; Color Coded conductor insulation
Jacket:	LS PVC - Low Smoke Polyvinyl Chloride with ripcord Trade Name Example: Flamarrest Sequential Footage Marking: Every two feet Jacket Color: **Black**
Manufacturer(s):	Cooper Industries – Belden Category 6 DataTuff cables; or equal.
Execution:	
Applications:	Gigabit Ethernet Data Communications LAN, CCTV Fixed. Component or Composite Video, Digital Video, RS-422
Installation:	Install in accordance with associated equipment manufacturer's instruction.

3.7 CABLE SPECIFICATION SHEET—CABLESPEC

Cable System Identification:	DC1
Testing:	Test in accordance with paragraph 16120-3.05.

Cable System Identification:	SIC
Description:	Single twisted, shielded pair or triad, 18 AWG, instrumentation and signal cable; UL listed; Cable Tray rated
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8
Insulation Material:	15 mil, Polyvinyl Chloride (PVC) with 4 mil nylon, 90 degree C temperature rated Color Code per ICEA Method-1: Pairs- Black and White with one conductor in each pair printed alpha-numerically for identification
Lay:	Twisted on a 2-inch lay
Shield:	100 percent, 1.35 mil aluminum-Mylar tape with a 7-strand tinned copper drain wire
Jacket:	45 mil Polyvinyl Chloride (PVC)
Flame Resistance:	UL 1277
Manufacturer(s):	Okonite, Okoseal-N Type P-OS (Pair(s) Overall Shield) and Type TOS (Triad(s) Overall Shield); or Cooper Industries-Belden equal; or General Cable equal
Execution:	
Use:	Analog signal cable and RTD device Triad extension cable.
Installation:	Install in accordance with paragraph 16120-3.03.
Testing:	Test in accordance with paragraph 16120-3.05.

Cable System Identification:	XHHW
Description:	Industrial grade single conductor Sizes: 14 AWG through 750 kcmil as shown
Voltage:	600 volts
Conductor Material:	Bare annealed copper; stranded per ASTM B8
Insulation:	NEC Type XHHW-2; 90 degree C dry and C wet; Cross-Linked Polyethylene (XLP) per ICEA S-66-524 and UL-44; Color in sizes 14, 12 and 10 AWG: Black, Green, Yellow, White, Orange, Brown, Red, Blue
Jacket:	None
Flame Resistance:	UL 83
Manufacturer(s):	Okonite, X-Olene; Cablec, Durasheath XLP; or equal.
Uses Permitted:	Power, control, lighting and outlet circuits.
Execution:	
Installation:	Install in accordance with paragraph 16120-3.02.
Testing:	Test in accordance with paragraph 16000-3.02 and Section 16030.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16124

SINGLE MODE FIBER OPTIC
DATA COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies requirements for indoor/outdoor rated single-mode fiber optic data communication cables including installation, terminations, termination cabinets, testing, and accessories.

B. Provide tools, supplies, materials, equipment, test equipment and the labor for the raceways system, cable installation, and testing of a complete and operable fiber optic cabling system as specified herein on the Cable Specification Sheets.

C. Provide fiber optic cable with each fiber usable and tested as specified herein.

D. Provide the fiber optic cable splices and appurtenances required to complete the fiber optic cabling system. Appurtenances are specified herein.

E. Refer to the drawings and drawing notes for specific requirement for the project, since not all specified products, methods, and procedures are applicable to the project.

1.2 QUALITY ASSURANCE

A. Manufacturer: Equipment and cabling shall be the product of firms regularly engaged in the design and manufacturer of equipment and cables. Manufacturer shall be ISO 9001 certified.

B. Installer: Installation, termination, and testing of equipment and cabling provided under this section shall be performed by qualified, skilled technicians regularly engaged in fiber optic cabling system work of similar complexity and who possess the licenses or certificates required to perform such work.

C. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified

by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
AASHTO	HS-20 Truck Loading
ASTM F 512	Smooth-Wall Poly (Vinyl Chloride)(PVC) Conduit and Fittings for Underground Installation
ANSI/ICEA S-87-640	Standard for Optic Fiber Outside Plant Communications Cable.
ANSI/TIE/EIA 568-B.3	Commercial Building Telecommunications Cabling Standard part 3
BELLCORE GR-20-CORE	Generic Requirements for Optical Fiber and Optical Fiber Cables
BELLCORE GR-409-CORE	Generic Requirements for Intrabuilding Fiber Cable
BELLCORE GR-487-CORE	Generic Requirements for Electronic Equipment Cabinets
BELLCORE GR-771-CORE	Generic Requirements for Fiber Optic Splice Closures
ISO 9001	Quality Management Systems
ITU G.652	Recommendation - Characteristics of a single-mode optical fiber cable.
ANSI/NECA 301	National Electrical Contractors Association – Standard for Installing and Testing Fiber Optic Cables
TIA/EIA-455-86	FOTP-86 Fiber Optic Cable Jacket Shrinkage
TIA/EIA-455-107A	FOTP-107 Determination of Component Reflectance or Link/System Return Loss Using a Loss Test Set
TIA/EIA-526-7	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA/EIA-598-B	Standard for Optical Fiber Cable Color Coding
NFPA 70	National Electric Code (NEC)

D. Factory Test: Manufacturer's factory testing shall be conducted for all fiber optic cable reels provided for this Contract. Test documentation shall include the following:

1. Measurement of fiber length using Optical Time Domain Reflectometer (OTDR).

2. Measurement of average attenuation using OTDR.

3. Traces of OTDR measurements taken.

4. Test for short distance cable fault detection using Visual Tracer.

E. Certification: Splicing, terminating, and testing shall be conducted by Fiber Optics Association Certified Fiber Optic Technicians (CFOT).

1.3 SUBMITTALS

The following information shall be submitted for review in accordance with Section 01300:

A. Product Literature:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

   A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*

2. A copy of the contract document, fiber-optic network system block diagrams, cabinet and panel drawings, control single-line diagrams, and process and instrumentation diagrams that apply to the equipment in this section marked to show specific changes necessary for the supplied equipment.

   If no changes are required, the drawings shall be marked "No Changes Required." Manufacturer's specifications, data sheets, and catalog literature for the indoor/outdoor rated fiber optic cable that clearly and unambiguously shows that the cable meets all the requirements specified herein.

3. Manufacturer's catalog literature and catalog data sheets for the following items, marked to indicate products proposed, as applicable to the project:

   a. Fiber optic cables including manufacturers' maximum recommended pulling tension.

   b. Fiber optic cable termination connectors

   c. Fiber optic termination panels

   d. Fiber optic adapter plug-in

   e. Fiber optic cable clamp kit

   f. Connector/Adapter cleaning kit

   g. Cable pulling grips, swivel, and lubricant

4. Shop drawings:

   a. Termination panel fabrication and layout drawings with materials list and nameplate engraving list.

b. Interconnection cable diagrams for the complete system, showing each fiber in each cable with each splice and termination point.

B. Qualifications:

1. Contractor's experience and resumes for the personnel installing and testing the fiber optic system including factory training certifications.

2. Information on successfully performed cable installations of comparable size and complexity with name, address, and telephone number of facility owner, name of project and completion date, and type of conduit system and length of cable pulled.

3. Proof of certification for splicing, terminating, and testing personnel per paragraph 1.02 E.

C. Fiber cable pulling and splicing plan as specified in Part 3.

D. Submit cable samples for review that include the specified cable marking.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide fiber optic cable jacket: free of holes, splits, and blisters with no metal elements and of a consistent thickness.

2.2 CONDUIT

A. Provide 4 -inch diameter PVC Schedule 40 conduit per Section 16110 that shall be direct buried, installed in a raceway ductbank, or placed in a steel casing with the annular space grouted per ASTM F 512 - Smooth-Wall Poly Vinyl Chloride (PVC) Conduit and Fittings for Underground Installation, as shown.

2.3 PULL BOXES

A. Unless otherwise shown, provide pull boxes with the approximately dimensions of 30 inches wide by 48 inches long, by 18” deep with hollow bottoms, designed for H-20 traffic loading.

B. Pull box covers shall be galvanized steel with the words "FIBER OPTICS" in raised letters on the upper surface. Covers shall have locking devices and form a watertight seal to prevent surface water from entering. Knockouts in the sidewalls shall permit underground conduit side entry and exit.

C. Pull boxes shall by George Ingraham, Vikamatic or equal.

2.4 CONDUIT SEALANT

A. Conduit sealant shall be Semco duct sealing compound or equal.

2.5 IDENTIFICATION TAPE

A. Provide a 6-inch wide magnetically detectable warning tape with orange protective polyethylene jacket. Provide polyethylene tape continuously imprinted "CAUTION-FIBER OPTIC CABLE".

B. Identification warning tape shall be Teletrace by George Ingraham, Vikamatic, or equal.

2.6 TRACER WIRE

A. Provide a #10 AWG XHHW insulated green stranded copper wire with a multi-pin terminal block for termination of the tracer wire in concrete manhole / pullbox for tracer wire access.

2.7 PULL ROPE

A. Provide a low friction, polyethylene jacketed, polypropylene rope with 1,800 psi of tensile strength.

B. Pull rope shall be Vikamatic "Fiber Glide" or equal.

2.11 CABLE IDENTIFICATION TAGS

A. Provide identification tags:
"FROM: _____ TO:_____CIRCUIT:_____PURPOSE:_____".

B. Cable identification tags shall be Brady or Thomas & Betts or equal.

2.12 FIBER OPTIC BUFFERED CABLE CONNECTORS AND PATCH CORDS

A. General:

1. Provide preparation for the connections including polishing, connectors, hardware, cleaving tool, continuity tester, visual fault locator, and supplies for installation of connectors. Terminations shall be ST type. Fusion-spliced pigtails are not acceptable.

2. Fiber optic cable connections shall be provided with ceramic ferrules, polycarbonate not acceptable.

B. Connector Characteristics: Connectors shall be specifically designed for fiber optic buffered cables specified herein.

2.14 PRODUCT DATA

A. The following information and product data specified shall be provided in accordance with Section 01300.
1. Factory test results as specified in paragraph 1.02.

2. Cable pull records as specified in Part 3.

3. Results of all tests specified in Part 3.

PART 3 - EXECUTION

3.1 RACEWAY SYSTEM

A. Conduit Installation:

1. Conduit bends shall have a radius of 24 times the conduit diameter. Conduit sections shall be joined in accordance with the manufacturers' recommendations and shall be watertight.

2. Conduits entering pull boxes shall be capped or sealed watertight. Conduits entering access concrete manholes and vaults shall be terminated with flush end bells. Provide bushings on ends of conduits entering pull boxes.

3. Annular spaces around the conduit and precast unit walls shall be grouted. Bedding and backfill shall be as specified for the pipeline trench.

4. Concrete encasement shall be red concrete in accordance with Section 03300 placed at least 4 inches thick below and above the conduit.

5. Provide identification tape above underground conduit along the entire length of the conduit route

6. Provide and install fiber cable identification tags in each access vault, pullbox, and/or vault

7. Tracer wire shall be installed in the trench with fiber optic cable conduit and at pullbox / manholes with ten feet of tracer wire coiled and secured as specified herein.

B. Pull Box Installation:

1. Pull boxes shall be installed on a compacted level foundation consisting of 4 inches of granular material. Backfilling around pull boxes shall not be done until mortar sealant has thoroughly set.

2. Install the pull box covers with the top of the cover flush with the finished grade. Install pull boxes in soil areas with top of the cover 3 inches above the final grade level of the restored surface to prevent accumulation of dirt, silt and debris on the top of the cover. Perform conduit integrity tests for each section between the pull boxes after backfilling and compaction using the test and procedures described in this Section, prior to installation of the pull rope.

3. Pull boxes shall be free of debris and water, ready for cable installation upon final acceptance of the conduit system. Pull box conduit entries shall be sealed

with grout to prevent the intrusion of water and debris into the pull boxes. Use red urethane: Greybar catalog #02044 or equal.

C. Conduit System Cleaning and Testing:

1. Conduits shall be cleaned of loose material by brush and compressed air following the backfill placement and compaction. Provide a test mandrel approximately 3/8 inch smaller than the inside diameter to be passed through conduits to detect alignment and deformation problems. Remove and replace conduit that fails the mandrel test. The replacement conduit shall then be cleaned and tested as described herein.

2. Cleaning and testing of the conduit shall be witnessed by the Construction Manager for conduit sections between adjacent pull boxes or manholes for the entire conduit route. Provide 5-day advance notice of the schedule and test location to the Construction Manager.

3.2 FIBER OPTIC SYSTEM

A. Fiber Optic Cable Installation and Splicing Plan:

1. Submit 30 days prior to cable installation.

2. Air assisted cable placement method using high speed air blowing, push-pull, cable jetting plan with the procedure, the equipment setup, and a work plan.

3. Work plan shall include the following:

a. Pull tension calculations.

b. Indicate additional pull boxes required, including station number and a written description of the location.

c. Detailed description of pull operation methods for raceways.

d. Tools and equipment for cable installation and testing

e. Physical location of equipment setup and type

f. Exact location of splice points

g. Safety Plan and cable pulling operations

h. Detailed schedule for pulling and testing cables

B. Fiber Optic Cable Installation:

1. Fiber optic cable handling and storage shall be performed in accordance with the manufacturer’s recommendations. The cable installation personnel shall be experienced with specific knowledge of the cable manufacturer's recommended procedures. Cable reel lagging shall remain on the cable reels until they arrive at

the installation site. If the lagging has been removed, securely fasten the cable ends to avoid damage during transit. The cable shall not be left exposed or unattended during the installation process. Verify cable is not damaged during storage and installation.

2. Cable tension shall not exceed the manufacturer's specification for tensile loading. Pulling tension shall be continuously monitored and recorded during installation. Fiber cable shall be pulled in a steady continuous manner. The bending radius of the cable shall not be exceeded. Cable tension monitoring devices shall not exceed cable pull tension and bend limits.

3. Cable shall be installed in continuous lengths without intermediate splices. Cable shall be provided without splices except as shown on the plans. If additional splices are required, advanced approval of the Construction Manager shall be obtained.

4. Additional cable shall extend to the nearest clean and level work area. Coils shall measure 100 feet for splice work locations.

5. Cable strength elements shall be properly attached to a pulling eye and 600 lb breakaway swivel. Kellums pulling grips are not allowed except for short-length hand pulls.

6. Cable and conduits shall be lubricated during the pulling procedures. Each pullbox / concrete manhole / vault shall contain cable coiled into a slack loop and stored in a slack enclosure.

7. Tensile and bending limitation shall not be exceeded when power equipment is used to install cables. Tension monitoring shall use commercial dynamometers or load-cell instruments with chart recorder. Large diameter wheels, pulling sheaves, and cable guides shall maintain the specified bending radius.

8. Cable shall be installed using a hydraulic capstan or winch equipped with a recording running line dynamometer graph which measures and records pulling tensions. Provide Polywater Type 5 lubricant, or equal.

9. Cable pull records shall be documented by a graph which is annotated with the following information:

    a. Reel number.

    b. Station or pullbox from and station or pullbox to.

    c. Date and time.

    d. Explanations for abnormalities in readings or interruptions.

    e. Sign-off by Contractor and Construction Manager.

    f. Submit fiber optic pull records as specified herein.

10. Racking shall conform to the following:

a. Loosely secure cables in racked position with Ty-Raps or equal.

b. Attach imprinted plastic coated cloth identification/warning tags to the cable in at least two locations in each pullbox/concrete manhole/vault.

c. Provide tags manufactured by Brady or Thomas & Betts.

11. Protect coiled cable to prevent damage to the cable and fibers with racking securing cables to brackets and racking hardware that extend from the sidewalls of the handhole. When cables are securely racked, unused conduits and void areas around conduit containing cables shall be sealed. In concrete manholes and vaults, coiled cable shall be placed into a slack enclosure to prevent damage to the cable and fibers.

12. Provide Semco compound or equal material.

C. Fiber Optic Cable Splicing And Terminations:

1. Prior to beginning the splicing, provide a work area to protect the cable splices from physical damage.

2. Work shall be performed by trained and FOA certified technicians and in accordance with the manufacturer's recommendations in the performance of installation, splicing and termination work.

3. Active and spare fiber optic cables fibers shall be provided with a breakout kit, and terminated with ST type terminations.

4. Splices shall have a loss no greater than 0.15 dB, as determined by either a Profile Alignment System (PAS) or Light Injection (LID) splice loss estimate, at the time the splice is made. Splices with an optical loss of greater than 0.15 dB shall be redone.

5. Indoor splices shall be mounted in a splice tray and the splice trays may be stored in either a separate indoor rack mounted splice module or within the patch panel. Outdoor splices shall be in an outdoor plant splice NEMA 4X enclosure.

3.3 FIBER OPTIC TESTING:

A. The Construction Manager shall be notified a minimum of 5 days prior to tests and reserve the right to witness field tests.

B. Test Equipment:

1. Test equipment shall be traceable to NIST standards. Use the following to perform the pre-installation and post-installation cable tests:

2. Optical time domain reflectometer (OTDR) shall be laser precision, ALT, Inc. Model 5200 LRFL or equal.

C. Pre-Installation Tests:

1. Perform acceptance tests on the cable prior to installation to verify that the cable conforms to the manufacturer's specifications, and is free of defects, breaks and damages by transportation and manufacturing processes. Perform tests on all reels of cable. Cable shall not be installed until the Construction Manager has reviewed the test report.

2. Verify continuity and attenuation or loss for each fiber on each reel and document results of physical inspections to identify any cable and reel damage conditions, and any deviations from the manufacturer's specifications.

3. Notify the Construction Manager 5 days prior to tests. Document test results and submit the report to the Construction Manager for review. Documentation shall consist of both hard copy and electronic disk complete with application software.

D. Post-Installation Tests:

1. OTDR: Conduct the following tests on each cable segment with an OTDR each optical fiber in the fiber cable. Tests shall be conducted at both 1310 and 1550 nm. No splice loss shall have a loss of 0.15 dB or greater with fiber attenuation measured in dB/km.

2. Excess Fiber Coefficient (EFC) Test shall be made as part of the cable testing. The following procedure shall be performed from both ends on each fiber provided.

   a. Prior to stripping the cable for splicing, record the meter marks to determine the physical cable length.

   b. Record the fiber Index of Refraction (IOR) from the cable data submitted by the Manufacturer.

   c. With the OTDR, set to the proper IOR and record the OTDR fiber length.

   d. Calculate the excess fiber coefficient (EFC) according to the following formula: EFC = OTDR length/Sheath length

3. OLTS Fiber Attenuation: Measure the attenuation of each optical fiber in both directions using a with an Optical Loss Test Set (OLTS) at both 1310 nm and 1550 nm. Test shall be conducted per TIA/EIA 526-7. Provide a reference power level measured with a patch cord and connectors of the same types used on the fiber cable. Measure and record the reference power level of the Laser Light Source. Measure and record the received power level of each optical. Repeat the same measurements in the other direction.

4. The measured insertion loss shall be no greater than the loss calculated in the formula below:

$$IL = 2(Ls) + 2(Lc) + (La)(Length) + 0.5$$

where:

IL	=	Insertion Loss
Ls	=	Splice losses at the pigtails (maximum 0.15 dB)
Lc	=	Connector face loss (maximum 0.6 dB)
La	=	Manufacturer's cable attenuation (dB/km)
Length	=	Fiber length (km)

E. Cable Acceptance:

1. Pigtail splices shall have a loss no greater than 0.15 dB, as determined by either a Profile Alignment System (PAS) or Light Injection (LID) splice loss estimate, at the time the splice is made. Splices with an optical loss of greater than 0.15 dB shall be redone.

2. OTDR traces at both 1310 nm and 1550 nm wavelengths display no unexplained losses, reflectance events, or other discontinuities.

3. The insertion losses measured at both 1310 nm and 1550 nm wavelengths and in both directions do not exceed the maximum allowed values. After cable tests, the cable installation shall be subject to a physical inspection to verify the remaining fiber optic specification requirements have been met. If any test requirements are not met, or in the event of fiber test failure of one or more fibers, splice or replace cable as necessary until tests pass.

F. Fiber Optic System Acceptance: Perform the inspection and establish a punch-list of the following:

1. Fiber splices: neatly organized.

2. Connectors: capped and undamaged.

3. Cabling: organized with no excessive bending.

4. Specified coiled cable present in the splice cabinet.

5. Cable entrances to the cabinets secured.

6. Unused cable delivered to the Owner.

G. Identify cables with the directories installed in each fiber cabinet. Discrepancies found during the inspection of the fiber system installation shall be listed and provided on the punch-list. Inform the Construction Manager upon resolution and completion of the punch-list items.

3.4 CABLE SPECIFICATION SHEETS (CABLESPEC)

A. General:

1. Cable types for different locations, service conditions and raceway systems are specified on individual cable specification sheets. Cables that are scheduled herein shall be installed in accordance with the CABLESPEC SHEETS.

2. Single mode fiber optic cables shall meet the requirements of the referenced ANSI, ICEA, ITU, TIA, and EIA standards for outside plant data communications cable.

B. CABLESPEC Sheets: The following CABLESPEC sheets are included in this section:

Type	Volt	Product	Purpose
FOC-SM	300	FIBER OPTIC CABLE INDOOR/OUTDOOR	DATA COMMUNICATION

3.4 CABLE SPECIFICATION SHEET--CABLESPEC

Cable System Identification:	FOC-SM
Description:	Single Mode Fiber Optic Data Cable; 6-pair fiber conductor: Outdoor; Heavy Duty-MFPT; Cable Tray Rated Loose tube construction. Optical fibers shall not adhere to the inside of the buffer tube. Fibers and buffer tubes shall be color coded with distinct and recognizable colors in accordance with EIA/TIA-598-B.
Material:	8.2/125/250 micron
Jacket:	Chlorinated Polyethylene (CPE) Color: Yellow or Black Mark the exterior sheathing with the manufacturer's name, month and year of manufacture, and sequential meter or foot markings for easily determining the length of the cable at all points along the cable run. Provide a telecommunication handset symbol as required by Section 350G of the National Electrical Safety Code® (NESC®), fiber count, and fiber type.

Type:	OFNR with industrial cable tray rating and IEEE flame test rated: 802.3Z Fiber Type: Single Mode Clad Diameter: 125 ± 0.7 µm Coating Diameter: 245 ± 5 µm Core Diameter: 8.2 µm Attenuation: ≤ 0.35 db/km @ 1310 nm ≤ 0.25 db/km @ 1550 nm Operating Temperature Range: -40 to +70 Deg C Maximum Tensile Loading: 600 lbf Minimum Cable Bending Radius: 10 x diameter
Manufacturers:	Corning Cable Systems Alcoa Fujikura Corning SMF-28e fiber or approved equal
Execution:	
Application:	Data Communications.
Installation:	Install in accordance with manufacturers instructions and as specified.
Testing:	Test as specified above.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16155

INDIVIDUAL MOTOR STARTERS

PART 1--GENERAL

1.1 DESCRIPTION

A. This section specifies individual motor starters and motor controllers installed in enclosures other than motor control centers. Refer to drawings for product, device, and circuit requirements.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid or on the effective date of the Agreement if there were no Bids.

C. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

D. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NEMA ICS 1	General Standards For Industrial Control and Systems
NEMA 250	Enclosures for Electrical Equipment (1000-Volt Maximum)

1.3 SUBMITTALS

A. The following submittals shall be provided in accordance with Section 01300:

1. Verification of fault withstand ratings, as applicable, and interrupting ratings

2. The bill-of-material, schematic diagram, and wiring diagrams

3. Shop drawings of all motor controls and components.

a. Shop drawing submittals shall comply with the "Shop Drawings and Samples" paragraph of Section 16050. The submittal shall also include conduit entrance locations and requirements; nameplate legends;

electrical characteristics including voltage, frame size and trip ratings of overcurrent devices, short circuit withstand ratings, and protective device time-current curves of all equipment and components.

4. Product data on motor starters and combination motor starters, relays, pilot devices and switching and overcurrent protective devices.

5. The bill-of-material, schematic diagram, and wiring diagrams, and an elementary control diagram. An identifying number shall be assigned to each wire.

6. Seismic design certification and anchorage sketches in accordance with Section 16050.

PART 2--PRODUCTS

2.1 ENCLOSURE

A. The door to the motor starter enclosure shall be interlocked with an externally operated disconnect handle. Disconnect handle shall be arranged to indicate disconnect position. The disconnect operator handle shall have provisions to accept up to three 3/8-inch shackle padlocks to lock the disconnect in the open position.

B. Enclosures shall be:

1. NEMA 12 for indoor areas.

2. NEMA 4X 316 Stainless Steel for outdoor and process locations.

3. NEMA 7 cast metal for hazardous areas.

2.2 MOTOR BRANCH CIRCUIT PROTECTION

A. General: Motor branch circuit protection shall be provided by fused disconnect switches or molded case motor circuit protectors as specified or as indicated.

B. Fused Disconnect Switches: Fused disconnect switches shall be provided with visible knife blades, shielded line terminals and quick-make, quick-break switch operator. Fuse clips shall be Class R rejection type and sized for UL Class RK, one-time, time-delay fuses. Fuse assembly shall have a minimum short circuit capacity of 50,000 amps symmetrical.

C. Molded Case Motor Circuit Protectors:

1. The motor circuit protector (MCP) type molded case circuit breaker shall only be used as a part of a combination motor starter.

2. The MCP shall operate on the magnetic principle with a current sensing coil in each of the three poles to provide an instantaneous trip for short circuit protection. The trip setting shall be adjustable over a range of 700 to 1300 percent of the full load current of the motor served and shall be adjustable from the front of the breaker.

3. The MCP circuit breaker shall be rated to interrupt 10,000 ampere symmetrical when used in conjunction with an individual motor starter.

2.3 MOTOR STARTERS

A. The basic full voltage, non-reversing motor starter (FVNR) shall consist of a 3 pole, 600 volt AC contactor, transient surge suppressor, and solid-state overload relay, NEMA Size-2 minimum. Reversing (FVR) and multispeed (2S2W) starters shall have additional contactors, overload relays and auxiliary relays as required for the specified functions.

B. The contactors shall comply with NEMA ICS and NEMA rated for the horsepower as specified.

C. Overload relays shall be adjustable solid-state with protection for each of the poles. An overload condition shall cause the overload relay to latch in the open position. Reset shall be accomplished with a reset button located on the unit door exterior. Trip setting shall be adjustable from 85 to 115 percent of rating. Provide 1 Form-C 2-ampere auxiliary contact for remote monitoring of the overload alarm condition.

2.4 TERMINAL BLOCKS

A. Terminal blocks shall be heavy duty, rated at 20 amperes, 600 volts, and shall contain integral marking strips.

B. Terminal blocks shall be provided for external control connections. Spare terminals shall be provided as specified. Terminals shall be permanently identified with the numbers specified.

2.5 CONTROL DEVICES

A. Combination starters shall be provided with door-mounted control devices as shown on the diagrams. Control devices shall be as specified in Section 16175.

2.6 TRANSIENT SURGE SUPPRESSORS

A. Transient surge suppressors shall be provided in each starter. Suppressors shall be encapsulated, three component, solid-state circuit, in a module suitable for mounting directly to the starter coil. Additional space for suppressors shall not be required. Suppressors shall be rated 120 volts AC/DC.

2.7 CONTROL CIRCUIT TRANSFORMERS

A. Each combination motor control unit shall be provided with a control circuit transformer rated for 480 x 240-120V, single phase, 60 Hertz. Unless otherwise specified, transformers shall have a minimum volt-ampere rating as follows:

Starter	CPT Minimum Volt-Ampere Rating
Size 1	100
Size 2	150
Size 3	200
Size 4	300

B. The transformer size shall be increased if the devices applied will cause a control transformer overload or secondary terminal voltage to drop to or below 95 percent of rated secondary control voltage when rated primary voltage is applied. Each control transformer shall be mounted within the enclosure along with its associated circuit breaker and starter.

2.8 CONTROL CIRCUIT FUSING

A. Two primary fuses, rated to interrupt 200,000 amperes at 600 volts, shall be provided on all motor starters.

B. Each control circuit transformer shall be provided with one control circuit secondary fuse. The secondary fuse shall have an interrupting rating of 10,000 amperes at 250 volts. The secondary fuse shall be sized at 125 percent of full load current. Fuses shall have time delay characteristics as required to prevent false tripping due to coil in-rush currents.

C. Fuse holders shall be lamp indicating type for blown fuse indication and shall contain neon lamp, clear transparent knob, and solder terminals.

2.9 WIRING

A. Conductors shall be 90-degree C switchboard type. Conductors shall be identified with tag numbers as specified in 16000.

2.10 MANUAL STARTERS

A. Manual starters shall comprise a horsepower rated quick-make, quick-break, toggle mechanism together with overloads in all phase conductors.

2.11 NAMEPLATES

A. Nameplates shall be provided in accordance with the requirements of 16000.

2.12 PRODUCT DATA

A. The following product data shall be provided in accordance with Section 01300:

1. Operating and maintenance as specified in Section 01730.

2. Manufacturer's catalog data for all material provided under this section. The catalog data shall be assembled in a folder with each page clearly marked with the item and reference number to the specification.

3. MCP and solid-state overload rating selection data.

4. Product calibration and setup information.

5. A copy of the electrical diagrams in a plastic folder in the units.

PART 3--EXECUTION

3.1 DEVICE CALIBRATION AND TESTING

A. The Contractor shall size the overload relay heater elements or adjust the solid-state overload device to the actual nameplate full load amperes of the motor connected to the starter.

B. The Contractor shall adjust motor circuit protector to the lowest setting not causing false tripping.

C. The Contractor shall record the settings on each motor controller and record the settings as part of the Record As-Built drawing submittal.

3.2 MOUNTING HEIGHT

A. The Contractor shall mount local motor starters at 48 inches above the floor.

3.3 TESTING

A. Local motor starters and circuits shall be tested in accordance with Section 16030.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16170

GROUNDING SYSTEM

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing grounding for electrical systems, exposed nonenergized metal surfaces of equipment and metal structures.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03300 Cast-In-Place Concrete

2. Section 16050 Basic Electrical Materials and Methods

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. IEEE 81; Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, Guide for

2. UL 467: Standard for Grounding and Bonding Equipment

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop drawings showing details of grounding system.

2. Product data for grounding electrodes and connections.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's instructions including instructions for storage, handing, protection, examination, preparation and installation of exothermic welded connectors.

2. Test reports indicating overall resistance to ground.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

B. **Storage:** Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The WORK of this Section includes the following:

1. Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

2. Except as otherwise indicated, grounding products and systems shall comply with the NEC.

2.2 ROD ELECTRODE

A. Rod electrodes shall be 3/4 inch copper-clad steel, sectional type, joined by threaded copper alloy couplings. Length of rods forming an individual ground array shall be equal in length and shall be of the length required to obtain a minimum ground resistance of 5 ohms. Top of ground rod shall be fitted with a coupling and steel driving stud. Rods shall be of sufficient length to ensure contact with ground water and shall be not less than 10 feet.

2.3 CABLE

A. Ground cable shall be annealed bare copper, concentric stranded wire. If cable sizes are not indicated, the minimum sizes shall be as follows:

1. 480V panel: 2/0 AWG

2. Mini-Power Center: 2/0 AWG

3. Mini-Power Center Transformer: 8 AWG

4. Submersible Pump Controller: 2/0 AWG

5. PLC enclosure: 2/0 AWG

6. Exposed metal: 2 AWG

2.4 MECHANICAL CONNECTORS

A. Compression connectors shall comply with the following:

1. Material: Cast Copper

2.5 GROUNDING WELL COMPONENTS

A. Grounding well components shall comply with the following:

1. Well Pipe: 8-inch diameter by 24 inch long concrete pipe with belled end.

2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.6 MANUFACTURERS

A. Products indicated shall be manufactured by one of the following (or equal):

1. Rods and Fittings:

a. Copperweld
b. Blackburn
c. Weaver

2. Compression Connectors:

a. Thomas and Betts

PART 3 -- EXECUTION

3.1 GENERAL

A. Embedded and buried ground connections shall be made by compression connectors utilizing diamond or hexagon dies and a hand compression tool for wire sizes 2 AWG and smaller and a hydraulic pump and compression head for wire sizes 2/0 AWG and larger. Compression connections shall be prepared in accordance with the manufacturer's instructions. Exposed ground connections to equipment shall be made by bolted clamps unless otherwise indicated. Solder shall not be used in any part of the ground circuits.

B. Embedded ground cables and fittings shall be securely attached to concrete reinforcing steel with tie wires and prevented from displacement during concrete placement. As each part of the grounding system which is laid below finished grade is completed, the CONSTRUCTION MANAGER shall be notified 2 hours prior to backfilling.

C. Grounding conductors which are extended beyond concrete surfaces for equipment connection shall be extended a sufficient length to reach the final connection point without splicing. Minimum extension shall be 3 feet. Grounding conductors which project from a concrete surface shall be located as close as possible to a corner of the equipment pad, protected by conduit, or terminated in a flush grounding plate. Exposed grounding conductors shall be supported by noncorrosive metallic hardware at 4-foot intervals maximum Grounding conductors for future equipment shall be terminated using a two-hole copper flush mounted grounding plate.

D. Grounding conductor shall not be used as a system neutral.

3.2 FACILITY GROUNDING

A. Ground continuity throughout the facility shall be maintained by installing an electrically-continuous metallic raceway system, or a non-metallic raceway with a grounding conductor.

B. Metallic raceway shall be installed with double lock nuts or hubs at enclosures. Metallic conduits shall be assembled to provide a continuous ground path. Metallic conduits shall be bonded using insulated grounding bushings and shall be connected to the grounding system. Cable trays shall have No. 2/0 AWG bare copper ground conductor run on the outside of each tray. Conductor shall be connected to each section or fitting using a carriage bolt and clamp.

3.3 EQUIPMENT AND ENCLOSURE GROUND

A. Electrical and distribution equipment and metal equipment platforms which support any electrical equipment shall be bonded to the nearest ground bus or to the nearest switchgear ground bus. This grounding requirement is in addition to the indicated raceway grounding.

B. Connection to ground electrodes and ground conductors shall be exothermic welded where concealed and shall be bolted pressure type where exposed. Bolted connectors shall be assembled wrench-tight.

C. Insulated grounding bushings shall be employed for all grounding connections to steel conduits in switchboards, in motor control centers, in pullboxes, and elsewhere where conduits do not terminate at a hub or a sheet metal enclosure.

D. Where insulated bushings are required, they shall be installed in addition to double lock-nuts.

E. Shielded power cable shall have its shield grounded at each termination in a manner recommended by the cable manufacturer. Shielded instrumentation cable shall be grounded at one end only; this shall be at the Motor Control Board or otherwise at the "receiving" end of the signal carried by the cable except as otherwise indicated. Termination of each shield drain wire shall be on its own terminal screw. All of these terminal screws in one rack shall be connected with No. 16 solid tinned bare copper wire jumper; connection to ground shall be accomplished with a No. 12 green insulated conductor to the main ground bus.

F. Nonelectrical equipment with metallic enclosures shall be connected to the grounding system.

3.4 EXAMINATION

A. The WORK of this Section includes verification that final backfill and compaction has been completed before driving rod electrodes.

3.5 INSTALLATION

A. Rod electrodes shall be installed at locations indicated.

B. Grounding well pipes with cover shall be installed at each rod location with well pipe top flush with finished grade.

C. Metal siding not attached to grounded structure shall be bonded together and to ground.

D. Reinforcing steel and metal accessories shall be bonded to structures.

E. Where equipment grounding conductors are indicated, separate insulated conductors shall be installed within each feeder and branch circuit raceway. Ends shall be terminated on suitable lug, bus, or bushing.

3.6 FIELD QUALITY CONTROL

A. Grounding and bonding system conductors and connections shall be inspected for tightness and proper installation.

3.7 GROUNDING SYSTEM TESTS

A. Suitable test instruments shall be used to measure resistance to ground of system. Testing shall be performed in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

B. The grounding test shall comply with IEEE Standard 81. A plot of ground resistance readings for each isolated ground rod or ground mat shall be submitted on 8-1/2 x 11 inch size graph paper. The current reference rod shall be driven at least 100 feet from the ground rod or grid under test. The measurements shall be made at 10-foot intervals beginning 25 feet from the test electrode and ending 75 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

C. A grounding system that shows greater than 2 ohm resistance for the flat portion of the plotted data shall be considered inadequately grounded. Additional parallel connected ground rods and/or deeper driven rods shall be provided until the ground resistance measurements complies with the indicated requirements. Use of salts, water or compounds to attain the specified ground resistance is not acceptable.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16175

MISCELLANEOUS ELECTRICAL DEVICES

PART 1--GENERAL

1.1 DESCRIPTION

A. The vendor, manufacturer, and custom control panels shall provide enclosures, selector switches, pushbuttons, indicators, terminal strips, surge devices, nameplates, testing procedures, wiring method, wiring color coding, wire labeling, separation between power, controls, and instruments, hardwired logic relays or PLC logic products as specified herein and in Section 16485.

B. This section specifies electrical control and monitoring devices:

1. Control Devices:

   a. Pushbuttons
   b. Selector Switches
   c. Indicating Lights
   d. Control Station Enclosures

2. Control Relays:

   a. Load-Switching
   b. Logic Level Switching
   c. Timers and Time Switch
   d. Alternators

C. This section specifies power devices:

1. Magnetic Contactors:

   a. Motor Contactors

2. Safety Disconnect Switches

3. Manual starters per Section 16155 – Individual Motor Starters

4. Field Instrument and Field Analyzer: Key-Switch in control station with surge devices

5. Overcurrent Protection: Circuit breakers

6. Elapsed Time Indicators

7. Current transformers and transducers

8. Time Switch

9. Motor Driven Timers – On Delay and Off Delay

10. Thermostats

C. Request clarification where conflicts occur with this section and other sections in Divisions 11, 13, 15, and 16.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid or on the effective date of the Agreement if there were no Bids.

C. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

D. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA ICS-1	General Standards For Industrial Controls and Systems
NEMA ICS-2	Industrial Control Devices, Controllers, and Assemblies
NEMA KS 1	Enclosed Switches

1.3 SUBMITTALS

A. The following submittals shall be provided in accordance with Section 01300 and Section 16485:

1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

a. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

b. The Construction Manager shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

c. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

2. Arrangement drawings of the panel enclosure indicating the front door and panel equipment arrangement and dimensions, and enclosure type.

3. Nameplate legend with engraving and sizes.

4. Internal layout drawings showing all components.

5. List of materials and components with the layout drawings.

6. Elementary / schematic diagrams

7. Internal wiring connection diagrams.

8. External wiring interconnection diagrams including interlocks.

9. Power and control single line diagrams, where motor controllers are included.

10. Manufacturer's catalog data for all material provided under this section shall be assembled in a folder with each page clearly marked with the item model number and reference number to the specification.

PART 2--PRODUCTS

2.1 CONTROL DEVICES

A. Pushbuttons: Pushbuttons shall be flush head, heavy-duty, with NEMA rating to match enclosure type. Operators shall be green for start function, red for stop functions, and black for all other functions. The escutcheon legend shall be as specified on the drawings.

1. UL Listed.

2. Dielectric Strength: 1300 Volts for one minute for Logic Reed contacts, 2200 Volts for one minute for other contacts.

3. 30.5mm mounting hole.

4. Temperature operating range –10 degree C. to +55 degree C.

5. Momentary contact type

6. When switching circuits are monitored by programmable controllers or other solid state circuits, furnish hermetically-sealed, logic-reed type contacts rated not less than 0.15 amperes at 150 Vac and 0.06 amperes at 30 Vdc.

7. When switching circuits are not monitored by programmable controllers or other solid state circuits, furnish contacts with NEMA Utilization Category rating A600 rated not less than 10 amperes continuous and 6 amperes break at 120 Vac.

8. Manufacturer: Allen-Bradley 800T/800H series or equal.

B. Selector Switches: Selector switches shall be heavy-duty with NEMA rating to match enclosure type. Selector switches shall have maintained position contacts. Switches shall be provided with contact blocks and number of positions as required performing the specified or indicated operations.

1. The escutcheon legend shall be as specified on the drawings. Provide:

a. UL Listed.

b. Dielectric Strength: 1300 Volts for one minute for Logic Reed contacts, 2200 Volts for one minute for other contacts.

c. 30.5mm mounting hole.

d. Temperature operating range –10 degree C. to +55 degree C.

e. Standard knob operator (not lever type nor wing lever type)

f. Number of positions and contact configuration as shown on Drawings.

g. When switching circuits are monitored by programmable controllers or other solid state circuits, furnish hermetically-sealed, logic-reed type contacts rated not less than 0.15 amperes at 150 Vac and 0.06 amperes at 30 Vdc.

h. When switching circuits are not monitored by programmable controllers or other solid state circuits, furnish contacts with NEMA Utilization Category rating A600 rated not less than 10 amperes continuous and 6 amperes break at 120 Vac.

2. Manufacturer: Allen-Bradley 800T/800H series or equal.

C. Field instruments and field analyzers specified in Section 13310 – Instrument Index shall have a lock-out style selector switch for locking on or locking off the 120Vac power source. The selector switch shall use a control station in NEMA-4X 316 stainless steel . Provide O-Z/Gedney Class 441 with two position key-operated maintained contact switch. Provide surge protection device that matches the enclosure type of the power disconnect type control station, field instrument, or field analyzer: Telematic TP48 transmitter surge protection device or equal.

D. Indicating Lights:

1. Amber, green, and white indicating lights shall be heavy-duty full voltage 120Vac or 24Vdc push-to-test LED type with NEMA rating to match enclosure type for installation in a 30.5mm hole. Furnish with 28 chip high visibility LED. The escutcheon and lens color shall be as shown on Drawings or scheduled.

2. White indicating lights shall be as above, incandescent type lamp.

E. Manufacturer:

1. Allen-Bradley 800H-QRTH10 series or equal for 120Vac applications with colors other than white.

2. Allen-Bradley 800HQRTH24 series or equal for 24Vdc applications with colors other than white.

3. Allen-Bradley 800H-QRT10 series or equal for 120Vac applications with white.

4. Allen-Bradley 800H-QRT24 series or equal for 24Vdc applications with white.

F. Indicating Light Lens Color:

Lens Color	Typical Function	Example
Green	Danger, running	Equipment operating, motor running, valve open, power voltage applied, cycle in automatic
Amber	Fault condition, attention	Equipment failure, status abnormal, DCS Interlock.
Red	Ready condition	End of cycle; unit or head returned; motors stopped; motion stopped; contactors open, valve closed
White or Clear	Normal condition	Normal pressure of air, water, lubrication, control power on, status okay

G. Control Station Enclosures:

1. Enclosures locations and ratings:

a. Indoors: NEMA 12

b. Outdoors and Corrosive areas: NEMA 4X 316 stainless steel

c. NEC 500 Hazardous Areas: NEMA-7.

H. Control Power Transformers:

1. Sized for the panel devices and products.

2. Dual primary and single secondary fusing.

2.2 CONTROL RELAYS

A. Load-Switching Control Relays:

1. Control relays used for switching loads such as solenoids, actuators, contactors, motor starter coils, remote interlocking, etc. shall be heavy-duty machine tool type.

2. Contacts shall be 4-pole and be field interchangeable to either normally-open or normally- closed. Relay shall be capable of accepting a 4-pole adder.

3. AC relays shall have NEMA A600 contact ratings and electrical clearances for 600 volts. DC relays shall have NEMA P300 contact ratings and electrical clearances for 250 volts.

4. Manufacturer: Allen Bradley Bulletin-700, Square D Class 8501, or equal.

B. Logic Level Switching Control Relays:

1. Control relays for signal circuits shall have a minimum of three SPDT, gold-flashed, fine silver contacts rated 3-ampere resistive at 120V AC or 28Vdc.

2. Control relays shall be plug-in type with heavy-duty, barrier-protected screw terminal sockets and clear polycarbonate dust cover with clip fastener.

3. AC models shall have neon lamp indicator wired in parallel with coil. DC models shall have LED lamp indicator wired in parallel with coil.

4. Manufacturer: Potter Blumfield series KUP; Schrack Series RA; or equal

B. Timers:

1. Multi-function, micro-controller based, socket mounted timing relay.

2. Single functions:

a. Delay on Make
b. Delay on Break
c. Recycle (on time first, equal recycle delays)
d. Single shot
e. Interval
f. Trailing edge single shot
g. Inverted single shot
h. Inverted delay on break
i. Accumulative delay on make
j. Re-triggerable single shot

3. Dual functions:

a. Delay on make/delay on break
b. Delay on make/recycle (on time first, equal recycle delays.)
c. Delay on make/interval

d. Delay on make/single shot
e. Interval/recycle (on time first, equal recycle delays)
f. Delay on break/recycle (on time first, equal recycle delays)
g. Single shot/recycle (on time first, equal recycle delays)
h. Recycle – both times adjustable (on time first)
i. Recycle – both times adjustable (off time first)
j. Interval/delay on make
k. Accumulative delay on make/interval

4. Time delay range, switch selectable:

a. Single function 0.1 second to 1,705 hours in 8 ranges.
b. Dual function 0.1 second to 3,100 minutes in 8 ranges.
c. Setting accuracy +/- 1 percent or 50 milliseconds, whichever is greater.
d. Repeat accuracy +/- 0.1 percent or 16 milliseconds, whichever is greater.

5. Output:

a. Two Form-C electromechanical isolated contacts rated 10-amperes resistive at 240Vac
b. Rated 1/3-horsepower at 120 or 240Vac
c. Double-pole double-throw: DPDT.
d. Mechanical life: 10,000,000 operations
e. Electrical life: 1,000,000 operations at full load.

6. Mounting: Magnal Plug 11-pin socket

7. Environment: -20 to +65 degree C.

8. Manufacture:

a. ABB / SSAC's multifunction type TRDU time delay relay with dip-switch function setting with 12Vdc, 24Vac, 120Vac, 240Vac inputs as required or indicated or equal.

D. Alternating Relay

1. Alternate assignment between "Duty" and "Stand-by" at the end of each run cycle.

2. Double-pole, double-throw output relay rated for 7-amps inductive at 120-volts AC. Isolation not less than 1,500-volt RMS input to output. Life of 1,000,000 operations at full electrical load.

3. Switch to select alteration or continuous operation of either load.

4. Mount in Magnal 11-pin socket.

5. Operating temperature range of –20 to +60-degree C.

6. Manufacturer: ABB-SSAC type ARP series or Engineer accepted substitute.

E. Motor Driven Timers- on Delay And Off-Delay

1. Time Delay Relay - Upon Energization (TDE) or Upon De-Energization (TDDE): TDE driven by a 120 Vac synchronous motor that starts timing when initiated by an external signal via closing a dry contact. Turn a knob on the front of the dial for time settings. TDE device will reset upon power failure. TDDE device will not reset upon power failure. Special configuration where specified: will not reset upon power failure.

2. Provide a pilot light visible from the front of the timer to indicate when the timer motor is energized. Provide visual indication by a cycle progress pointer that advances to zero from the setting then back to zero as time progresses.

3. Provide two of "instantaneous" NEMA Form-C output contacts that actuate when the timing is initiated. Provide two "delayed" NEMA Form-C contacts that actuate when the unit has timed out or de-energized. The timer automatically resets, when the timing cycle is completed. Contact ratings: 10-ampere at 120 Vac and 5-ampere at 240 Vac.

4. Permanently mount and setup the timer with the initial settings shown or specified. Timer range with 16 configurations from 5-seconds to 60-hours. Range and timer setpoints shown on drawings.

5. Timer Manufacturer: Eagle Cycl-Flex Automatic or Manual Reset Timer: HP5 series or HP5E series; Automatic Timing Controls, Series 305D Motor Driven Analog Reset; or equal.

2.3 MAGNETIC CONTACTORS

A. Motor Contactors:

1. Motor contactors shall be designed for continuous operation of induction motors at 600Vac or less at 60-Hertz and shall comply with NEMA ICS 2-210. Unless otherwise specified or indicated, minimum contactor size shall be NEMA Size-1.

2. Motor contactors shall be supplied with a normally open auxiliary contact for use as a hold-in-contact and status contacts with a minimum of two additional Form-C contacts. Provide 120Vac coil voltage and 60-Hertz frequency with the number of poles and auxiliary contacts as indicated.

3. Manufacturer: GE, ABB, Allen Bradley, Square D, Eaton-Cutler Hammer or equal.

4. Provide solid-state overloads relays with one alarm contact. Where specified and shown as E-SSOL, provide the electronic SSOL relay: Automatic Timing and Controls (ATC) Motor Guardian for alarming and tripping on under-current, over-current, single-phase, ground-fault, motor-jam conditions. Provide ATC current transformers and voltage connections.

5. Manufacturer: ATC Lancaster, PA. Model: Motor Performance Analyzer; or equal.

2.4 SAFETY DISCONNECT SWITCHES

A. Safety disconnect switches shall be heavy-duty, 30-400-ampere ratings as indicated, circuit breaker operated, stainless steel operator, safety type rated 600 volts AC.

B. Enclosure locations and ratings:

1. Indoor enclosures: NEMA 12

2. Outdoor or corrosive areas: NEMA 4X 316 stainless steel.

3. Hazardous areas: NEMA 7

4. Classified areas: Suitable for the specified classification.

C. The operating handle shall be capable of being padlocked in the "off" position. The operator shall be a positive, quick-make, quick-break mechanism. Provide bolt-on hubs. Provide door lock. Provide nameplates with the equipment tag number, equipment description, and power source as indicated on the drawings. Submit nameplate list.

D. Switches shall be horsepower rated for motors and shall comply with NEMA KS-1. Switches shall be provided with defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position. Switches shall have line terminal shields.

D. Manufacturer: ABB, Cutler-Hammer, General Electric, Square-D, or equal.

2.5 OVERCURRENT PROTECTION

A. Circuit Breakers: Circuit breakers shall be thermal magnetic, molded case type with the ampere rating as specified.

2.6 ELAPSED TIME INDICATORS

A. Elapsed time indicators shall be panel mounted, non-resettable, 5.5-digit, hour indicator, rated 120Vac, 60-Hertz.

2.7 CURRENT TRANSFORMERS AND TRANSDUCERS

A. Provide monitoring current transformers with 600Vac insulation and primary ampere rating as indicated with 5-ampere output.

B. Provide AC current transducer for any one of the phase conductors of the power circuit to be installed through onboard toroid. Provide a loop-powered transducer with input rated from 0 to 50-ampere with 4-20madc analog output scaled for the primary current of the current transformer. Provide zero and span adjustments.

1. Manufacturer: ABB AC current transducer TCSA Series Loop Powered and mounting accessories, or equal.

D. Provide a DIN rail or back plate mounted AC current transducer that is a loop-powered transducer with input rated from 0 to 5-ampere and with 4-20madc analog output scaled for the primary current of the current transformer.

1. Manufacturer: ABB AC current transducer DCSA Series Loop Powered and mounting accessories, or equal.

2.8 TERMINAL STRIPS, BLOCKS, AND DEVICES

A. Power Wiring: Provide back plate mounted terminal strips rated at 600 Vac.

B. Control Wiring: Provide a DIN rail with spring powered contact rated at 300 Vac 24 ampere with pluggable terminals.

C. Terminal identification standard to the product provided.

D. Manufacturer:

1. Standard: Allen Bradley or equal.

2. Standard: DIN rail: Phoenix Contact or Weidmuller Z-Series.

2.9 THERMOSTATS

A. Thermostats shall be line voltage type with motor current rated contact and 70-degree to 140-degree Fahrenheit setpoint range.

B. Manufacturer: Honeywell T631A-1022 or equal.

C. Manufacturer: Earth-Rite Plus with Hytrel Cable and Ground Clamp or equal.

2.10 NAMEPLATES

A. Nameplates for all control stations, relays, timers, motor contactors and disconnect switches shall be provided in accordance with the requirements of Section 16000-2.02G.

2.11 PRODUCT DATA

A. Operation and maintenance data as specified in Section 01730 including approved submittal manufacturer's catalog data, as-built drawings, and instructions for all configurable or programmable components.

PART 3--EXECUTION

3.1 GENERAL

A. Control stations, contactors and safety disconnect switches shall be mounted 48 inches above the floor, ground, or slab to center of device.

B. Miscellaneous electrical devices shall be tested in accordance with Section 16000 and Section 16030.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16431

**SHORT CIRCUIT STUDY,
PROTECTIVE DEVICE COORDINATION AND
ARC FLASH ANALYSIS REPORT**

PART 1--GENERAL

1.1 WORK OF THIS SECTION:

A. This section specifies that the Contractor subcontract an independent full member NETA Engineering and Study Firm:

1. Electrical equipment short circuit study (SCS) for the new equipment being installed.

2. Protective device coordination study (PDCS) report for the new and existing equipment being installed in the Tierrasanta Pump Station

3. Arc flash analysis study report for the new and existing equipment being installed in the Tierrasanta Pump Station

B. The contractor shall be responsible for the electrical testing described therein.

C. The Short Circuit and Protective Device Coordination Report shall include analysis including Utility Company equipment that affect the installed equipment's short circuit ratings, protective device ratings and protective device settings.

D. Report shall also include analysis of the equipment's short circuit ratings, protective device ratings and protective device settings affected by the installed equipment.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

1.	IEEE 141	Recommended Practice for Electric Power Distribution for Industrial Plants
2.	IEEE 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

1.3 SCHEDULE

A. The report shall be completed, submitted to the Engineer for acceptance and reworked to include the Engineer's comments and corrections, as required. The report shall be approved by the Engineer prior to purchase and fabrication of electrical equipment including switchgear and switch boards.

1.4 CONTRACT SUBMITTALS

A. The report specified in this Section shall be provided in accordance with Section 01300 – Contractor Submittals.

PART 2--PRODUCTS

2.1 REPORT

A. The product shall be a certified report summarizing the short circuit and coordination study and conclusions or recommendations which may affect the integrity of the electric power distribution system. As a minimum, the report shall include the following:

1. The equipment manufacturer's information used to prepare the study.

2. Power Utility Company system information applicable to the project.

3. Short circuit calculations listing short circuit levels at each bus. Provide a sketch of the bus and use both the project term and the bus-code-name to identify the bus, branches, sources, loads. Base the system on the Project One-Line diagram.

4. Coordination study time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.

5. Comparison of short circuit duties of each bus to the interrupting capacity of the equipment protecting that bus.

6. Data used as input to the report that includes cable impedances, source impedances, equipment ratings for the equipment being purchased for the project, etc.

7. Assumptions made during the study.

PART 3--EXECUTION

3.1 INSTALLATION - GENERAL

A. Provide a short circuit and coordination study on the electrical power distribution system as specified and as described in Section 6.1 of NETA ATS. The studies shall be performed in accordance with IEEE Standards 141 and 242 and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010.

B. The studies shall be performed using actual equipment data for both existing and new equipment. The coordination study shall use the data from the same manufacturer of protective relay devices as being provided by the electrical equipment manufacturer.

C. For new equipment, the Contractor shall provide copies of final reviewed equipment submittals upon request by the Study Firm.

3.2 QUALIFICATIONS

A. The short circuit and coordination report shall be performed by an independent study Firm. The studies shall be signed by the professional electrical engineer responsible for the studies and registered to practice engineering in the state in which the project is located.

3.3 SHORT CIRCUIT STUDY

A. The Contractor shall be responsible to obtain and verify all data needed to perform the study for both new and existing equipment. As a minimum, the short circuit study shall include the following:

B. One-Line Diagram:

1. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.

2. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.

3. Power, voltage ratings, impedance, primary and secondary connections of all transformers including the utility transformers.

4. Type, manufacturer, and ratio of all instrument transformers energizing each relay.

5. Nameplate ratings of all motors and generators with their subtransient reactances. Transient reactances of synchronous motors and generators and synchronous reactances of all generators.

6. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors.

7. Significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.

8. Emergency as well as normal switching conditions, as applicable.

9. The time-current setting of existing adjustable relays and direct-acting trips, as applicable.

C. Impedance Diagram:

1. Available MVA, voltage, and impedance from the power utility company.

2. Local generated capacity impedance.

3. Bus impedance.

4. Transformer and/or reactor impedances.

5. Cable impedances.

6. Equipment impedances.

7. System voltages.

8. Grounding scheme for the project: resistance grounding, solid grounding, or no grounding.

D. Calculations:

1. Determine the paths and situations where short circuit currents are the greatest.

2. Study shall address bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.

3. Calculate the maximum and minimum fault currents.

3.4 PROTECTIVE DEVICE COORDINATION STUDY

A. As a minimum, the coordination study for the power distribution system shall include the following on 5-cycle, log-log graph paper:

1. Time-current for each protective relay or fuse showing graphically that the settings will provide protection and selectivity within industry standards. Each curve shall be identified, and the tap and time dial settings shall be specified.

2. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause.

3. Time-current curves and points for cable and equipment damage.

4. Circuit interrupting device operating and interrupting times.

5. Indicate maximum fault values on the graph.

6. Sketch of bus and breaker arrangement.

3.5 ARC FLASH ANALYSIS

A. The Contractor shall be responsible to obtain and verify all data needed to perform the study. The arc flash analysis study shall include the following IEEE Standard 1584 nine step analysis process:

1. Collect system and installation data.

2. Determine modes of operation.

3. Determine bolted fault current.

4. Determine arc fault current.

5. Determine protective device characteristic and arc fault duration.

6. Document system voltages and equipment class.

7. Select working distances.

8. Calculate incident energy.

9. Calculate the arc flash protection boundary.

3.6 IMPLEMENTING PDCS SETTINGS

A. The contractor shall implement the protective device coordination study settings on new and existing equipment as required, based on the Engineers accepted Protective Device Coordination Report specified herein and submit a final amended report of the Record As-Built electrical equipment protective device settings subsequent to start-up and testing.

B. The contractor shall work with the Study Firm for implementing the Arc Flash Hazard sign installation requirements for electrical equipment as specified in NEC Article 110.16 Flash Protection and NFPA 70E.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16440

INSTRUMENT TRANSFORMERS, METERS, SWITCHES AND ACCESSORIES

PART 1--GENERAL

1.1 DESCRIPTION

A. This section specifies instrument transformers, meters, test switches and accessories for electrical distribution equipment assemblies.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI C57.13	Requirements for Instrument Transformers

PART 2--PRODUCTS

2.1 INSTRUMENT TRANSFORMERS

A. General: Instrument transformers shall be molded dry-type in accordance with ANSI C57.13. Transformer volt-ampere rating shall be suitable for carrying the specified load without overheating or exceeding the permissible accuracy for the transformer.

B. Current Transformers: Current transformers shall be furnished with the specified ratios. The accuracies shall conform to ANSI C37.20.

2.2 PANEL METERS AND POWER MONITORS

A. All indicating meters shall be digital display.

B. Power Monitors and Analyzers shall be the standard product of the electrical equipment manufacture with the standard electrical parameter selection and display.

C. voltage and current monitors, or a power monitor with a combination of both, are required in the submersible pump control panel.

D. Power Monitors, where shown on the drawings, shall have the following analog 4-20 mAdc outputs:

1. Phase-Phase Voltage

2. Average Current

2.3 INSTRUMENT SWITCHES

A. Instrument switches shall be provided with contact blocks and positions specified. Switches shall be of the rotary-cam type and contacts shall have positive wiping action of silver-to-silver contact buttons. Switches shall be provided with escutcheon plates and pistol-grip handles. Switches shall be General Electric, SBM; Siemens, ABB equal.

2.5 INDICATING LIGHTS

A. Indicating lights shall be resistor type of the voltage specified.

2.6 NAMEPLATES

A. Nameplates shall be provided in accordance with Section 16000.

2.7 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Operation and maintenance items as specified in Section 01730.

2. Manufacturer's product data with features and dimensions of devices.

3. Burden, accuracy class, and ratio data for instrument transformers.

PART 3--EXECUTION

A. Accessories and devices shall be installed per the electrical distribution equipment manufacturer's instructions.

** END OF SECTION **

SECTION 16460

DRY-TYPE TRANSFORMERS

PART 1--GENERAL

1.1 DESCRIPTION

A. This section specifies dry-type transformers with primary winding rated 600 volts and less used for power distribution, lighting and control purposes as specified or shown.

B. This section specifies mini-power centers that include the primary transformer protection, transformer, secondary protection and a circuit breaker panel in one package.

102 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ANSI/IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers
ANSI/UL 506	Specialty Transformers
NEMA ST20	Dry-Type Transformers for General Application

1.3 RATINGS AND STANDARDS

A. Transformers rated:

1. 10 kVA and smaller shall be single phase or as indicated.

2. 15 kVA and greater shall be 3 phase or as indicated.

3. Voltage, frequency, number of phases and kVA as indicated.

4. Conform to ANSI/IEEE C57.12.01 and ANSI/ UL 506.

PART 2--PRODUCTS

2.1 MANUFACTURERS

A. The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Candidate manufacturers include:

1. Refer to section 2.10

2.2 INSULATION

A. Transformers temperature rise based on 40-degree C ambient temperature:

1. below 15 kVA: Not exceed **115** degree C temperature rise.

2.3 COILS

A. Transformer coils:

1. Copper

2. 10 kVA and below: Encapsulated

2.4 WINDING CONFIGURATION

A. Transformers shall have electrically isolated primary and secondary windings. Primary and secondary winding configurations shall be as specified or shown. Provisions shall be made to permit separate grounding of the neutral conductor and the enclosure. Single-phase transformers shall be the four winding type.

2.5 TERMINAL COMPARTMENTS

A. Terminal compartments shall be sized to permit termination of cables specified. Terminal connections shall be made in the bottom third of the enclosure. The terminals shall be copper and sized for the cable specified.

2.6 ENCLOSURES

A. Transformers enclosures:

1. Outdoor: Weatherproof enclosures

2.7 MOUNTING

A. Transformers 25 kVA and below shall be suitable for wall mounting and include mounting brackets and hardware.

2.8 NAMEPLATES

A. Nameplates shall be provided in accordance with the requirements of paragraph 16000-2.

2.9 SOUND LEVELS

A. The sound levels shall not exceed the following values:

kVA	dB
0-9	40
10-45	42
50-450	45
225-300	50
500	54

2.10 MINI-POWER CENTERS

`A. Mini-power center (MPC) consists of an encapsulated dry-type transformer, primary and secondary main circuit breakers, and secondary panelboard all in one enclosure.

B. Transformer Rating: KVA, primary voltage, secondary voltage, frequency and number of phases shall be as shown on the Drawings.

C. Branch Circuits: Molded case circuit breakers, plug-in thermal magnetic type with number of poles and trip ratings as shown on the Drawings.

D. Enclosure: Weatherproof, NEMA 4X.

E. Manufacturer:

1. ABB
2. Acme Electric Corporation
3. Eaton Cutler Hammer
4. Siemens
5. Square D Company.
6. or equal

2.11 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Manufacturer's verification that the unit has been built and tested in accordance with the specified ANSI standards.

2. Manufacturer's verification of the sound levels, if different from the specified NEMA ST20 standards.

3. Applicable operation and maintenance information as specified in Section 01730.

4. Manufacturer's product literature.

PART 3--EXECUTION

3.1 GENERAL

A. Bond transformer enclosures and neutrals together and connect to the ground grid.

3.2 INSTALLATION

A. Install transformers on walls or floors at locations shown on the Drawings. Install floor mounted transformers on raised concrete bases. Provide sufficient access and working space for ready and safe operation and maintenance.

B. Mount transformers so that vibrations are not transmitted to the structural parts of the building or to other equipment. Make connections to transformers with flexible conduit.

C. Adjust tap settings to provide proper voltage at panelboards.

D. Ground transformer in conformance with the National Electrical Code.

3.3 TESTING

A. Transformers shall be tested in accordance with Section 16030 – Electrical Acceptance Testing.

** END OF SECTION **

SECTION 16470

LIGHTING AND POWER DISTRIBUTION PANELBOARDS

PART 1--GENERAL

1.1 DESCRIPTION

A. Three phase, three wire 480Y/277 volt, dead front, circuit breaker type panelboard with current rating of 600-amperes or less.

B. Provide metal oxide varistor (MOV) surge protective device (SPD) integral within each panelboard that indicates the status and condition of the SPD, tested per NEMA LS-1, rated IEEE C3 Combined Wave of 20kV and 10kA with 200kAIC internal fusing and listed / labeled per UL 1449.

1.2 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEEE	Institute of Electrical and Electronic Engineers
NEMA	National Electrical Manufacturing Association
NFPA 70	National Electrical Code (NEC)
UL 50	Cabinets and Boxes
UL 67	Underwriters Laboratories, Electric Panelboards
UL 489	Molded-Case Circuit Breakers and Circuit Breaker Enclosures
UL 1449	Surge Suppression Devices

PART 2--PRODUCTS

2.1 MANUFACTURERS

A. The Owner and Construction Manager believe the following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's products, nor shall it be construed that named manufacturers' standard equipment or products will comply with the requirements of this Section. Candidate manufacturers include:

1. Eaton / Cutler-Hammer: PRL3a with Clipper Power Visor Surge Protective Device series

2. Siemens: P2 with internal Surge Protective Devices

3. Square D: NQOD and NF with internal Surge Protective Devices

4. or equal

2.2 ARRANGEMENT AND CONSTRUCTION

A. The front of the panel shall have concealed trim clamps and hinges. The locks shall be flush with cylinder tumbler-type with spring loaded door pulls. The fronts shall not be removable with doors in the locked position. Panelboard locks shall be keyed alike.

B. Gutter space shall be provided on all sides of the breaker assembly to neatly connect and arrange incoming wiring.

C. Panelboard shall be composed of individually mounted circuit breakers designed to be removable without disturbing other breakers.

D. A directory holder with clear plastic plate and metal frame shall be mounted on the inside of the door.

2.3 BUS

A. Bus shall be tin-plated copper and shall have current ratings as shown on the panelboard schedules, sized in accordance with UL 67. Ratings shall be determined by temperature rise test.

B. The minimum bus size shall be 225A amperes. Panel fault withstand rating shall be not less than the interrupting rating of the smallest circuit breaker in the panel. Series rating is prohibited.

C. Panelboards shall be provided with a separate ground bus and, where specified, with a full capacity neutral bus. The neutral bus shall be mounted on insulated stand-offs.

2.4 CIRCUIT BREAKERS

A. Circuit breakers shall be molded-case type provided for the current ratings and pole configurations specified on the panelboard schedule. Circuit breakers shall be bolt-on type. Circuit breakers shall be listed in accordance with UL 489 for the service specified. Load terminals of circuit breakers shall be solderless connectors.

B. Circuit breakers rated 277/480 volt alternating current shall have a minimum interrupting current rating of 65,000 amperes symmetrical at 480 volt or as specified on the panelboard schedule.

C. Main circuit breakers in panel 03-PNL-003 shall be able to accommodate connection of 4/0 AWG cable without requiring external lug connections.

D. New 225A feeder breaker in existing panel 80-DP2 shall be able to accommodate connection of 4/0 AWG cable without requiring external lug connections.

2.5 FINISH

A. Panelboard cabinet shall be fabricated from hot-dip galvanized steel in accordance with UL 50. Panelboard fronts shall have a gray, baked enamel finish.

2.6 NAMEPLATES

A. Nameplates shall be provided in accordance with the requirements of Section 16000.

2.7 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01300:

1. Manufacturer's certification that bus bracing is capable of withstanding the specified short circuit condition.

2. Operation and maintenance information as specified in Section 01730.

3. Quantity and rating of circuit breakers provided with each panelboard.

PART 3--EXECUTION

3.1 GENERAL

A. The Contractor shall type in the circuit description on the circuit directory as shown on the final record drawings or panelboard schedule.

B. Provide “Circuit Directory and Circuit Identification” in accordance with NEC 408.4. Each circuit shall be of sufficient detail to allow each circuit to be distinguished from other circuits. Circuit identification shall include load location and provide equipment or instrument Tag Number and Tag Description, where shown on the drawings.

3.2 TESTING

A. Panelboards shall be tested for proper operation and function.

3.3 SCHEDULE

A. Panelboards are scheduled in contract drawings.

** END OF SECTION **

SECTION 16485

LOCAL CONTROL PANELS

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing local control panels including enclosures, wiring and control devices for panels 03-LCP-01 and 03-LCP-02.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 13300 General Requirements for Instrumentation and Control
2. Section 16050 Basic Electrical Materials and Methods
3. Section 16170 Grounding System
4. Section 16155 Individual Motor Starters
5. Section 16175 Miscellaneous Electrical Devices

1.3 CODES

A. The WORK of this Section shall comply with the current editions, with revisions, of the following codes and City of San Diego Supplements:

1. National Electrical Code

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1. JIC EGP-1: Electrical Standards for General Purpose Machine Tools
2. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
3. UL: Underwriters' Laboratories

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Manufacturer's product data including catalogue cut sheets showing classifications.

2. Arrangement drawings of the local control panel enclosure indicating the front door and rear panel equipment arrangement and dimensions.

3. List of materials and components.

4. Connection diagrams.

5. Shop drawings indicating mounting of devices, discrete inputs and outputs, and termination points.

1.6 OWNER'S MANUAL

A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:

1. Manufacturer's installation instructions.

2. Manufacturer's maintenance procedures.

3. Manufacturer's certification that products comply with the indicated requirements.

1.7 FACTORY TESTING

A. **Product Testing**: Panels shall be tested at the factory for sequence of operation.

B. **Witnesses**: The OWNER and the CONSTRUCTION MANAGER (at the option of either) reserves the right to witness factory tests.

1.8 FIELD TESTING

A. **Testing**: Panels shall be field-tested for functional operation after connection of external conductors and prior to equipment startup.

PART 2 -- PRODUCTS

2.1 LABELING

A. Products shall bear the UL label.

2.2 CLASSIFICATION

A. Unless otherwise indicated, enclosures installed indoors shall be NEMA 12 with gasketed doors. Enclosures installed outdoors or in corrosive areas shall be NEMA 4X. Enclosures installed in the indicated hazardous areas shall comply with the NEC requirements for that area.

2.3 SIZE

B. Unless otherwise indicated, the minimum enclosure area, height by width, shall be twice the sum of the areas of the individual components mounted on the back panel. The enclosure depth shall not be less than 6 inches.

2.4 LOCAL CONTROL PANELS (LCP)

A. The LCP shall be designed to provide the indicated sequence of operations. The LCP controls shall be 120 VAC. Where the electrical power supply to the LCP is 240 VAC single phase or 480 VAC 3-phase, as indicated on the electrical drawings or elsewhere, the LCP shall be provided with a control power transformer. Control conductors shall comply with the requirements of Section 16050.

B. Each LCP shall include terminal strips identified for the connection of external conductors. The LCP shall include sufficient terminal blocks to connect 25 percent additional conductors for future use. Termination points shall be identified in accordance with shop drawings. The LCP shall be the source of power for 120 VAC solenoid valves interconnected with the LCP. Equipment associated with the LCP shall be ready for service after connection of conductors to equipment, controls, and LCP.

C. Internal wiring shall be factory-installed and shall be enclosed in plastic raceways with removable covers. Wiring to door-mounted devices shall be extra flexible and shall be anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent contact. Provide full height swing-out panel for internal door-mounted equipment.

D. Enclosures shall be either freestanding or designed to be mounted on pedestals or equipment skids or as indicated. Internal control components shall be mounted on a removable mounting pan. Enclosure shall include a LED light (min.) designed to be controlled by a hand-operated switch and a circuit breaker and 15-amp GFIC duplex receptacle.

E. The main feeder disconnect shall be flange-mounted unless otherwise indicated.

F. Each source of voltage and motor control shall include a means for disconnecting by disconnecting or pull-apart terminal blocks or a disconnect operable from the panel front.

G. Motor starters, where indicated, shall comply with Section 16155.

H. Discrete outputs from the LCP shall be provided by electrically isolated dry contacts rated for 5 amps at 120 VAC. Analog inputs and outputs shall be isolated 4-20 mA two-wire signal with power supply complying with Section 13375.

I. Identification of panel-mounted devices, conductors, and electrical components shall comply with Section 16050.

J. LCPs shall include programmable logic controllers (PLC’s) in accordance with Section 13375.

K. Indicating lights shall be "Push-to-Test" type.

L. Provide door stop kit, stainless steel drip shield, data pocket, internal swing-out panels, corrosion inhibitor, floor stands indicated, and filter vent louvers.

M. LCP shall include motor protection relay. Refer to Section 16440 for further requirements.

N. LCP shall include disconnects for the control panel and the submersible pumps that can be externally operated by the operator.

2.5 COLOR CODING

A. Wiring shall be color coded complying with Section 16175.

2.6 LABELING AND NAMEPLATES

A. **Labeling**: Local control panel components shall be labeled to match the description on the elementary diagram. Internal components of the local control panel on the back side of the door shall be labeled with the same description as provided on the front side. Labeling shall be permanently marked on or near each component. Plastic embossed labels such as "Dymo" tape will not be accepted.

B. **Nameplates**: External door-mounted components and the local control panel description shall be identified with plastic nameplates.

2.7 GROUNDING

A. Neutrals of locally derived control circuits shall be grounded to the mounting plate using a copper bus or grounding lug. A grounding lug for a size No. 2 AWG bare copper conductor shall be included to ground the panel to the plant's grounding system.

2.8 MANUFACTURERS

A. Products of the type or model (if any) indicated shall be manufactured by one of the following (or equal):

1. Hoffmann Engineering Co., Bulletin A

2. E.M. Wiegman and Co., Inc.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Products, equipment, conduit, conductors and terminations shall be installed in accordance with the manufacturer's written installation instructions and Section 16050.

B. LCP interior and exteriors shall be cleaned, and coatings shall be touched up to match original finish upon completion of the WORK.

C. Alternating current control circuits shall be grounded. One terminal of each load device shall be connected to the grounded conductor. Control contacts shall be installed in the ungrounded side of the circuit.

D. Signal and control wiring shall be separated and installed in separate wireways.

E. The panel shall be grounded to the plant grounding system as indicated.

F. Local control panel centers shall be mounted at 36 inches minimum above the finished floor.

G. A copy of the wiring diagrams shall be placed on the inner panel door. Drawings shall be enclosed in a transparent, protective jacket. A metal pocket measuring not less than 10 inches wide by 8 inches high by 3/4-inch deep shall be provided on the inside of the door for the drawings.

** END OF SECTION **

THIS PAGE INTENTIONALLY LEFT BLANK

SUPPLEMENTARY SPECIAL PROVISIONS

APPENDICES

APPENDIX A

NOTICE OF EXEMPTION

NOTICE OF EXEMPTION

(Check one or both)

TO: __X__ Recorder/County Clerk
P.O. Box 1750, MS A-33
1600 Pacific Hwy, Room 260
San Diego, CA 92101-2400

_____ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

FROM: City of San Diego
Engineering & Capital Projects Department
525 B Street, Suite 750, MS 908A
San Diego, CA 92101

Project Name: Metro Biosolids Center Storm Drain Diversion **WBS No.:** B-19197.02.06

Project Location-Specific: The project is located at the Metro Biosolids Center (MBC) wastewater treatment facility, 5240 Convoy Street, within the Military Facilities Area (Council District 6).

Project Location-City/County: San Diego/San Diego

Description of nature and purpose of the Project: The project will construct a new storm water diversion structure and pump station, which will divert surface storm water runoff from the western outfall (to be abandoned) to the eastern outfall; connect the diversion structure and pump station to an existing sanitary sewer at the pipe gallery of the Digester Complex via 6-inch diameter force main; replace and install 1,068 linear feet (LF) of 30-inch diameter storm drain; install 198 LF of 12-inch diameter sewer main; and abandon 200 LF of existing 48-inch diameter storm drain, which will require coordination with the Department of Defense (NavFac). The project will also include trees and vegetation removal and replacement, new irrigation, new curb and gutter, modification to existing curb ramps for ADA compliance, and new paved access driveway to and around the new diversion structure and pump station. All work will occur within the Metro Biosolids Center facility perimeter.

Name of Public Agency Approving Project: City of San Diego

Name of Person or Agency Carrying Out Project: City of San Diego
Engineering & Capital Projects Department
Contact: Jerry Jakubauskas;
Email: JJakubauskas@sandiego.gov / Phone: (619) 533-3755
525 B Street, Suite 750 (MS 908A), San Diego, CA 92101

Exempt Status: (CHECK ONE)

( ) Ministerial (Sec. 21080(b)(1); 15268);
( ) Declared Emergency (Sec. 21080(b)(3); 15269(a));
( ) Emergency Project (Sec. 21080(b)(4); 15269 (b)(c))
(X) Categorical Exemption: 15301 (Existing Facilities); 15302 (Replacement or Reconstruction); and 15303 (New Construction or Conversion of Small Structures)

Reasons why project is exempt: The City of San Diego conducted an environmental review which determined that the project meets the categorical exemption criteria set forth in CEQA State Guidelines, Section 15301 (Existing Facilities), which allows for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public facilities involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination, including existing publicly-owned utilities used to provide electric power, natural gas, sewerage, or other public utility services (diversion structure and pump station are minor alterations to the existing facility intended to repair existing off-site stormwater drainage conditions); Section 15302

(Replacement or Reconstruction), which consists of replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site, including replacement or reconstruction of existing utility systems and/or facilities involving negligible or no expansion of capacity (new storm drain, landscaping, irrigation, curb, gutter, and driveway are replacements or reconstructions within the existing facility); Section 15303 (New Construction or Conversion of Small Structures), which consists of construction of limited numbers of new, small facilities or structures, including water mains, sewage, electrical, gas, and other utility extensions (diversion structure and pump station are new, small structures within the existing facility); and where the exceptions listed in Section 15300.2 would not apply. The project will implement paleontological resources monitoring for grading activities in accordance with San Diego Municipal Code Section 142.0151.

Lead Agency Contact Person: Jerry Jakubauskas **Telephone**: (619) 533-3755

If filed by applicant:

1. Attach certified document of exemption finding.
2. Has a notice of exemption been filed by the public agency approving the project? ( ) Yes ( ) No

It is hereby certified that the City of San Diego has determined the above activity to be exempt from CEQA

James Arnhart for
Carrie Purcell, Interim Deputy Director

November 22, 2021
Date

Check One:
(X) Signed By Lead Agency
( ) Signed by Applicant

Date Received for Filing with County Clerk or OPR:

APPENDIX B

FIRE HYDRANT METER PROGRAM

CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS	NUMBER **DI** 55.27	DEPARTMENT Water Department
SUBJECT **FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)**	**PAGE** 1 **OF** 10	**EFFECTIVE DATE** October 15, 2002
	SUPERSEDES **DI** 55.27	**DATED** April 21, 2000

1. **PURPOSE**

1.1 To establish a Departmental policy and procedure for issuance, proper usage and charges for fire hydrant meters.

2. **AUTHORITY**

2.1 All authorities and references shall be current versions and revisions.

2.2 San Diego Municipal Code (NC) Chapter VI, Article 7, Sections 67.14 and 67.15

2.3 Code of Federal Regulations, Safe Drinking Water Act of 1986

2.4 California Code of Regulations, Titles 17 and 22

2.5 California State Penal Code, Section 498B.0

2.6 State of California Water Code, Section 110, 500-6, and 520-23

2.7 Water Department Director

Reference

2.8 State of California Guidance Manual for Cross Connection Programs

2.9 American Water Works Association Manual M-14, Recommended Practice for Backflow Prevention

2.10 American Water Works Association Standards for Water Meters

2.11 U.S.C. Foundation for Cross Connection Control and Hydraulic Research Manual

3. **DEFINITIONS**

3.1 **Fire Hydrant Meter:** A portable water meter which is connected to a fire hydrant for the purpose of temporary use. (These meters are sometimes referred to as Construction Meters.)

3.2 **Temporary Water Use:** Water provided to the customer for no longer than twelve (12) months.

3.3 **Backflow Preventor:** A Reduced Pressure Principal Assembly connected to the outlet side of a Fire Hydrant Meter.

4. POLICY

4.1 The Water Department shall collect a deposit from every customer requiring a fire hydrant meter and appurtenances prior to providing the meter and appurtenances (see Section 7.1 regarding the Fees and Deposit Schedule). The deposit is refundable upon the termination of use and return of equipment and appurtenances in good working condition.

4.2 Fire hydrant meters will have a 2 ½" swivel connection between the meter and fire hydrant. The meter shall not be connected to the 4" port on the hydrant. All Fire Hydrant Meters issued shall have a Reduced Pressure Principle Assembly (RP) as part of the installation. Spanner wrenches are the only tool allowed to turn on water at the fire hydrant.

4.3 The use of private hydrant meters on City hydrants is prohibited, with exceptions as noted below. All private fire hydrant meters are to be phased out of the City of San Diego. All customers who wish to continue to use their own fire hydrant meters must adhere to the following conditions:

a. Meters shall meet all City specifications and American Water Works Association (AWWA) standards.

b. Customers currently using private fire hydrant meters in the City of San Diego water system will be allowed to continue using the meter under the following conditions:

1. The customer must submit a current certificate of accuracy and calibration results for private meters and private backflows annually to the City of San Diego, Water Department, Meter Shop.

2. The meter must be properly identifiable with a clearly labeled serial number on the body of the fire hydrant meter. The serial number shall be plainly stamped on the register lid and the main casing. Serial numbers shall be visible from the top of the meter casing and the numbers shall be stamped on the top of the inlet casing flange.

3. All meters shall be locked to the fire hydrant by the Water Department, Meter Section (see Section 4.7).

4. All meters shall be read by the Water Department, Meter Section (see Section 4.7).

5. All meters shall be relocated by the Water Department, Meter Section (see Section 4.7).

6. These meters shall be tested on the anniversary of the original test date and proof of testing will be submitted to the Water Department, Meter Shop, on a yearly basis. If not tested, the meter will not be allowed for use in the City of San Diego.

7. All private fire hydrant meters shall have backflow devices attached when installed.

8. The customer must maintain and repair their own private meters and private backflows.

9. The customer must provide current test and calibration results to the Water Department, Meter Shop after any repairs.

10. When private meters are damaged beyond repair, these private meters will be replaced by City owned fire hydrant meters.

11. When a private meter malfunctions, the customer will be notified and the meter will be removed by the City and returned to the customer for repairs. Testing and calibration results shall be given to the City prior to any re-installation.

12. The register shall be hermetically sealed straight reading and shall be readable from the inlet side. Registration shall be in hundred cubic feet.

13. The outlet shall have a 2 ½ "National Standards Tested (NST) fire hydrant male coupling.

14. Private fire hydrant meters shall not be transferable from one contracting company to another (i.e. if a company goes out of business or is bought out by another company).

4.4 All fire hydrant meters and appurtenances shall be installed, relocated and removed by the City of San Diego, Water Department. All City owned fire hydrant meters and appurtenances shall be maintained by the City of San Diego, Water Department, Meter Services.

4.5 If any fire hydrant meter is used in violation of this Department Instruction, the violation will be reported to the Code Compliance Section for investigation and appropriate action. Any customer using a fire hydrant meter in violation of the requirements set forth above is subject to fines or penalties pursuant to the Municipal Code, Section 67.15 and Section 67.37.

4.6 **Conditions and Processes for Issuance of a Fire Hydrant Meter**

Process for Issuance

a. Fire hydrant meters shall only be used for the following purposes:

1. Temporary irrigation purposes not to exceed one year.

2. Construction and maintenance related activities (see Tab 2).

b. No customer inside or outside the boundaries of the City of San Diego Water Department shall resell any portion of the water delivered through a fire hydrant by the City of San Diego Water Department.

c. The City of San Diego allows for the issuance of a temporary fire hydrant meter for a period not to exceed 12 months (365 days). An extension can only be granted in writing from the Water Department Director for up to 90 additional days. A written request for an extension by the consumer must be submitted at least 30 days prior to the 12 month period ending. No extension shall be granted to any customer with a delinquent account with the Water Department. No further extensions shall be granted.

d. Any customer requesting the issuance of a fire hydrant meter shall file an application with the Meter Section. The customer must complete a "Fire Hydrant Meter Application" (Tab 1) which includes the name of the company, the party responsible for payment, Social Security number and/or California ID, requested location of the meter (a detailed map signifying an exact location), local contact person, local phone number, a contractor's license (or a business license), description of specific water use, duration of use at the site and full name and address of the person responsible for payment.

e. At the time of the application the customer will pay their fees according to the schedule set forth in the Rate Book of Fees and Charges, located in the City Clerk's Office. All fees must be paid by check, money order or cashiers check, made payable to the City Treasurer. Cash will not be accepted.

f. No fire hydrant meters shall be furnished or relocated for any customer with a delinquent account with the Water Department.

g. After the fees have been paid and an account has been created, the

meter shall be installed within 48 hours (by the second business day). For an additional fee, at overtime rates, meters can be installed within 24 hours (within one business day).

4.7 **Relocation of Existing Fire Hydrant Meters**

a. The customer shall call the Fire Hydrant Meter Hotline (herein referred to as "Hotline"), a minimum of 24 hours in advance, to request the relocation of a meter. A fee will be charged to the existing account, which must be current before a work order is generated for the meter's relocation.

b. The customer will supply in writing the address where the meter is to be relocated (map page, cross street, etc). The customer must update the original Fire Hydrant Meter Application with any changes as it applies to the new location.

c. Fire hydrant meters shall be read on a monthly basis. While fire hydrant meters and backflow devices are in service, commodity, base fee and damage charges, if applicable, will be billed to the customer on a monthly basis. If the account becomes delinquent, the meter will be removed.

4.8 **Disconnection of Fire Hydrant Meter**

a. After ten (10) months a "Notice of Discontinuation of Service" (Tab 3) will be issued to the site and the address of record to notify the customer of the date of discontinuance of service. An extension can only be granted in writing from the Water Department Director for up to 90 additional days (as stated in Section 4.6C) and a copy of the extension shall be forwarded to the Meter Shop Supervisor. If an extension has not been approved, the meter will be removed after twelve (12) months of use.

b. Upon completion of the project the customer will notify the Meter Services office via the Hotline to request the removal of the fire hydrant meter and appurtenances. A work order will be generated

for removal of the meter.

c. Meter Section staff will remove the meter and backflow prevention assembly and return it to the Meter Shop. Once returned to the Meter Shop the meter and backflow will be tested for accuracy and functionality.

d. Meter Section Staff will contact and notify Customer Services of the final read and any charges resulting from damages to the meter and backflow or its appurtenance. These charges will be added on the customer's final bill and will be sent to the address of record. Any customer who has an outstanding balance will not receive additional meters.

e. Outstanding balances due may be deducted from deposits and any balances refunded to the customer. Any outstanding balances will be turned over to the City Treasurer for collection. Outstanding balances may also be transferred to any other existing accounts.

5. EXCEPTIONS

5.1 Any request for exceptions to this policy shall be presented, in writing, to the Customer Support Deputy Director, or his/her designee for consideration.

6. MOBILE METER

6.1 Mobile meters will be allowed on a case by case basis. All mobile meters will be protected by an approved backflow assembly and the minimum requirement will be a Reduced Pressure Principal Assembly. The two types of Mobile Meters are vehicle mounted and floating meters. Each style of meters has separate guidelines that shall be followed for the customer to retain service and are described below:

a) **Vehicle Mounted Meters**: Customer applies for and receives a City owned Fire Hydrant Meter from the Meter Shop. The customer mounts the meter on the vehicle and brings it to the Meter Shop for

inspection. After installation is approved by the Meter Shop the vehicle and meter shall be brought to the Meter Shop on a monthly basis for meter reading and on a quarterly basis for testing of the backflow assembly. Meters mounted at the owner's expense shall have the one year contract expiration waived and shall have meter or backflow changed if either fails.

b) **Floating Meters**: Floating Meters are meters that are not mounted to a vehicle. **(Note: All floating meters shall have an approved backflow assembly attached.)** The customer shall submit an application and a letter explaining the need for a floating meter to the Meter Shop. The Fire Hydrant Meter Administrator, after a thorough review of the needs of the customer, (i.e. number of jobsites per day, City contract work, lack of mounting area on work vehicle, etc.), may issue a floating meter. At the time of issue, it will be necessary for the customer to complete and sign the "Floating Fire Hydrant Meter Agreement" which states the following:

    1) The meter will be brought to the Meter Shop at 2797 Caminito Chollas, San Diego on the third week of each month for the monthly read by Meter Shop personnel.

    2) Every other month the meter will be read and the backflow will be tested. This date will be determined by the start date of the agreement.

If any of the conditions stated above are not met the Meter Shop has the right to cancel the contract for floating meter use and close the account associated with the meter. The Meter Shop will also exercise the right to refuse the issuance of another floating meter to the company in question.

Any Fire Hydrant Meter using reclaimed water shall not be allowed use again with any potable water supply. The customer shall incur the cost of replacing the meter and backflow device in this instance.

7. FEE AND DEPOSIT SCHEDULES

7.1 **Fees and Deposit Schedules:** The fees and deposits, as listed in the Rate Book of Fees and Charges, on file with the Office of the City Clerk, are based on actual reimbursement of costs of services performed, equipment and materials. Theses deposits and fees will be amended, as needed, based on actual costs. Deposits, will be refunded at the end of the use of the fire hydrant meter, upon return of equipment in good working condition and all outstanding balances on account are paid. Deposits can also be used to cover outstanding balances.

All fees for equipment, installation, testing, relocation and other costs related to this program are subject to change without prior notification. The Mayor and Council will be notified of any future changes.

8. UNAUTHORIZED USE OF WATER FROM A HYDRANT

8.1 Use of water from any fire hydrant without a properly issued and installed fire hydrant meter is theft of City property. Customers who use water for unauthorized purposes or without a City of San Diego issued meter will be prosecuted.

8.2 If any unauthorized connection, disconnection or relocation of a fire hydrant meter, or other connection device is made by anyone other than authorized Water Department personnel, the person making the connection will be prosecuted for a violation of San Diego Municipal Code, Section 67.15. In the case of a second offense, the customer's fire hydrant meter shall be confiscated and/or the deposit will be forfeited.

8.3 Unauthorized water use shall be billed to the responsible party. Water use charges shall be based on meter readings, or estimates when meter readings are not available.

8.4 In case of unauthorized water use, the customer shall be billed for all applicable charges as if proper authorization for the water use had been obtained, including but not limited to bi-monthly service charges, installation charges and removal charges.

8.5 If damage occurs to Water Department property (i.e. fire hydrant meter, backflow, various appurtenances), the cost of repairs or replacements will be charged to the customer of record (applicant).

Water Department Director

Tabs: 1. Fire Hydrant Meter Application
2. Construction & Maintenance Related Activities With No Return To Sewer
3. Notice of Discontinuation of Service

APPENDIX

Administering Division: Customer Support Division

Subject Index:
Construction Meters
Fire Hydrant
Fire Hydrant Meter Program
Meters, Floating or Vehicle Mounted
Mobile Meter
Program, Fire Hydrant Meter

Distribution: DI Manual Holders

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

Application for Fire Hydrant Meter (EXHIBIT A)

(For Office Use Only)

NS REQ	FAC#
DATE	BY

METER SHOP (619) 527-7449

Application Date	Requested Install Date:

Meter Information

Fire Hydrant Location: (Attach Detailed Map//Thomas Bros. Map Location or Construction drawing.) Zip:	T.B.	G.B. (CITY USE)
Specific Use of Water:		
Any Return to Sewer or Storm Drain, If so , explain:		
Estimated Duration of Meter Use: ☐ Check Box if Reclaimed Water		

Company Information

Company Name:			
Mailing Address:			
City:	State:	Zip:	Phone: ( )
*Business license#	*Contractor license#		
A Copy of the Contractor's license OR Business License is required at the time of meter issuance.			
Name and Title of Billing Agent: (PERSON IN ACCOUNTS PAYABLE)			Phone: ( )
Site Contact Name and Title:			Phone: ( )
Responsible Party Name:			Title:
Cal ID#			Phone: ( )
Signature:		Date:	

Guarantees Payment of all Charges Resulting from the use of this Meter. Insures that employees of this Organization understand the proper use of Fire Hydrant Meter

☐ Fire Hydrant Meter Removal Request		Requested Removal Date:
Provide Current Meter Location if Different from Above:		
Signature:	Title:	Date:
Phone: ( )	Pager: ( )	

☐ City Meter ☐ Private Meter		
Contract Acct #:	Deposit Amount: $ 936.00	Fees Amount: $ 62.00
Meter Serial #	Meter Size: 05	Meter Make and Style: 6-7
Backflow #	Backflow Size:	Backflow Make and Style:
Name:	Signature:	Date:

WATER USES WITHOUT ANTICIPATED CHARGES FOR RETURN TO SEWER

Auto Detailing
Backfilling
Combination Cleaners (Vactors)
Compaction
Concrete Cutters
Construction Trailers
Cross Connection Testing
Dust Control
Flushing Water Mains
Hydro Blasting
Hydro Seeing
Irrigation (for establishing irrigation only; not continuing irrigation)
Mixing Concrete
Mobile Car Washing
Special Events
Street Sweeping
Water Tanks
Water Trucks
Window Washing

Note:

1. If there is any return to sewer or storm drain, then sewer and/or storm drain fees will be charges.

Date

Name of Responsible Party
Company Name and Address
Account Number:_____

Subject: Discontinuation of Fire Hydrant Meter Service

Dear Water Department Customer:

The authorization for use of Fire Hydrant Meter #_____, located at *(Meter Location Address)* ends in 60 days and will be removed on or after *(Date Authorization Expires)*. Extension requests for an additional 90 days must be submitted in writing for consideration 30 days prior to the discontinuation date. If you require an extension, please contact the Water Department, or mail your request for an extension to:

City of San Diego
Water Department
Attention: Meter Services
2797 Caminito Chollas
San Diego, CA 92105-5097

Should you have any questions regarding this matter, please call the Fire Hydrant Hotline at (619)_____-_____.

Sincerely,

Water Department

APPENDIX C

MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE

MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

APPENDIX D

SAMPLE CITY INVOICE WITH CASH FLOW FORECAST

City of San Diego, CM&FS Div., 9753 Chesapeake Drive, SD CA 92123

Project Name:

Work Order No or Job Order No.

City Purchase Order No.

Resident Engineer (RE):

RE Phone#: Fax#:

Contractor's Name:

Contractor's Address:

Contractor's Phone #:

Contractor's fax #:

Contact Name:

Invoice No.

Invoice Date:

Billing Period: (To)

Item #	Item Description	Contract Authorization				Previous Totals To Date		This Estimate		Totals to Date	
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1					$ -		$ -		$ -	0.00	$ -
2					$ -		$ -		$ -	0.00%	$ -
3					$ -		$ -		$ -	0.00%	$ -
4					$ -		$ -		$ -	0.00%	$ -
5					$ -		$ -		$ -	0.00%	$ -
6					$ -		$ -		$ -	0.00%	$ -
7					$ -		$ -		$ -	0.00%	$ -
8					$ -		$ -		$ -	0.00%	$ -
5					$ -		$ -		$ -	0.00%	$ -
6					$ -		$ -		$ -	0.00%	$ -
7					$ -		$ -		$ -	0.00%	$ -
8					$ -		$ -		$ -	0.00%	$ -
9					$ -		$ -		$ -	0.00%	$ -
10					$ -		$ -		$ -	0.00%	$ -
11					$ -		$ -		$ -	0.00%	$ -
12					$ -		$ -		$ -	0.00%	$ -
13					$ -		$ -		$ -	0.00%	$ -
14					$ -		$ -		$ -	0.00%	$ -
15					$ -		$ -		$ -	0.00%	$ -
16					$ -		$ -		$ -	0.00%	$ -
17	**Field Orders**				$ -		$ -		$ -	0.00%	$ -
					$ -		$ -		$ -	0.00%	$ -
	CHANGE ORDER No.				$ -		$ -		$ -	0.00%	$ -
					$ -		$ -		$ -	0.00%	$ -
	Total Authorized Amount (including approved Change Order)				**$ -**		**$ -**		$ -	**Total Billed**	$ -

SUMMARY

A. Original Contract Amount	$ -
B. Approved Change Order #00 Thru #00	$ -
C. Total Authorized Amount (A+B)	$ -
D. Total Billed to Date	$ -
E. Less Total Retention (5% of D)	$ -
F. Less Total Previous Payments	$ -
G. Payment Due Less Retention	**$0.00**
H. Remaining Authorized Amount	$0.00

I certify that the materials have been received by me in the quality and quantity specified

_____

Resident Engineer

_____

Construction Engineer

Retention and/or Escrow Payment Schedule

Total Retention Required as of this billing (Item E)	$0.00
Previous Retention Withheld in PO or in Escrow	$0.00
Add'l Amt to Withhold in PO/Transfer in Escrow:	***$0.00***
Amt to Release to Contractor from PO/Escrow:	

Contractor Signature and Date: _____

NOTE: CONTRACTOR TO CALCULATE TO THE 2ND DECIMAL PLACE.

WBS #:	B18108
Date Submitted:	10/10/2018
NTP Date:	3/23/2018
Final Statement of WD Date:	5/23/2020
Contract #:	K-XX-XXXX-XXX-X
Contract Amount:	$5,617,000

Construction Cash Flow Forecast

"Sewer and Water Group Job 965 (W)"

Year	January	February	March	April	May	June	July	August	September	October	November	December
2018				15,000	25,000	52,000	52,000	100,000	10,000	100,000	100,000	100,000
2019	10,000	10,000	85,000	58,000	100,000	100,000	100,000	100,000	100,000	100,000	1,000,000	1,000,000
2020	100,000	100,000	100,000	1,000,000	1,000,000							
2021												
2022												
2023												
2024												
2025												

APPENDIX E

LOCATION MAP

The City of SAN DIEGO Public Works

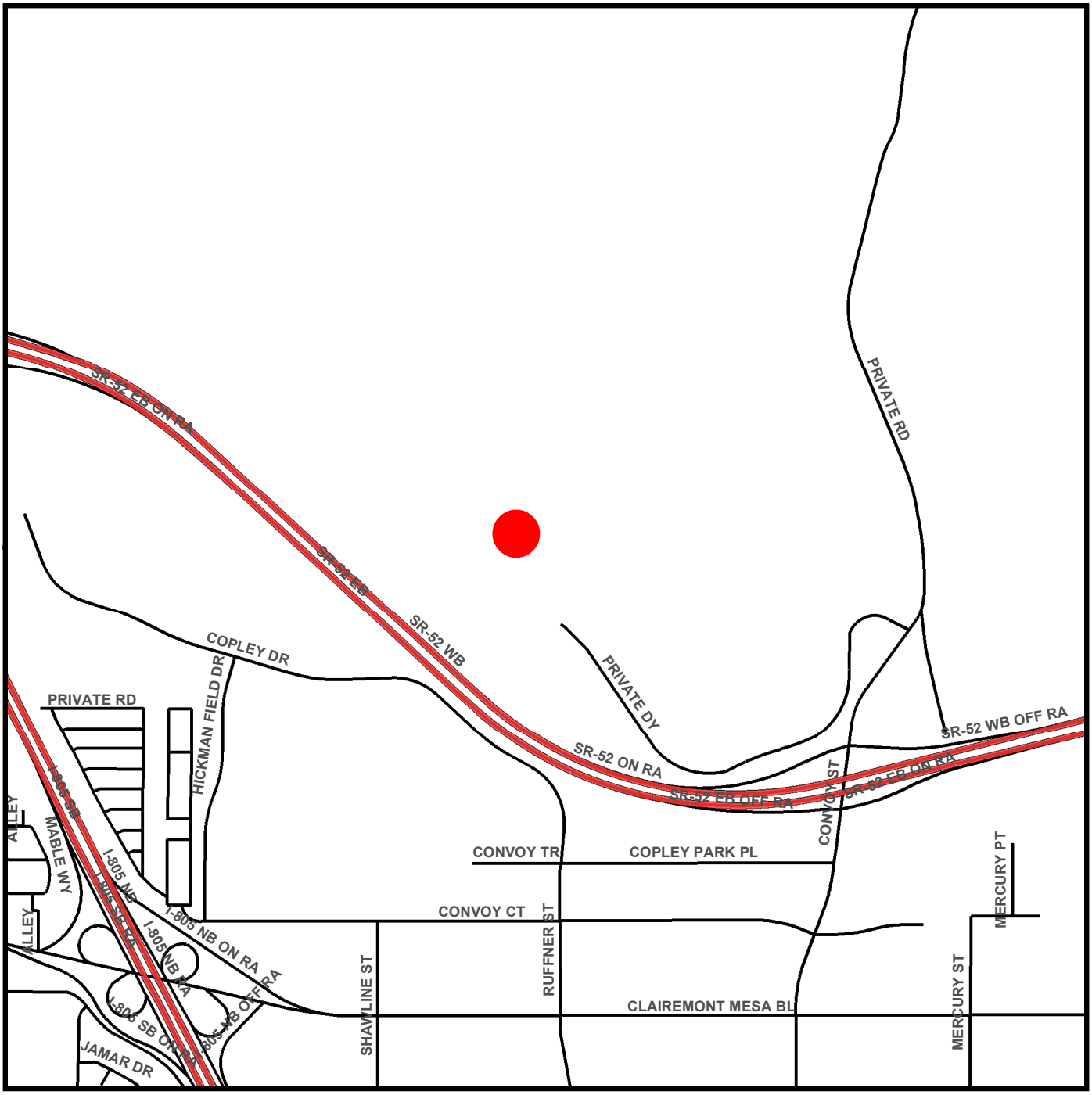
MBC Storm Water Diversion Project

SENIOR ENGINEER
Brian Vitalle
619-533-5105

PROJECT MANAGER
Gabriel Torres
619-533-4630

PROJECT ENGINEER
Jorge A Larriva
619-533-7405

FOR QUESTIONS ABOUT THIS PROJECT
Call: 619-533-4207
Email: engineering@sandiego.gov



MBC SD Diversion Project

N
W E
S

No Scale

COMMUNITY NAME:
MCAS Miramar

COUNCIL DISTRICT: 6

SAP ID: B19197(S)

Date: May 1, 2022

APPENDIX F

SAMPLE OF PUBLIC NOTICE

FOR SAMPLE REFERENCE ONLY

The City of SAN DIEGO

CONSTRUCTION NOTICE

PROJECT TITLE

Work on your street will begin within one week to replace the existing water mains servicing your community.

The work will consist of:

- Saw-cutting and trench work on Ingulf Street from Morena Boulevard to Galveston Street to install new water mains, water laterals and fire hydrants.
- Streets where trenching takes place will be resurfaced and curb ramps will be upgraded to facilitate access for persons with disabilities where required.
- This work is anticipated to be complete in your community by December 2016.

How your neighborhood may be impacted:

- Water service to some properties during construction will be provided by a two-inch highline pipe that will run along the curb. To report a highline leak call 619-515-3525.
- Temporary water service disruptions are planned. If planned disruptions impact your property, you will receive advance notice.
- Parking restrictions will exist because of the presence of construction equipment and materials.
- "No Parking" signs will be displayed 72 hours in advance of the work.
- Cars parked in violation of signs will be TOWED.

Hours and Days of Operation:
Monday through Friday X:XX AM to X:XX PM.

City of San Diego Contractor:
Company Name, XXX-XXX-XXXX

To contact the City of San Diego: SD Public Works
619-533-4207 | engineering@sandiego.gov | sandiego.gov/CIP

This information is available in alternative formats upon request.

The City of SAN DIEGO

CONSTRUCTION NOTICE

PROJECT TITLE

Work on your street will begin within one week to replace the existing water mains servicing your community.

The work will consist of:

- Saw-cutting and trench work on Ingulf Street from Morena Boulevard to Galveston Street to install new water mains, water laterals and fire hydrants.
- Streets where trenching takes place will be resurfaced and curb ramps will be upgraded to facilitate access for persons with disabilities where required.
- This work is anticipated to be complete in your community by December 2016.

How your neighborhood may be impacted:

- Water service to some properties during construction will be provided by a two-inch highline pipe that will run along the curb. To report a highline leak call 619-515-3525.
- Temporary water service disruptions are planned. If planned disruptions impact your property, you will receive advance notice.
- Parking restrictions will exist because of the presence of construction equipment and materials.
- "No Parking" signs will be displayed 72 hours in advance of the work.
- Cars parked in violation of signs will be TOWED.

Hours and Days of Operation:
Monday through Friday X:XX AM to X:XX PM.

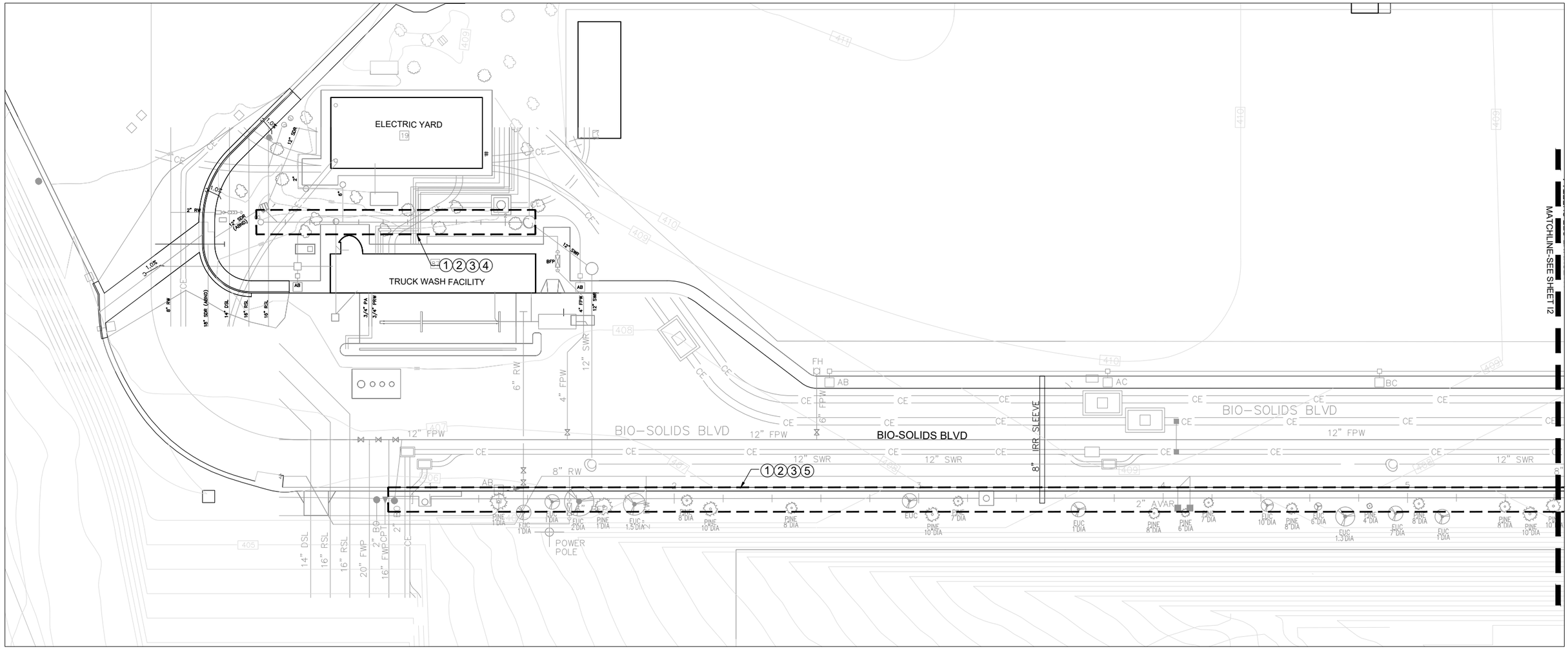
City of San Diego Contractor:
Company Name, XXX-XXX-XXXX

To contact the City of San Diego: SD Public Works
619-533-4207 | engineering@sandiego.gov | sandiego.gov/CIP

This information is available in alternative formats upon request.

ATTACHMENT F

IRRIGATION PLANS AND LANDSCAPE PLANS



SHEET NOTES

① REVEGETATION AREA BOUNDARY (APPROXIMATE). BOUNDARY MAY BE MODIFIED DURING CONSTRUCTION. REVIEW SITE WITH CITY REPRESENTATIVE PRIOR TO ORDERING COMPONENTS OR BEGINNING WORK.

② CUT AND CAP EXISTING IRRIGATION LINES AFFECTED BY WORK. SEE AS BUILT PLANS FOR APPROXIMATE LOCATIONS OF EXISTING IRRIGATION SYSTEM COMPONENTS. CONTRACTOR SHALL FIELD VERIFY LOCATIONS. APPLICABLE AS-BUILT PLANS ARE REFERENCED IN THE GENERAL NOTES.

③ PROVIDE WATER TO PLANTING AREAS AFFECTED BY CUTTING AND CAPPING USING A WATER TRUCK/WATER BUFFALO AND HOSES UNTIL THE IRRIGATION SYSTEM IS RESTORED. WATER SHALL BE SUPPLIED IN QUANTITIES NECESSARY TO KEEP EXISTING LANDSCAPE PLANTS ALIVE AND HEALTHY. WATERING SHALL AVOID EROSION.

④ RESTORE AFFECTED IRRIGATION SYSTEM TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION. SEE FIRP/NSPF FINAL SITE WORK AND TRUCK WASH CONSTRUCTION AS-BUILT PLANS, DRAWING NO. SI-LI-9, AND ASSOCIATED IRRIGATION EQUIPMENT SCHEDULE, DETAILS, AND NOTES DRAWING NO. SI-LI-401, SI-LI-501, AND DRAWING NO. R-91 OF THE AS-BUILT FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION LANDSCAPE LEGEND AND NOTES.

⑤ RESTORE AFFECTED IRRIGATION SYSTEM TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION. SEE FIRP/NSPF FINAL SITE WORK AND TRUCK WASH CONSTRUCTION AS-BUILT PLANS, DRAWING NO. SI-LI-11, SI-LI-12, SI-LI-13, AND ASSOCIATED IRRIGATION EQUIPMENT SCHEDULE, DETAILS, AND NOTES DRAWING NO. SI-LI-401, SI-LI-501, AND DRAWING NO. R-91 OF THE AS-BUILT FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION LANDSCAPE LEGEND AND NOTES.

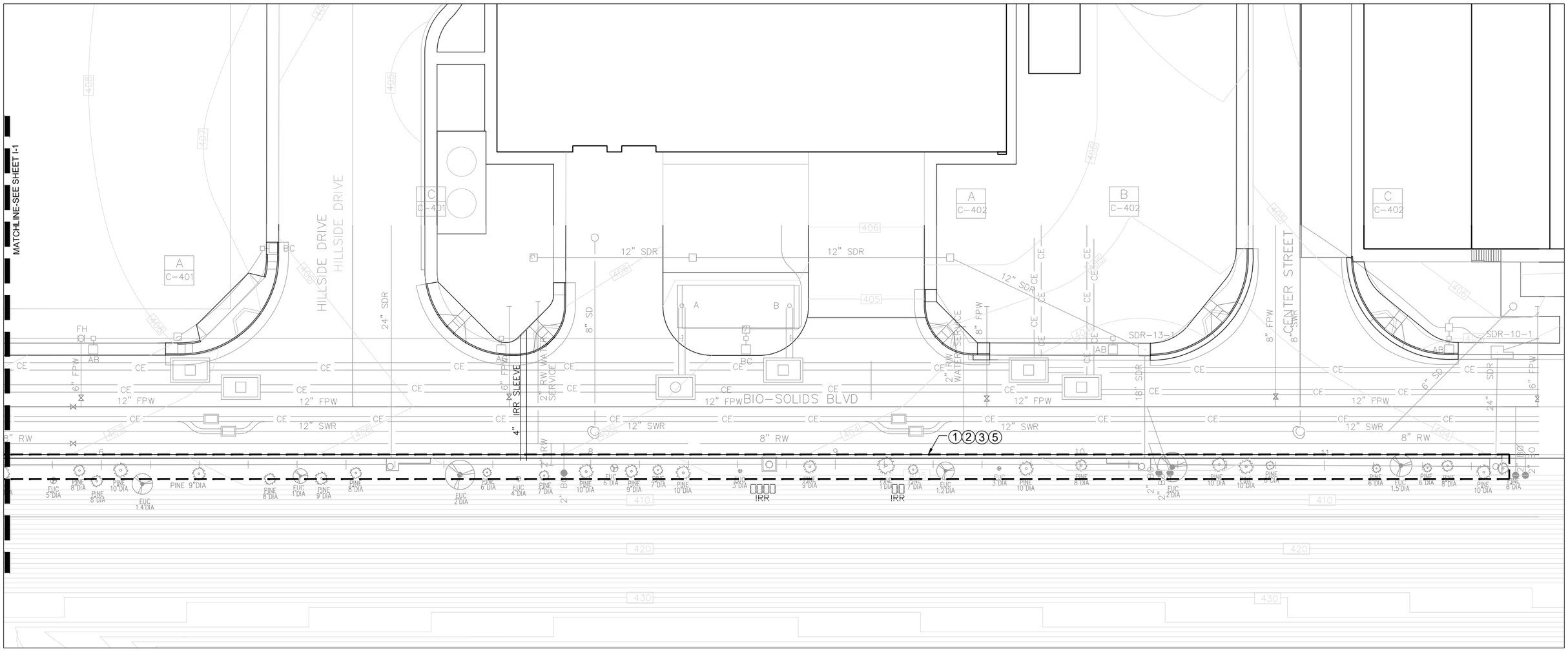
GENERAL NOTES

1. REPLACE IRRIGATION COMPONENTS WITHIN REVEGETATION AREAS IN-KIND AND IN PLACE, USING AS BUILT PLANS TO RESTORE AFFECTED IRRIGATION SYSTEMS TO THE ORIGINAL CONDITION.

2. REFER TO THE FOLLOWING AS-BUILT PLAN SETS: FIRP/NSPF FINAL SITE WORK AND TRUCK WASH AND FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION.

3. IRRIGATION SYSTEM UTILIZES RECLAIMED WATER AND IS SUBJECT TO RECLAIMED WATER USE AND IRRIGATION SYSTEM STANDARDS AND TESTING PROCEDURES. CONTRACTOR SHALL SCHEDULE AND PERFORM ANY REQUIRED TESTS E.G. COVERAGE TEST, CROSS-CONNECTION CONTROL SHUTDOWN TEST ETC. SCHEDULE TESTING AT LEAST 30 DAYS IN ADVANCE OF DESIRED TESTING DATE. CONTACT THE COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH (DEH).

IRRIGATION PLAN -SHEET 1



SHEET NOTES

① REVEGETATION AREA BOUNDARY (APPROXIMATE). BOUNDARY MAY BE MODIFIED DURING CONSTRUCTION. REVIEW SITE WITH CITY REPRESENTATIVE PRIOR TO ORDERING COMPONENTS OR BEGINNING WORK.

② CUT AND CAP EXISTING IRRIGATION LINES AFFECTED BY WORK. SEE AS BUILT PLANS FOR APPROXIMATE LOCATIONS OF EXISTING IRRIGATION SYSTEM COMPONENTS. CONTRACTOR SHALL FIELD VERIFY ACTUAL LOCATIONS. APPLICABLE AS-BUILT PLANS ARE REFERENCED IN THE GENERAL NOTES.

③ PROVIDE WATER TO PLANTING AREAS AFFECTED BY CUTTING AND CAPPING USING A WATER TRUCK/WATER BUFFALO AND HOSES UNTIL THE IRRIGATION SYSTEM IS RESTORED. WATER SHALL BE SUPPLIED IN QUANTITIES NECESSARY TO KEEP EXISTING LANDSCAPE PLANTS ALIVE AND HEALTHY. WATERING SHALL AVOID EROSION.

④ RESTORE AFFECTED IRRIGATION SYSTEM TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION. SEE FIRP/NSPF FINAL SITE WORK AND TRUCK WASH CONSTRUCTION AS-BUILT PLANS, DWG NO. SI-LI-9, AND ASSOCIATED IRRIGATION EQUIPMENT SCHEDULE, DETAILS, AND NOTE DRAWING NO. SI-LI-401, SI-LI-501, AND DRAWING NO. R-91 OF THE AS-BUILT FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION LANDSCAPE LEGEND AND NOTES.

⑤ RESTORE AFFECTED IRRIGATION SYSTEM TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION. SEE FIRP/NSPF FINAL SITE WORK AND TRUCK WASH CONSTRUCTION AS-BUILT PLANS, DWG NO. SI-LI-11, SI-LI-12, SI-LI-13, AND ASSOCIATED IRRIGATION EQUIPMENT SCHEDULE, DETAILS, AND NOTES DRAWING NO. SI-LI-401, SI-LI-501, AND DRAWING NO. R-91 OF THE AS-BUILT FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION LANDSCAPE LEGEND AND NOTES.

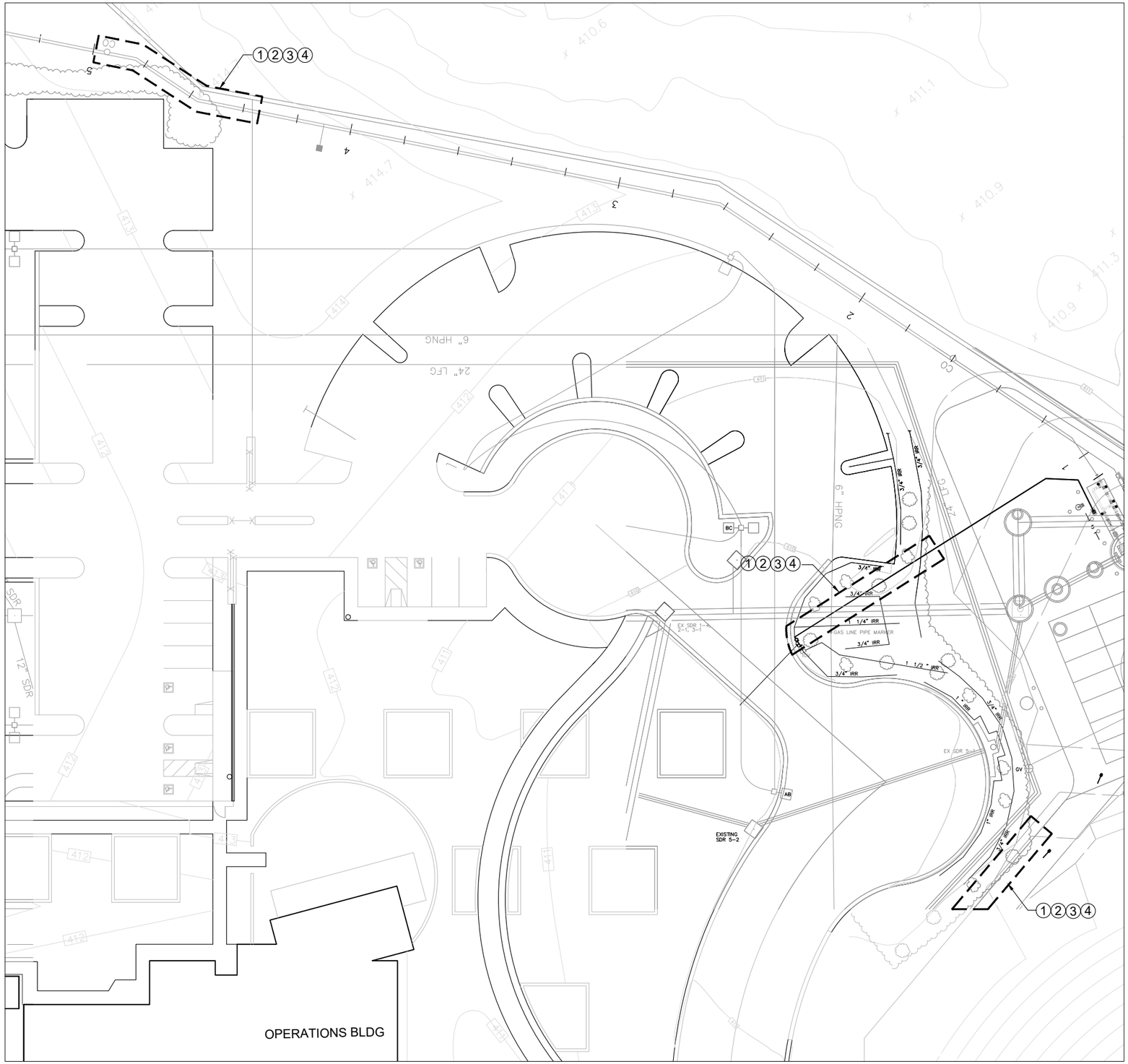
GENERAL NOTES

1. REPLACE IRRIGATION COMPONENTS WITHIN REVEGETATION AREAS IN-KIND AND IN PLACE, USING AS BUILT PLANS TO RESTORE AFFECTED IRRIGATION SYSTEMS TO THE ORIGINAL CONDITION.

2. REFER TO THE FOLLOWING AS-BUILT PLAN SETS: FIRP/NSPF FINAL SITE WORK AND TRUCK WASH AND FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION.

3. IRRIGATION SYSTEM UTILIZES RECLAIMED WATER AND IS SUBJECT TO RECLAIMED WATER USE AND IRRIGATION SYSTEM STANDARDS AND TESTING PROCEDURES. CONTRACTOR SHALL SCHEDULE AND PERFORM ANY REQUIRED TESTS E.G. COVERAGE TEST, CROSS-CONNECTION CONTROL SHUTDOWN TEST ETC. SCHEDULE TESTING AT LEAST 30 DAYS IN ADVANCE OF DESIRED TESTING DATE. CONTACT THE COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH (DEH).

IRRIGATION PLAN -SHEET 2



SHEET NOTES

1. REVEGETATION AREA BOUNDARY (APPROXIMATE). BOUNDARY MAY BE MODIFIED DURING CONSTRUCTION. REVIEW SITE WITH CITY REPRESENTATIVE PRIOR TO ORDERING COMPONENTS OR BEGINNING WORK.

2. CUT AND CAP EXISTING IRRIGATION LINES AFFECTED BY WORK. SEE AS BUILT PLANS FOR APPROXIMATE LOCATIONS OF EXISTING IRRIGATION SYSTEM COMPONENTS. CONTRACTOR SHALL FIELD VERIFY ACTUAL LOCATIONS. APPLICABLE AS-BUILT PLANS ARE REFERENCED IN THE GENERAL NOTES.

3. PROVIDE WATER TO PLANTING AREAS AFFECTED BY CUTTING AND CAPPING USING A WATER TRUCK/WATER BUFFALO AND HOSES UNTIL THE IRRIGATION SYSTEM IS RESTORED. WATER SHALL BE SUPPLIED IN QUANTITIES NECESSARY TO KEEP EXISTING LANDSCAPE PLANTS ALIVE AND HEALTHY. WATERING SHALL AVOID EROSION.

4. RESTORE AFFECTED IRRIGATION SYSTEM TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION. SEE FIRP/NSPF FINAL SITE WORK AND TRUCK WASH CONSTRUCTION AS-BUILT PLANS, DWG NO. SI-LI-2, AND ASSOCIATED IRRIGATION EQUIPMENT SCHEDULE, DETAILS, AND NOTE DRAWING NO. SI-LI-401, SI-LI-501, AND DRAWING NO. R-91 OF THE AS-BUILT FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION LANDSCAPE LEGEND AND NOTES.

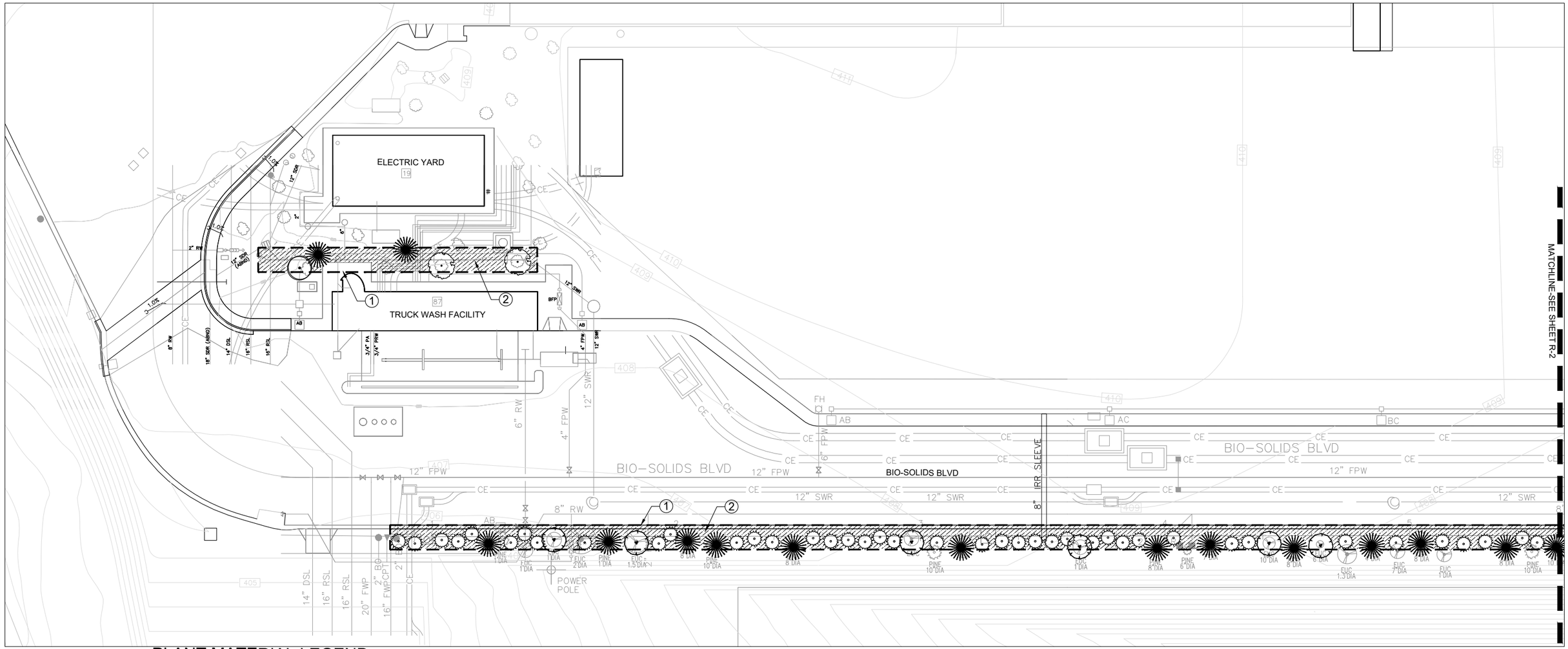
GENERAL NOTES

1. REPLACE IRRIGATION COMPONENTS WITHIN REVEGETATION AREAS IN-KIND AND IN PLACE, USING AS BUILT PLANS TO RESTORE AFFECTED IRRIGATION SYSTEMS TO THE ORIGINAL CONDITION.

2. REFER TO THE FOLLOWING AS-BUILT PLAN SETS: FIRP/NSPF FINAL SITE WORK AND TRUCK WASH AND FIRP/NSPF YARD PIPING AND POWER DISTRIBUTION.

3. IRRIGATION SYSTEM UTILIZES RECLAIMED WATER AND IS SUBJECT TO RECLAIMED WATER USE AND IRRIGATION SYSTEM STANDARDS AND TESTING PROCEDURES. CONTRACTOR SHALL SCHEDULE AND PERFORM ANY REQUIRED TESTS E.G. COVERAGE TEST, CROSS-CONNECTION CONTROL SHUTDOWN TEST ETC. SCHEDULE TESTING AT LEAST 30 DAYS IN ADVANCE OF DESIRED TESTING DATE. CONTACT THE COUNTY OF SAN DIEGO DEPARTMENT OF ENVIRONMENTAL HEALTH (DEH).

IRRIGATION PLAN -SHEET 3



PLANT MATERIAL LEGEND

TREES:

SYMBOL	SCIENTIFIC NAME	COMMON NAME	SIZE	QUANTITY	NOTES
	CINNAMOMUM CAMPHORA	CAMPHOR TREE	24" BOX	AS SHOWN	INSTALL PER SDSD L-01 & L-06
	EUCALYPTUS NICHOLII	WILLOW LEAVED PEPPERMINT	24" BOX	AS SHOWN	INSTALL PER SDSD L-01 & L-06
	KEOLREUTERIA PANICULATA	GOLDEN RAIN TREE	24" BOX	AS SHOWN	INSTALL PER SDSD L-01 & L-06
	LIQUIDAMBAR STYRACIFLUA	AMERICAN SWEET GUM	15 GAL	AS SHOWN	INSTALL PER SDSD L-01 & L-06
	PINUS CANARIENSIS	CANARY ISLAND PINE	24" BOX	AS SHOWN	INSTALL PER SDSD L-01 & L-06

SHRUBS:

SYMBOL	SCIENTIFIC NAME	COMMON NAME	SIZE	QUANTITY	NOTES
	ACACIA REDOLONS	ONGERUP	1 GAL	AS SHOWN	INSTALL PER SDSD L-02
	HETEROMLES ARBUTIFOLIA	TOYON	5 GAL	AS SHOWN	INSTALL PER SDSD L-02

GROUND COVERS:

SYMBOL	SCIENTIFIC NAME	COMMON NAME	SIZE	QUANTITY	NOTES
	DELOSPERMA ALBA	DISNEYLAND ICE PLANT	FLATS	AS SHOWN	INSTALL PER SDSD L-02
	TYPE 9 MULCH	LANDSCAPE MULCH	BULK	AS REQURIED	INSTALL 2" DEEP

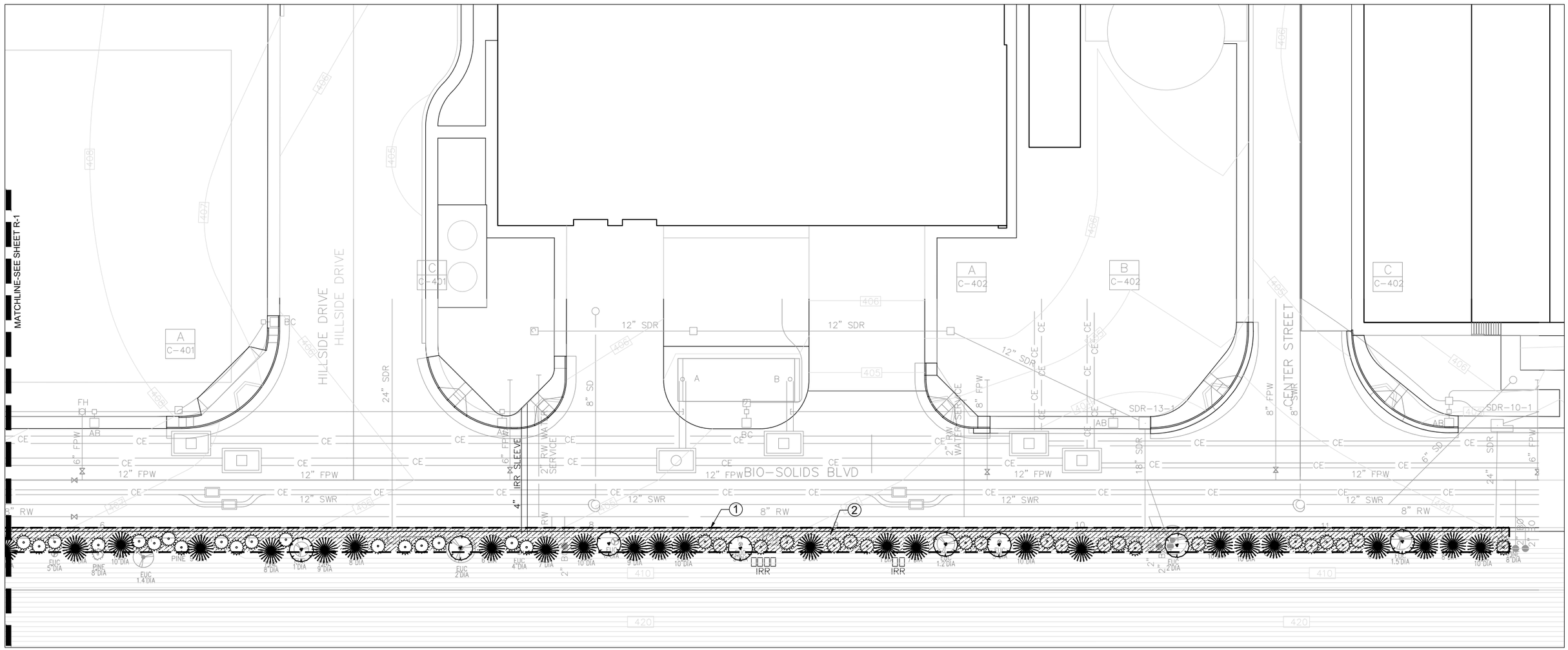
NOTES

1. REVEGETATION AREA BOUNDARY
2. INSTALL 2-INCH DEEP TYPE 9 MULCH LAYER THROUGHOUT ENTIRE REVEGETATION AREA

GENERAL NOTES

1. REVEGETATION WORK SHALL BE INSTALLED IN CONFORMANCE WITH THE CITY OF SAN DIEGO WHITE BOOK, STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 2021 EDITION.
2. SEE 2021 CITY OF SAN DIEGO STANDARD DRAWINGS (SDSD) FOR DETAILS

LANDSCAPE PLAN -SHEET 1



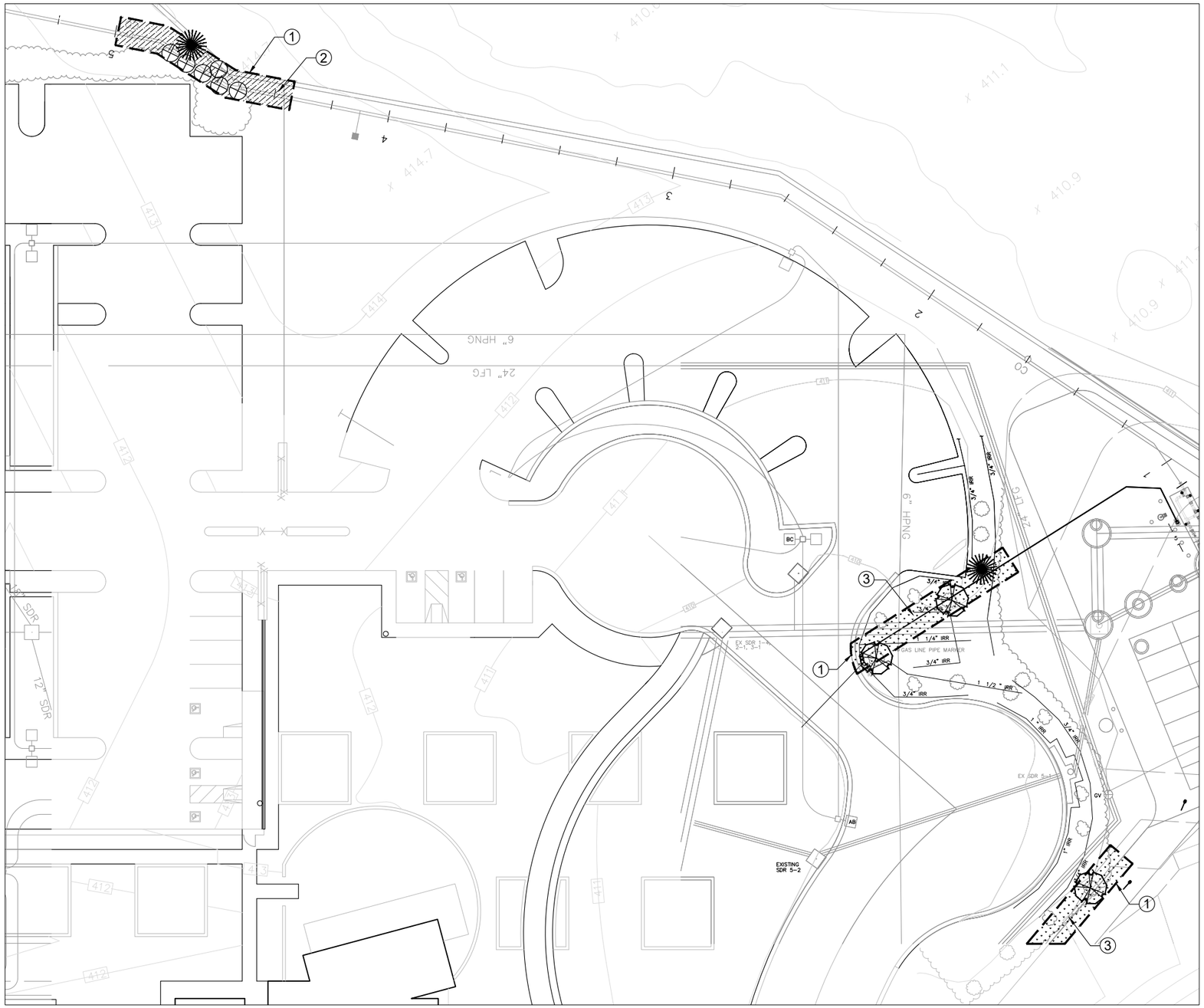
NOTES

1. REVEGETATION AREA BOUNDARY
2. INSTALL 2-INCH DEEP TYPE 9 MULCH LAYER THROUGHOUT ENTIRE REVEGETATION AREA

GENERAL NOTES

1. REVEGETATION WORK SHALL BE INSTALLED IN CONFORMANCE WITH THE CITY OF SAN DIEGO WHITE BOOK, STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 2021 EDITION.
2. SEE 2021 CITY OF SAN DIEGO STANDARD DRAWINGS (SDSD) FOR DETAILS

LANDSCAPE PLAN -SHEET 2



NOTES

1. REVEGETATION AREA BOUNDARY
2. INSTALL 2-INCH DEEP TYPE 9 MULCH LAYER THROUGHOUT ENTIRE REVEGETATION AREA
3. INSTALL DISNEYLAND ICE PLANT AT 8" ON-CENTER THROUGHOUT. SEE PLANT MATERIAL LEGEND & SDRSD L-02

GENERAL NOTES

1. REVEGETATION WORK SHALL BE INSTALLED IN CONFORMANCE WITH THE CITY OF SAN DIEGO WHITE BOOK, STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 2021 EDITION.
2. SEE 2021 CITY OF SAN DIEGO STANDARD DRAWINGS (SDSD) FOR DETAILS

LANDSCAPE PLAN -SHEET 3

GENERAL NOTES

1. CONTRACTOR SHALL PERFORM WORK IN ACCORDANCE THE THE CITY OF SAN DIEGO WHITEBOOK– STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 2018 EDITION, SAN DIEGO REGIONAL STANDARD DRAWINGS, 2018 EDITION, AND CITY OF SAN DIEGO LANDSCAPE STANDARDS.

2. CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF ALL PROJECT PERMITS, THE PROJECT SWPPP, AND ON–SITE DIRECTION FROM THE PROJECT BIOLOGIST AND DESIGNATED CITY REPRESENTATIVE.

3. THE LIMITS OF THE REVEGETATION AREAS SHALL BE STAKED BY THE CONTRACTOR AND APPROVED BY THE PROJECT BIOLOGIST AND CITY REPRESENTATIVE PRIOR TO BEGINNING WORK.

4. ALL SENSITIVE RESOURCES ADJACENT TO THE WORK AREAS, INCLUDING NATIVE VEGETATION AND WILDLIFE, SHALL BE PROTECTED–IN–PLACE AT ALL TIMES. THIS INCLUDES SENSITIVE RESOURCES NOT SHOWN ON THE PLANS.

5. CONTRACTOR SHALL HAVE ALL UTILITIES LOCATED AND CLEARLY MARKED OUT IN THE FIELD AT LEAST 48 HOURS PRIOR TO DIGGING/EXCAVATING.

6. EQUIPMENT/VEHICLES SHALL OPERATE ONLY WITHIN REVEGETATION AREAS AND ON ACCESS ROUTES APPROVED BY THE PROJECT BIOLOGIST AND CITY REPRESENTATIVE.

7. THE CLIENT AND PROJECT BIOLOGIST SHALL DESIGNATE A STAGING AREA ON SITE. STAGING AREAS SHALL BE LOCATED OUTSIDE OF SENSITIVE BIOLOGICAL AREAS, AS VERIFIED BY THE PROJECT BIOLOGIST. STAGING AREA LIMITS SHALL BE APPROVED BY THE CITY REPRESENTATIVE PRIOR TO WORK.

EROSION CONTROL NOTES

1. BMPS SHALL BE IMPLEMENTED AS NECESSARY FOR CONFORMANCE WITH THE PROJECT'S EROSION CONTROL PLANS AND STORM WATER POLLUTION PREVENTION PLAN (SWPPP).

2. THE REVEGETATION AREAS ARE GENERALLY FLAT, CONSIST OF DROUGHT TOLERANT LANDSCAPING, AND INCLUDE A 2–INCH DEEP SHREDDED MULCH LAYER, THEREFORE, ADDITIONAL BMPS ARE NOT ANTICIPATED TO BE NECESSARY. HOWEVER, BMPS MAY BE NEEDED IF THERE IS LAG–TIME BETWEEN COMPLETION OF GRADING AND REVGETATION WORK. IN SUCH INSTANCES BMPS SHALL BE IMPLEMENTED PER THE PROJECT SWPPP IN COORDINATION WITH THE PROJECT BIOLOGIST AND CITY REPRESENTATIVE.

3. THE CONTRACTOR SHALL MONITOR THE FIVE DAY WEATHER FORECAST. IN THE EVENT OF ANY FORECASTED PRECIPITATION, THE CONTRACTOR SHALL SECURE THE SITE, SO AS TO PREVENT ANY LANDSCAPING MATERIALS FROM ENTERING OR BEING WASHED INTO ON–SITE DRAINAGES OR PAVEMENT AREAS.

SITE PREPARATION & PLANTING NOTES:

1. PLANTING SHALL OCCUR WHEN WEED REMOVAL, SOIL TESTING, AND SITE PREPARATION WORK HAS BEEN COMPLETED. AND THE IRRIGATION SYSTEM IS INSTALLED AND OPERATIONAL. ALL PRE–PLANTING WORK SHALL BE APPROVED BY THE PROJECT BIOLOGIST AND CITY REPRESENTATIVE PRIOR TO PLANTING.

2. FOLLOWING SOIL AMENDING WORK THE SITE SHALL BE FINE GRADED SMOOTH WITH SURFACE IRREGULARITIES REMOVED, HAVE POSITIVE DRAINAGE WITHOUT LOW POINTS OR PONDING, AND HAVE ANY ROCKS, CLODS, STICKS AND OTHER DEBRIS REMOVED FROM THE SURFACE.

3. FOLLOWING GRADING THE CONTRACTOR SHALL COLLECT A TOTAL OF SIX SOIL SAMPLES SHALL FROM THE REVEGETATION AREAS, AS DIRECTED BY THE PROJECT BIOLOGIST. CONTRACTOR SHALL SEND SOIL SAMPLES TO A QUALIFIED SOIL LABORATORY FOR AGRICULTURAL SUITABILITY TESTING. IF SOIL TESTING INDICATES AMENDING IS NECESSARY FOR HEALTHY PLANT GROWTH THE BACKFILL MIX SHALL BE AMENDED AS OUTLINED BY THE SOIL LABORATORY'S RECOMMENDATIONS, AND PER THE WHITEBOOK SPECIFICATIONS.

4. CONTAINER PLANT MATERIALS SHALL BE ADEQUATE SIZE AND SHAPE FOR THEIR CONTAINER. ROOT BOUND, OR POORLY ROOTED PLANTS WILL NOT BE ACCEPTED. ALL PLANTS SHALL BE FREE OF PESTS AND DISEASES, AND SHALL BE IN A HEALTHY AND VIGOROUS CONDITION. ALL MATERIALS REJECTED BY THE PROJECT BIOLOGIST SHALL BE REMOVED FROM SITE AND REPLACED IN–KIND BY THE CONTRACTOR AT HIS/HER EXPENSE.

5. THE PROJECT BIOLOGIST WILL INSPECT ALL CONTAINER PLANTS DELIVERED TO THE SITE TO VERIFY THEY ARE THE CORRECT SPECIES, SIZE, AND QUANTITIES AND THAT THEY MEET THE REQUIREMENTS OUTLINED HEREIN AND IN THE SPECIFICATIONS.

6. ALL CONTAINER PLANTS MUST BE PLANTED WITHIN 10 WORKING DAYS FOLLOWING DELIVERY TO THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR WATERING. MAINTAINING IN OPTIMAL CONDITION AND PROTECTING ALL PLANTS AND MATERIALS STORED ON–SITE.

7. PLANTING SHALL ONLY OCCUR WHEN ENVIRONMENTAL CONDITIONS ARE FAVORABLE, BASED ON STANDARD HORTICULTURAL PRACTICES. PLANTING SHALL NOT TAKE PLACE IF TEMPERATURES ARE UNREASONABLY HIGH, OR IF THE SITE IS EXCESSIVELY WET OR MUDDY.

8. THE PROPOSED CONTAINER PLANT LAYOUT SHALL BE PIN–FLAGGED BY THE CONTRACTOR AND REVIEWED AND APPROVED BY THE PROJECT BIOLOGIST AND CITY REPRESENTATIVE PRIOR TO EXCAVATING PLANTING HOLES.

9. PLANTING HOLES SHALL BE FILLED WITH WATER AND ALLOWED TO DRAIN COMPLETELY 24 HOURS BEFORE PLANTING.

10. CONTAINER PLANTS SHALL BE PLANTED PER THE SDRSD DETAIL(S) INDICATED IN THE PLANT MATERIAL LEGEND, AND SHALL BE WATERED THOROUGHLY IMMEDIATELY AFTER BEING PLANTED.

11. TYPE 9 LANDSCAPE MULCH SHALL BE INSTALLED THROUGHOUT EACH REVEGETATION AREA, INCLUDING UNDER TREES, TO A DEPTH OF TWO–INCHES FOLLOWING APPROVAL OF PLANTING WORK. MULCH SHALL BE HELD BACK THREE–INCHES FROM TREE AND SHRUB CROWNS AND GROUNDCOVER PLANTINGS.

120-DAY PLANT ESTABLISHMENT AND MAINTENANCE PERIOD:

MAINTENANCE REQUIREMENTS:

1. THE 120 DAY PEP WILL BE BEGIN FOLLOWING SUCCESSFUL COMPLETION OF REVEGETATION INSTALLATION AND WRITTEN ACCEPTANCE BY THE CITY REPRESENTATIVE.

2. PRIOR TO FINAL APPROVAL, THE CITY REPRESENTATIVE MAY REQUIRE CORRECTIVE ACTION INCLUDING BUT NOT LIMITED TO REPLACING DEAD CONTAINER PLANTS, WEED REMOVAL, AND OR, IRRIGATION SYSTEM REPAIRS AND ADJUSTMENTS.

3. CONTAINER PLANTS THAT DIE DURING THE 120–DAY PEP SHALL BE REPLACED IN–KIND AND SIZE WITHIN 30 DAYS OF NOTIFICATION.

4. CONTRACTOR SHALL CONTROL WEEDS SUCH THAT WEED COVER NEVER EXCEEDS 5% OF THE REVEGETATION AREA(S). WEEDS SHALL BE REMOVED BEFORE THEY EXCEED SIX INCHES (6") IN HEIGHT, AND BEFORE THEY SET SEED. THERE SHALL BE 0% INVASIVE WEED COVER THROUGHOUT THE PEP. INVASIVE WEEDS ARE IDENTIFIED IN THE CITY LANDSCAPE GUIDELINES AS INVASIVE PLANT SPECIES, OR RATED BY THE CALIFORNIA INVASIVE PLANT COUNCIL (CAL–IPC) AS HIGHLY INVASIVE.

5 THE MAINTENANCE SCHEDULE IS OUTLINED IN TABLE 1. BELOW.

6. THE SUCCESS CRITERIA AREA OUTLINED IN TABLE 2. BELOW.

TABLE 1. PLANT ESTABLISHMENT PERIOD MAINTENANCE SCHEDULE

WORK TASK	1-30 DAYS	31-60 DAYS	61-90 DAYS	91-120 DAYS
WEEDING	X	X	X	X
DEAD PLANT REPLACEMENT	X	X	X	X
IRRIGATION MAINTENANCE/ADJUST	AS–NEEDED	AS–NEEDED	AS–NEEDED	AS–NEEDED
BMP MAINTENANCE/TRASH REMOVAL	X	X	X	X

TABLE 2. SUCCESS CRITERIA

TIME PERIOD	PERFORMANCE STANDARD		
	PERCENT COVER VEGETATION	PERCENT WEED COVER	
		HERBACEOUS	CAL-IPC LISTED SPECIES
END OF 120–DAY PEP	25%*	<5%	0%

*Traditional revgetation percent cover standards do not apply as this project includes revegetation of landscaped areas, i.e. not native habitat (mitigation) or open space revegetation. All landscaped areas are container planted, permanently irrigated and mulched with the goal of returning the landscaped areas to pre–project conditions.

LANDSCAPE PLAN -SHEET 4

ATTACHMENT G

CONTRACT AGREEMENT

ATTACHMENT G

CONTRACT AGREEMENT

CONSTRUCTION CONTRACT

This Phase-Funded contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and **Ahrens Mechanical** herein called "Contractor" for construction of **Metropolitan Biosolids Center (MBC) Storm Water Diversion Project**; Bid No. **K-22-2096-DBB-3;** in the total amount of **$6,399,932.80**, which is comprised of the Base Bid, consisting of an amount not to exceed **$3,922,600.00** for Phase I and **$2,477,332.80** for Phase II**.**

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:

   (a) The attached Faithful Performance and Payment Bonds.

   (b) The attached Proposal included in the Bid documents by the Contractor.

   (c) Reference Standards listed in the Instruction to Bidders and the Supplementary Special Provisions (SSP).

   (d) Phased Funding Schedule Agreement.

   (e) That certain documents entitled **Metropolitan Biosolids Center (MBC) Storm Water Diversion Project**, on file in the office of the Purchasing & Contracting Department as Document No. **B-19197**, as well as all matters referenced therein.

2. The City wishes to construct this Project on a Phase-Funded basis. In accordance with Whitebook section 7-3.10, the City is only obligated to pay for Phase I; Contractor cannot begin, nor is the City financially liable for any additional Phases, unless and until Contractor is issued a Notice to Proceed for each additional Phase by the City.

3. The Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Metropolitan Biosolids Center (MBC) Storm Water Diversion Project**, Bid Number **K-22-2096-DBB-3,** San Diego, California.

4. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and the Contractor shall accept such payment in full satisfaction of all claims incident to such performances. (See WHITEBOOK, Section 7-3.10, Phased Funding Compensation).

5. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

6. This contract is effective as of the date that the Mayor or designee signs the agreement and is approved by the City Attorney in accordance with San Diego Charter Section 40.

CONTRACT AGREEMENT (continued)

IN WITNESS WHEREOF, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102, authorizing such execution.

THE CITY OF SAN DIEGO

By Berric Doringo

Print Name: Berric Doringo
Deputy Director
Purchasing & Contracting Dept.

Date: 10/5/2022

APPROVED AS TO FORM

Mara W. Elliott, City Attorney

By

Print Name: Bonny Hsu
Deputy City Attorney

Date: October 5, 22

CONTRACTOR

By

Print Name: Gregory S. Ahrens

Title: President

Date: 29 August 2022

City of San Diego License No.: B2010037845

State Contractor's License No.: 957287

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: 1000000554

CERTIFICATIONS AND FORMS

The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certifications, forms and affidavits submitted as part of this bid are true and correct.

BIDDER'S GENERAL INFORMATION

To the City of San Diego:

Pursuant to "Notice Inviting Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this 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.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID UNDER 23 UNITED STATES CODE 112 AND PUBLIC CONTRACT CODE 7106

State of California

County of San Diego

The bidder, being first duly sworn, deposes and says that he or she is authorized by the party making the foregoing bid 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.

CONTRACTOR CERTIFICATION

COVID-19 VACCINATION ORDINANCE

CERTIFICATION OF COMPLIANCE

I hereby certify that I am familiar with the requirements of San Diego Ordinance No. O-21398 implementing the City's Mandatory COVID-19 Vaccination Policy.

TERMS OF COMPLIANCE

The City's Mandatory COVID-19 Vaccination Policy, outlined in San Diego Ordinance O-21398 (Nov. 29, 2021), requires ALL City contractors, who interact in close contact with City employees while providing contracted services indoors in City facilities or while performing bargaining unit work while indoors, to be fully vaccinated against COVID-19, effective January 3, 2022, as a condition for provision or continued provision of contracted services.

1. "City contractor" means a person who has contracted with the City of San Diego to provide public works, goods, services, franchise, or consultant services for or on behalf of the City, and includes a subcontractor, vendor, franchisee, consultant, or any of their respective officers, directors, shareholders, partners, managers, employees, or other individuals associated with the contractor, subcontractor, consultant, or vendor. "Person" means any natural person, firm, joint venture, joint stock company, partnership, association, club, company, corporation business trust or organization.
2. "Fully vaccinated" means a person has received, at least 14 days prior, either the second dose in a two-dose COVID-19 vaccine series or a single-dose COVID-19 vaccine, or otherwise meets the criteria for full vaccination against COVID-19 as stated in applicable public health guidance, orders, or law. Acceptable COVID-19 vaccines must be approved by the U.S. Food and Drug Administration (FDA) or authorized for emergency use by the FDA or the World Health Organization.
3. "Close contact" means a City contractor is **within 6 feet** of a City employee for a **cumulative total of 15 minutes or more over a 24-hour period** (for example, three individual 5-minute exposures for a total of 15 minutes).
4. City contractors who interact in close contact with City employees must fully comply with the City's Mandatory COVID-19 Vaccination Policy,which may include a reporting program that tracks employee vaccination status.
5. City contractors with employees or subcontractors who interact in close contact with City employees must certify that those members of their workforce, and subcontractors regardless of tier, who work indoors at a City facility, are fully vaccinated and that the City contractor has a program to track employee compliance.
6. City contractors that have an Occupational Safety and Health Administration compliant testing program for members of their workforce, as a reasonable accommodation, may be considered for compliance.

Non-compliance with the City's Mandatory COVID-19 Vaccination Policy may result in termination of a contract for cause, pursuant to the City's General Terms and Provisions, Reference Standards, and the San Diego Municipal Code.

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in the WHITEBOOK, Section 5-1.3, "Drug-Free Workplace", of the project specifications, and that;

This company has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

CONTRACTOR CERTIFICATION

AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the Americans With Disabilities Act (ADA) outlined in the WHITEBOOK, Section 5-1.2, "California Building Code, California Code of Regulations Title 24 and Americans with Disabilities Act". of the project specifications, and that:

This company has in place workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE

I declare under penalty of perjury that I am authorized to make this certification on behalf of the company submitting this bid/proposal, that as Contractor, I am familiar with the requirements of City of San Diego Municipal Code § 22.3004 regarding Contractor Standards as outlined in the WHITEBOOK, Section 5-1.4, ("Contractor Standards and Pledge of Compliance"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3004.

CONTRACTOR CERTIFICATION

EQUAL BENEFITS ORDINANCE CERTIFICATION

I declare under penalty of perjury that I am familiar with the requirements of and in compliance with the City of San Diego Municipal Code § 22.4300 regarding Equal Benefits Ordinance.

CONTRACTOR CERTIFICATION

EQUAL PAY ORDINANCE CERTIFICATION

Contractor shall comply with the Equal Pay Ordinance (EPO) codified in the San Diego Municipal Code (SDMC) at section 22.4801 through 22.4809, unless compliance is not required based on an exception listed in SDMC section 22.4804.

Contractor shall require all of its subcontractors to certify compliance with the EPO in their written subcontracts.

Contractor must post a notice informing its employees of their rights under the EPO in the workplace or job site.

By signing this Contract with the City of San Diego, Contractor acknowledges the EPO requirements and pledges ongoing compliance with the requirements of SDMC Division 48, section 22.4801 et seq., throughout the duration of this Contract.

CONTRACTOR CERTIFICATION

PRODUCT ENDORSEMENT

I declare under penalty of perjury that I acknowledge and agree to comply with the provisions of City of San Diego Administrative Regulation 95.65, concerning product endorsement. Any advertisement identifying or referring to the City as the user of a product or service requires the prior written approval of the City.

AFFIDAVIT OF DISPOSAL

(To be submitted upon completion of Construction pursuant to the contracts Certificate of Completion)

WHEREAS, on the _____ DAY OF _____, 2_____ the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

Metropolitan Biosolids Center (MBC) Storm Water Diversion Project
(Project Title)

as particularly described in said contract and identified as Bid No. **K-22-2096-DBB-3**; SAP No. (WBS) **B-19197**; and **WHEREAS**, the specification of said contract requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and **WHEREAS**, said contract has been completed and all surplus materials disposed of:

_____

_____

NOW, THEREFORE, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

_____

_____

and that they have been disposed of according to all applicable laws and regulations.

Dated this _____ DAY OF _____, _____.

By:_____
Contractor

ATTEST:

State of _____ County of _____

On this_____ DAY OF _____, 2_____, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared_____ known to me to be the _____ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State

LIST OF SUBCONTRACTORS

***** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY *** TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY*** SEE INSTRUCTIONS TO BIDDERS, FOR FURTHER INFORMATION**

In accordance with the requirements of the "Subletting and Subcontracting Fair Practices Act", Section 4100, of the California Public Contract Code (PCC), the Bidder is to list below the name, address and license number of each Subcontractor who will perform work, labor, render services or specially fabricate and install a portion [type] of the work or improvement, in an amount of or in excess of 0.5% of the Contractor's total Bid. Failure to comply with this requirement may result in the Bid being rejected as non-responsive. The Contractor is to list only one Subcontractor for each portion of the Work. The Bidder's attention is directed to the Special Provisions – General; Paragraph 2-3 Subcontracts, which stipulates the percentage of the Work to be performed with the Bidder's own forces. The Bidder is to also list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which the Bidders are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	SUBCONTRACTOR LICENSE NUMBER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED②	CHECK IF JOINT VENTURE PARTNERSHIP
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:_____							
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:_____							

① As appropriate, Bidder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Subcontractor is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC		
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

NAMED EQUIPMENT/MATERIAL SUPPLIER LIST

***** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY *** TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY *** SEE INSTRUCTIONS TO BIDDERS FOR FURTHER INFORMATION**

NAME, ADDRESS AND TELEPHONE NUMBER OF VENDOR/SUPPLIER	MATERIALS OR SUPPLIES	DOLLAR VALUE OF MATERIAL OR SUPPLIES	SUPPLIER (Yes/No)	MANUFACTURER (Yes/No)	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED②
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:_____						
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:_____						

① As appropriate, Bidder shall identify Vendor/Supplier as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Vendor/Supplier is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC		
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

ELECTRONICALLY SUBMITTED FORMS

FAILURE TO FULLY COMPLETE AND SUBMIT ANY OF THE FOLLOWING FORMS WILL DEEM YOUR BID NON-RESPONSIVE.

PLANETBIDS WILL NOT ALLOW FOR BID SUBMISSIONS WITHOUT THE ATTACHMENT OF THESE FORMS

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

A. **BID BOND – See Instructions to Bidders, Bidders Guarantee of Good Faith (Bid Security) for further instructions**

B. **CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS**

C. **MANDATORY DISCLOSURE OF BUSINESS INTERESTS FORM**

D. **DEBARMENT AND SUSPENSION CERTIFICATION FOR PRIME CONTRACTOR**

E. **DEBARMENT AND SUSPENSION CERTIFICATION FOR SUBCONTRACTORS, SUPPLIERS AND MANUFACTURERS**

BID BOND

See Instructions to Bidders, Bidder Guarantee of Good Faith (Bid Security)

KNOW ALL MEN BY THESE PRESENTS,

That Ahrens Mechanical as Principal, and Swiss Re Corporate Solutions America Insurance Corporation as Surety, are held and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum of **10% OF THE TOTAL BID AMOUNT** for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled

Metropolitan Biosolids Center (MBC) Storm Water Diversion Project

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of agreement bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this 11th day of July, 2022

Ahrens Mechanical (SEAL)	Swiss Re Corporate Solutions America Insurance Corporation (SEAL)
(Principal)	(Surety)
By: _____	By: _____
(Signature)	(Signature)
GREGORY S. AHRENS, PRESIDENT	Anne Wright, Attorney-in-Fact

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

AHRENS MECHANICAL INCORPORATED NOV. 10, 2010 CALIFORNIA

SWISS RE CORPORATE SOLUTIONS

SWISS RE CORPORATE SOLUTIONS AMERICA INSURANCE CORPORATION F/K/A NORTH AMERICAN SPECIALTY INSURANCE COMPANY ("SRCSAIC")
SWISS RE CORPORATE SOLUTIONS PREMIER INSURANCE CORPORATION F/K/A WASHINGTON INTERNATIONAL INSURANCE COMPANY ("SRCSPIC")
WESTPORT INSURANCE CORPORATION ("WIC")

GENERAL POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, THAT SRCSAIC, a corporation duly organized and existing under laws of the State of Missouri, and having its principal office in the City of Kansas City, Missouri, and SRCSPIC, a corporation organized and existing under the laws of the State of Missouri and having its principal office in the City of Kansas City, Missouri, and WIC, organized under the laws of the State of Missouri, and having its principal office in the City of Kansas City, Missouri, each does hereby make, constitute and appoint:

MATTHEW C. GAYNOR, ANDY ROBERTS, and ANNE WRIGHT

JOINTLY or SEVERALLY

Its true and lawful Attorney(s)-in-Fact, to make, execute, seal and deliver, for and on its behalf and as its act and deed, bonds or other writings obligatory in the nature of a bond on behalf of each of said Companies, as surety, on contracts of suretyship as are or may be required or permitted by law, regulation, contract or otherwise, provided that no bond or undertaking or contract or suretyship executed under this authority shall exceed the amount of:

FIFTY MILLION ($50,000,000.00) DOLLARS

This Power of Attorney is granted and is signed by facsimile under and by the authority of the following Resolutions adopted by the Boards of Directors of both SRCSAIC and SRCSPIC at meetings duly called and held on the 18th of November 2021 and WIC by written consent of its Executive Committee dated July 18, 2011.

"RESOLVED, that any two of the President, any Managing Director, any Senior Vice President, any Vice President, the Secretary or any Assistant Secretary be, and each or any of them hereby is, authorized to execute a Power of Attorney qualifying the attorney named in the given Power of Attorney to execute on behalf of the Corporation bonds, undertakings and all contracts of surety, and that each or any of them hereby is authorized to attest to the execution of any such Power of Attorney and to attach therein the seal of the Corporation; and it is

FURTHER RESOLVED, that the signature of such officers and the seal of the Corporation may be affixed to any such Power of Attorney or to any certificate relating thereto by facsimile, and any such Power of Attorney or certificate bearing such facsimile signatures or facsimile seal shall be binding upon the Corporation when so affixed and in the future with regard to any bond, undertaking or contract of surety to which it is attached."

SWISS RE CORPORATE SOLUTIONS AMERICA INS. CORP. CORPORATE SEAL 1973 MISSOURI

SWISS RE CORPORATE SOLUTIONS PREMIER INS. CORP. CORPORATE SEAL MISSOURI

By _____
Erik Janssens, Senior Vice President of SRCSAIC & Senior Vice President of SRCSPIC & Senior Vice President of WIC

By _____
Gerald Jagrowski, Vice President of SRCSAIC & Vice President of SRCSPIC & Vice President of WIC

WESTPORT INSURANCE CORPORATION CORPORATE SEAL MISSOURI

IN WITNESS WHEREOF, SRCSAIC, SRCSPIC, and WIC have caused their official seals to be hereunto affixed, and these presents to be signed by their authorized officers

this 29TH day of APRIL, 2022

Swiss Re Corporate Solutions America Insurance Corporation
Swiss Re Corporate Solutions Premier Insurance Corporation
Westport Insurance Corporation

State of Illinois
County of Cook ss

On this 29TH day of APRIL, 20 22, before me, a Notary Public personally appeared Erik Janssens, Senior Vice President of SRCSAIC and Senior Vice President of SRCSPIC and Senior Vice President of WIC and Gerald Jagrowski, Vice President of SRCSAIC and Vice President of SPCSPIC and Vice President of WIC, personally known to me, who being by me duly sworn, acknowledged that they signed the above Power of Attorney as officers of and acknowledged said instrument to be the voluntary act and deed of their respective companies.

YASMIN A. PATEL
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
May 29, 2023

Yasmin A. Patel, Notary

I, Jeffrey Goldberg, the duly elected Senior Vice President and Assistant Secretary of SRCSAIC and SRCSPIC and WIC, do hereby certify that the above and foregoing is a true and correct copy of a Power of Attorney given by said SRCSAIC and SRCSPIC and WIC, which is still in full force and effect.
IN WITNESS WHEREOF, I have set my hand and affixed the seals of the Companies this 11th day of July, 2022.

Jeffrey Goldberg, Senior Vice President & Assistant Secretary of SRCSAIC and SRCSPIC and WIC

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of San Diego)

On July 11, 2022 before me, Andrew Roberts, Notary Public
(insert name and title of the officer)

personally appeared Anne Wright,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

ANDREW ROBERTS
Notary Public - California
San Diego County
Commission # 2317220
My Comm. Expires Dec 26, 2023

Signature _____ **(Seal)**

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

☒ The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

☐ The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

Contractor Name: Ahrens Mechanical

Certified By Gregory S. Ahrens
Name

Title President

Signature

Date 20 July 2021

USE ADDITIONAL FORMS AS NECESSARY

Mandatory Disclosure of Business Interests Form

BIDDER/PROPOSER INFORMATION

Legal Name		DBA	
Ahrens Mechanical		n/a	
Street Address	**City**	**State**	**Zip**
5959 Mission Gorge Rd., #204	San Diego	CA	92120
Contact Person, Title		**Phone**	**Fax**
Gregory S. Ahrens, President		619-487-9036	619-487-9195

Provide the name, identity, and precise nature of the interest* of all persons who are directly or indirectly involved** in this proposed transaction (SDMC § 21.0103).

* The precise nature of the interest includes:

- the percentage ownership interest in a party to the transaction,
- the percentage ownership interest in any firm, corporation, or partnership that will receive funds from the
- transaction, the value of any financial interest in the transaction,
- any contingent interest in the transaction and the value of such interest should the contingency be satisfied, and any
- philanthropic, scientific, artistic, or property interest in the transaction.

** Directly or indirectly involved means pursuing the transaction by:

- communicating or negotiating with City officers or employees,
- submitting or preparing applications, bids, proposals or other documents for purposes of contracting with the City,
- or directing or supervising the actions of persons engaged in the above activity.

Name	Title/Position
Gregory S. Ahrens	President
City and State of Residence	**Employer (if different than Bidder/Proposer)**
San Diego, CA	
Interest in the transaction	
100%	

Name	Title/Position
City and State of Residence	**Employer (if different than Bidder/Proposer)**
Interest in the transaction	

* Use Additional Pages if Necessary *

Under penalty of perjury under the laws of the State of California, I certify that I am responsible for the completeness and accuracy of the responses contained herein, and that all information provided is true, full and complete to the best of my knowledge and belief. I agree to provide written notice to the Mayor or Designee within five (5) business days if, at any time, I learn that any portion of this Mandatory Disclosure of Business Interests Form requires an updated response. Failure to timely provide the Mayor or Designee with written notice is grounds for Contract termination.

Gregory S. Arens, President		20 July 2022
Print Name, Title	Signature	Date

Failure to sign and submit this form with the bid/proposal shall make the bid/proposal non-responsive. In the case of an informal solicitation, the contract will not be awarded unless a signed and completed Mandatory Disclosure of Business Interests Form is submitted.

DEBARMENT AND SUSPENSION CERTIFICATION

PRIME CONTRACTOR

FAILURE TO COMPLETE AND SUBMIT AT TIME OF BID SHALL RENDER BID NON-RESPONSIVE

EFFECT OF DEBARMENT OR SUSPENSION
To promote integrity in the City's contracting processes and to protect the public interest, the City shall only enter into contracts with responsible- bidders and contractors. In accordance with San Diego Municipal Code §22.0814 (a): *Bidders* and *contractors* who have been *debarred* or *suspended* are excluded from submitting bids, submitting responses to requests for proposal or qualifications, receiving *contract* awards, executing *contracts*, participating as a *subcontractor*, employee, agent or representative of another *person* contracting with the City.

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of Names of the Principal Individual owner(s).

The names of all persons interested in the foregoing proposal as Principals are as follows:

NAME	TITLE
Gregory S. Ahrens	President

IMPORTANT NOTICE: If Bidder or other interested person is a corporation, state secretary, treasurer, and manager thereof; if a co-partnership, state true name of firm, also names of all individual co-partners composing firm; if Bidder or other interested person is an individual, state first and last names in full.

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

- Is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any Federal, State or local agency;
- has not been suspended, debarred, voluntarily excluded or determined ineligible by any Federal, State or local 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 in the following space.

Exceptions will be considered in determining bidder responsibility. For any exception noted above, indicate below to whom it applies, initiating agency, and dates of action.

Contractor Name: AHRENS MECHANICAL

Certified By Gregory S. Ahrens Title President

Name

Signature

Date 20 July 2022

NOTE: Providing false information may result in criminal prosecution or administrative sanctions.

DEBARMENT AND SUSPENSION CERTIFICATION

SUBCONTRACTORS, SUPPLIERS AND MANUFACTURERS

TO BE COMPLETED BY BIDDER

FAILURE TO COMPLETE AND SUBMIT AT TIME OF BID SHALL RENDER BID NON-RESPONSIVE

Names of the Principal individual owner(s)

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of Names of the Principal Individual owner(s) for their subcontractor/supplier/manufacturers.

Please indicate if principal owner is serving in the capacity of **subcontractor**, **supplier,** and/or **manufacturer**:

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Parada Painting -Jacqueline Parada	President

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Geo-Cell Solutions - Edward Taglione	President

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Dick Miller Inc - Glenn Bullock	President

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
LC Tree Service - Larry Coalson	President

Contractor Name: SHRENS MECHANICAL

Certified By Gregory S. Ahrens Title President

Name

Signature

Date 20 July 2022

USE ADDITIONAL FORMS AS NECESSARY*

DEBARMENT AND SUSPENSION CERTIFICATION

SUBCONTRACTORS, SUPPLIERS AND MANUFACTURERS

TO BE COMPLETED BY BIDDER

FAILURE TO COMPLETE AND SUBMIT AT TIME OF BID SHALL RENDER BID NON-RESPONSIVE

Names of the Principal individual owner(s)

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of Names of the Principal Individual owner(s) for their subcontractor/supplier/manufacturers.

Please indicate if principal owner is serving in the capacity of **subcontractor**, **supplier,** and/or **manufacturer**:

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Makelele Systems - Jose G. Arellano	President

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Nova Services Inc - Danny Barnett	President

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Solid Structures - Jeff Hicks	President

☒ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
SealRight Paving - Frank Vasquez	President

Contractor Name: SHRENS MECHANICAL

Certified By Gregory S. Ahrens Title President

Name

Signature

Date 20 July 2022

USE ADDITIONAL FORMS AS NECESSARY*

DEBARMENT AND SUSPENSION CERTIFICATION

SUBCONTRACTORS, SUPPLIERS AND MANUFACTURERS

TO BE COMPLETED BY BIDDER

FAILURE TO COMPLETE AND SUBMIT AT TIME OF BID SHALL RENDER BID NON-RESPONSIVE

Names of the Principal individual owner(s)

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of Names of the Principal Individual owner(s) for their subcontractor/supplier/manufacturers.

Please indicate if principal owner is serving in the capacity of **subcontractor**, **supplier,** and/or **manufacturer**:

[x] SUBCONTRACTOR [ ] SUPPLIER [ ] MANUFACTURER

NAME	TITLE
Condon Johnson & Assoc Inc. - James Johnson	President

[x] SUBCONTRACTOR [ ] SUPPLIER [ ] MANUFACTURER

NAME	TITLE
National Coating & Lining - Tom Unsell	Vice - President

[x] SUBCONTRACTOR [ ] SUPPLIER [ ] MANUFACTURER

NAME	TITLE
NEW, Inc. - Kenneth Morgan	President

[ ] SUBCONTRACTOR [ ] SUPPLIER [ ] MANUFACTURER

NAME	TITLE

Contractor Name: Ahrens Mechanical

Certified By Gregory S. Ahrens Title President

Name

Date 7/20/22

Signature

USE ADDITIONAL FORMS AS NECESSARY*

City of San Diego

CITY CONTACT: Brittany Friedenreich, Senior Contract Specialist, Email: BFriedenreic@sandiego.gov
Phone No. (619) 533-3104

ADDENDUM A

e - Bidding

FOR

METROPOLITAN BIOSOLIDS CENTER (MBC) STORM WATER DIVERSION PROJECT

BID NO.:	**K-22-2096-DBB-3**
SAP NO. (WBS/IO/CC):	**B-19197**
CLIENT DEPARTMENT:	**2000**
COUNCIL DISTRICT:	**6**
PROJECT TYPE:	**BO**

BID DUE DATE:

2:00 PM
JULY 20, 2022

CITY OF SAN DIEGO'S ELECTRONIC BIDDING SITE, PLANETBIDS

http://www.sandiego.gov/cip/bidopps/index.shtml

ENGINEER OF WORK

The Engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Engineer:

1) Registered Engineer	07/07/2022 Date	Seal: 
2) For City Engineer	07/07/2022 Date	Seal: 

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. BIDDER's QUESTIONS

Q1. The Bidding Documents do not list a date or time for a site visit. We would like to visit the site to examine the site conditions. How do we gain access to MBC to look at the site? Is there a person we should contact to arrange for a site visit? Please advise.

A1. The parking area is open to the public. Site conditions can be examined for the pump station and storage structure scope. Please do not disturb plant staff. There is no access to the facility behind gates.

Q2. The quantity for Bid Item 27-Storm Drains (48-inch RCP) appears to be incorrect. The listed quantity is 150 LF. The only location we found 48-Inch RCP on the plans is on Drawing C-106 and C-110 for the SD-3 profile. The quantity of 48-inch RCP on these drawings is approximately 74 LF. Please revise the bid form to reflect the correct quantity or advise us where the rest for the 48-inch RCP can be found on the contract plans.

A2. The listed quantity of 48-inch RCP should be approx. 95 LF, which includes piping for the proposed SDR-1-3 pipe connection. Bid form has been revised to reflect the correct LF of 48-inch RCP.

Q3. The quantity for Bid Item 30-Storm Drains (24-inch RCP) appears to be incorrect. The listed quantity is 60 LF. The only location we found 24-Inch RCP on the plans is on Drawing C-106 and C-110 for the SD-2 profile. The quantity of 24-inch RCP on these drawings is approximately 25 LF. Please revise the bid form to reflect the correct quantity or advise us where the rest for the 24-inch RCP can be found on the contract plans.

A3. Bid form has been revised to reflect the correct LF of 24-inch RCP.

Q4. Bid Item 31-Storm Drains (18-inch RCP) lists a quantity of 20 LF. We could not find any 18-inch RCP on the contract plans. Please revise the bid form to delete this item or advise us where the 18-inch RCP can be found on the contract plans.

A4. The 18-inch RCP is needed for the proposed SDR 1-3 pipe connection on sheet 17 of the plans.

Q5. The quantity for Bid Item 32-Sewer Force Main (6-inch PVC) appears to be incorrect. The listed quantity is 900 LF. The plan and profile on Drawings C-107 and C-108 show a length of about 848 LF, from Station 0+90 to 9+38. Please revise the bid form to reflect the correct quantity.

A5. Bid form has been revised to reflect the correct LF of 6-inch PVC.

Q6. The Bidding Documents include Attachment F -Irrigation Plans and Landscape Plans, consisting of 3 Irrigation Plans and 4 Landscape Plans. Drawing C-101 through C-103 include Note 1 -"Remove and replace trees as directed by preliminary environmental assessment and revegetation plan as provided by the Owner". Please confirm that the Attachment F plans should be used as the basis for the tree replacement scope and that there are no other requirements in the preliminary environmental assessment that we should consider.

A6. Confirmed.

Q7. The Contract Time listed on page 23 of the bid documents states that the time for completion of the work is 300 working days, **including** the 120-day Plant Establishment Period. 300 working days is approximately 15 months. The Plant Establishment Period is normally expressed in calendar days, so the 120-calendar day period would be about 4 months, leaving about 11 months for construction of the project. Due to current supply chain issues, it is not feasible to procure all necessary materials and complete construction of this project in 11 months. Lead time for pumps, electrical, and instrumentation materials are currently running at 60 to 80 weeks (up to 20 months), including submittal preparation, review, and procurement time. We request that the contract time be increased to 560 working days (28 months) which will

leave about 24 months for procurement and construction if the Plant Establishment Period is still included in the Contract time.

A7. Contract Time has been revised to 460 Working Days, including the 120-Day Plant Establishment Period.

Q8. Drawing S-101 shows two panels of 3'-6" x 3'-0" FRP at the openings in the wet well upper slab. Drawing M-101 shows two 3-6" x 3-0" aluminum double door hatch at this location. Please clarify which type of material should be installed at the openings in the wet well upper slab.

A8. Material for the double door hatches shall be aluminum per Specification Section 08305.

Q9. Drawings M-101 and M-102 have notes referring to Section 02744 for the 12'-0" ID Pre-Cast Wet Well. Section 02744 is missing from the Technical Specifications. Please provide this specification section.

A9. Please note that Drawings M-101 and M-102 should've referenced to Section 02601 Precast Manholes in lieu of Section 02744.

Q10. The Table of Contents in the Technical Specifications lists Section 11176 – Submersible Wastewater Pumps – Constant Speed. However, this section is not included in the body of the Technical Specifications. Please provide Specification Section 11176.

A10. See attached Specification Section 11176 of this Addendum.

C. INSTRUCTIONS TO BIDDERS

1. To Section **19**, **BIDDERS GUARANTEE OF GOOD FAITH (BID SECURITY) FOR DESIGN-BID-BUILD CONTRACTS:,** Subsection **19.5**, page 15, **DELETE** in its entirety and **SUBSTITUTE** with the following:

   19.5 Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original by 5PM, 3 working days after the bid opening date shall cause the bid to be rejected and deemed **non-responsive**.

Due to circumstances related to Covid-19, until further notice, all original bid bond submittals must be received by 5 PM, 3 working days after bid opening.

Upon circumstances returning to normal business as usual, the original bid bond shall once again be due by 5 PM the day after bid opening.

Original Bid Bond shall be submitted to:
Purchasing & Contracting Department, Public Works Division
1200 3rd Ave., Suite 200, MS 56P
San Diego, California, 92101
To the Attention of the Contract Specialist on the Front Page of this solicitation.

D. ATTACHMENTS

1. To **Attachment A**, **SCOPE OF WORK,** Section 3, **CONTRACT TIME,** page 23**, DELETE** in its entirety and **SUBSTITUTE** with the following:

   3. CONTRACT TIME: The Contract Time for completion of the Work, including the **120** day Plant Establishment Period, shall be **460 Working Days**.

2. To **Attachment E**, **TECHNICALS**, page 407, **ADD, Division 11 - Equipment, Section 11176, SUBMERSIBLE WASTEWATER PUMPS – CONSTANT SPEED**, pages 8 through 23 of this Addendum.

3. To **Attachment E**, **TECHNICALS**, **Section 13301, Control Specifications,** page 430 through page 436, **DELETE** in their entirety and **SUBSTITUTE** with pages 24 through 31 of this Addendum.

E. ADDITIONAL CHANGES

1. The following are additional changes to the Line Items in the PlanetBids Tab:

   For clarity where applicable, **ADDITIONS**, if any, have been **<u>Underlined</u>** and **DELETIONS**, if any, have been **~~Stricken out.~~**

Section	Item Code	Description	UoM	Quantity	Payment Reference
Main Bid	237110	Storm Drains (48 Inch RCP)	LF	95 ~~150~~	306-15.1
Main Bid	237110	Storm Drains (24 Inch RCP)	LF	30 ~~60~~	306-15.1
Main Bid	237110	Sewer Force Main (6 Inch, PVC)	LF	848 ~~900~~	306-15.1

Rania Amen, Director
Engineering & Capital Projects Department

Dated: *July 8, 2022*
San Diego, California

RA/AP/na

SECTION 11176

SUBMERSIBLE WASTEWATER PUMPS – CONSTANT SPEED

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. This section specifies submersible pumps suitable for pumping fluids containing unscreened wastewater solids at constant speed.
2. Pumps will be installed in a wet-pit configuration.
3. Pump units shall be complete with motor, inlet nozzle, discharge fitting, guide bar and brackets, chain and cable hooks and other accessories as specified. Each submersible pump will have a sump access frame, removable grating and fall protection system as per drawings.
4. Manufacturers proposing to furnish equipment specified under this section shall hold current certification under ISO 9001. Application for certification under ISO 9001 shall not be deemed as an acceptable substitute for current certification. Documentation attesting to current certification shall be signed by an officer of the manufacturer's corporation and shall be notarized.
5. Equipment shall additionally conform to the requirements of Section 11175 with the exception that provisions of Section 11175-1.05 and Section 111751.07 do not apply unless specifically called out in this project specification.

B. Type:

1. Pumps shall be of the heavy-duty, submersible, vertical shaft, centrifugal nonclog type, suitable for pumping fluids containing unscreened wastewater solids and stormwater runoff. The pumps shall be designed for continuous or cyclic operation under submerged, partially submerged or totally dry condition without damage to the pump and motor. Special attention shall be devoted to the shaft design to limit deflection under all operating conditions, as specified in this section.

C. Equipment List:

Item	Equipment Number
Submersible Pump 1	M03-P110
Submersible Pump 2	M03-P120

1.2 RELATED SECTIONS

A. This section contains specific references to the following related sections. Additional related sections may apply that are not specifically listed below.

1. Section 06632 Fiberglass Reinforced Plastic (FRP) Assemblies
2. Section 11175 Pumps, General
3. Section 11000 General Requirements for Equipment
4. Section 11002 Rigid Equipment Mounts

1.3 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. References shall be as listed in Section 11175.

1.4 DEFINITIONS

A. Terminology used in this section conforms to the following definitions:

1. Equipment Pad: concrete foundation (block or slab) supporting and elevating equipment mounts above the supporting structural floor slab or local grade
2. Mounting Pads: thickened or raised areas of baseplates and soleplates where the feet or mounting surfaces of mounted equipment and drivers rest on the baseplate or soleplate

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. See Section 01010: Summary of Work.

B. Unit Responsibility:

1. Assign unit responsibility, as specified in Section 11000, to the manufacturer of the vertical, non-clog submersible pumps provided for all equipment and accessories under this section. Have all mechanical equipment components, at least, of this entire equipment assembly furnished by the pump's manufacturer. Provide a completed, signed, and notarized Certificate of Unit Responsibility (Form 11000-C, Section 01999).
2. In addition, unit responsibility shall also include local control panel for sump pumps submitted in section 16480.

1.6 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01300.
2. Submittals shall conform to the requirements of Section 11175. A copy of this Section, addendum updates included, along with the sections listed below shall be submitted with each paragraph check-marked to indicate compliance or marked to indicate requested deviations.
   a. This Section (11176)
   b. Section 11000 – General Requirements for Equipment
   c. Section 11002 – Rigid Equipment Mounts
   d. Section 11175 – Pumps, General
   e. Section 16485 – Local Control Panels

3. The specification copies shall be complete with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check-marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. A copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
5. Unit Responsibility Certification form (Form 11000-C) attesting that unit responsibility has been assigned in accordance with the requirements of this Section. No other submittal material will be reviewed until the certificate has been found in conformance with this requirement.
6. Predicted pump performance curves for each condition point specified showing head, power, efficiency, and NPSH3 on the ordinate plotted against capacity on the abscissa. All curves shall clearly display the specified operating conditions, POR and the manufacturer's limits for the AOR.
7. Drawings showing dimensions of wet well sump pocket and pump cut sheet drawings confirming the size of pumps, motors, drives and specified appurtenances; piping connections; construction details of equipment (including bearings and bearing isolators); wiring diagrams; and weight of equipment.
8. Manufacturer's data including materials of construction and equipment weight.
9. Motor Data Form 11176 -A.
10. Proof of service of previously installed units of similar size and configuration in wet wells of the type specified in this Section.
11. Written factory tests report, as specified in paragraph 2.08.
12. Shaft deflection calculations.
13. Anchorage calculations and required documentation.
14. Cooling system calculations.
15. Manufacturer's operation and maintenance information in accordance with Section 01730.
16. Installation Forms in accordance with Section 11000.
17. 5-Year warrantee in accordance with paragraph 1.09.
18. Testing Forms in accordance with Section 01680.
19. Field vibration test protocol as specified in ANSI/HI 11.6.

20. Pump lifting cable capacity, size and length to confirm compatibility for use with davit crane provided under Section 14650. Contractor to provide written confirmation.
21. Moisture and temperature protection relays product literature and connection diagram.

B. Informational Submittals:
1. NOT USED

C. Closeout Submittals:
1. Operating and maintenance submittals:
a. Procedures: Section 01730.
2. Spare parts:
a. Procedures: Section 11000. Provide the following spare parts for each model and size of pump furnished for this Section.
b. One complete set of all gaskets and seals
c. One complete set of all bearings
d. One complete set of mechanical seals
e. One complete set of discharge connection sealing devices
f. One removable cable seal chamber cap with cable length as required in this Section.
g. If oil-filled motor is furnished, provide spare oil in sufficient quantity to allow for one-time flushing and replacement of coolant for all installed pumps.

1.7 QUALITY ASSURANCE

A. Critical Speeds: Critical Speeds shall be in accordance with Section 11175-1.04.

B. Vibration Limits: Vibration limits for submersible pumps shall be in accordance with ANSI/HI 11.6. Field testing shall be in accordance with paragraph 3.03 of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Procedures: Section 01600

B. Block shaft and prevent damage to bearings during shipment

1.9 SPECIAL WARRANTY

C. Provide a Special 5-Year Warranty. The manufacturer shall warrantee the pumps provided under this section against defects in materials and workmanship for 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following candidate manufacturers are capable of producing equipment and/or products that will satisfy the requirements of this Section. The manufacturer's standard product may require modification to conform to specified requirements:

1. Fairbanks Nijhuis
2. Xylem - Flygt
3. KSB
4. Wilo-EMU
5. ABS
6. Approved Equal

2.2 TYPE

A. Heavy-duty, submersible, vertical shaft, centrifugal nonclog type, suitable for pumping fluids containing unscreened wastewater solids and stormwater runoff.

2.3 PERFORMANCE/DESIGN CRITERIA

A. Service Conditions:

Description	
Equipment number	M03-P110 M03-P120
Sump classification	Class 1, Div 1, Group D
Fluid type	Unscreened wastewater and stormwater containing up 300 mg per liter of suspended solids consisting of organic and inorganic materials, rocks, grit, petroleum products, and grease The pumped material will have a tendency to form long fibrous strings due to the rotation of water through the piping passageways.
Fluid temperature	40 to 75 degrees F

B. Operating Conditions:

1. The performance requirements presented in tabular form below are intended to describe the results of hydraulic calculations developed using a mathematical modeling program specifically developed for the purpose. The model was intentionally used to develop the limits of expected extremes in variation of static head, coefficients for pipeline resistance and turbulence losses through fittings and valves.
2. Equipment furnished under this section shall be fully suitable for continuous operation at any specified condition or any condition lying between the extremes of the operating conditions specified in the following table. The total head in the information below is the total system head at the operating capacity, essentially a summation of the head of the two pumps at that capacity. The notes presented at the end of the table are intended to be complimentary to the information presented in the table.

C. Table of Operating Conditions:

Operating Condition	Value
Equipment number	M03-P110 M03-P120
Condition A [1,4]	
Capacity, gpm	300
Total head, feet	69
NPSHA, feet	31.5
Condition B [2,4]	
Capacity, gpm	From pump H/Q curve
Total head, feet	46
NPSHA, feet	31.5
Condition C [3,4]	
Capacity, gpm	From pump H/Q curve
Total head, feet	43
NPSHA, feet	31.5

Notes:

1. *Condition A shall be taken as the rated, continuous-duty maximum head operating condition. Performance at the rated condition shall be guaranteed in accordance with Section 11175. Condition A has been selected to obtain the rated pumping capacity for the installation. It is anticipated that Condition A lies to the left of the BEP. It is not intended that the pumps be selected for maximum efficiency at Condition A. Pumps furnished under this section shall be selected to achieve Condition A performance, and also shall operate continuously without objectionable vibration or cavitation at the head specified under Condition B. Condition A may be located in the Allowable Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and published in the manufacturer's published application data for the specific model proposed for this application.*
2. *Condition B head is presented to indicate continuous-duty operating conditions when the pump is operating against minimum anticipated system head, assuming a hypothetical head-capacity curve. Condition B shall be used for pump selection. Condition B shall be located within the Preferred Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application. Condition B shall be located to the right of BEPQ. Pumps with head-capacity curves steeper than that assumed will produce somewhat less flow at somewhat lower head. The reverse will occur with pumps having a shallower head-capacity curve. NPSHA, as listed for Condition B is calculated on a pumped flow of 640 gpm.*
3. *Condition C is the anticipated momentary startup head condition when the pump is operating against maximum static lift and minimum dynamic head, and represents the momentary minimum anticipated system head. Pumps furnished under this specification shall be capable of momentary operation at this condition without objectionable vibration within the requirements set forth in Section 11175. Condition C shall be located within the Allowable Operating Region as established by the pump manufacturer in accordance with ANSI/HI 9.6.3 and listed in the manufacturer's published application data for the specific model proposed for this application.*
4. *Total head in the above tabulation is the algebraic difference between the discharge head and suction head as defined in ANSI/HI 1.1 through 1.6. Net positive suction head available (NPSHA) in the above*

D. Design Requirements:

Item	Value
Equipment number	03-P-01 03-P-02
Pump	
Rigid sphere, inches diameter (min.), capable of passing through the pump from inlet to discharge	3
Minimum efficiency at best efficiency point (BEP) at maximum speed, percent [1]	68
Piping connection size, inches, minimum	
Pump inlet	4
Pump discharge	4
Inlet bell outer diameter, minimum[2]	9
Operating speed, rpm, maximum	1800
Operating speed, constant or variable	constant
Approximate pump suction centerline elevation, feet, NAVD 88	375
Suction specific speed, dimensionless, maximum[3]	9,000
Motor	
Horsepower	15
Type	Submersible, Hazardous Area Class 1 Division 1.
Inverter duty	No
Space heater	No
Over temperature protection	Yes
Moisture sensors	Yes
Operating speed, rpm, maximum	1800
Voltage/Phase	460 VAC, 3 Phase

Notes:

1. *The minimum acceptable efficiency at best efficiency point (BEP) at the speed required to achieve the performance specified under Condition Points A and B. The minimum acceptable efficiency is not necessarily required to be associated with any operating condition specified in paragraph 2.03 Operating Conditions.*
2. *The inlet velocity shall not exceed 4 feet per second at Condition Point B as specified in this Section. An extended suction nozzle, fitted with a flared inlet, will be required to reduce the suction velocity to 4.0 feet per second or less, and the nozzle length must exceed the difference between the inlet and outlet diameter of the nozzle. Nozzle length must be of sufficient length to allow pump volute be located above the trench sump pocket. It is preferred that the suction nozzle be a standard US or metric ductile iron flange-to-flare fitting.*
3. *The suction specific speed limitation listed applies only to pump selections where both Operating Conditions A and B reside within the proposed pump selection's POR. Proposed selections with Operating Condition A residing in the AOR shall be limited to designs with suction specific speed less than 8500. Suction specific speed shall be calculated for the maximum pump design speed and impeller diameter, using the capacity in gallons per minute and NPSH3 at Best Efficiency in accordance with the procedures set for in the standards of the Hydraulic Institute.*

2.4 SYSTEM OPERATION

A. The pumps will be operated by a control system that will start and stop the pumps at constant speed in accordance with the control strategy specified in Section 13300. Periodically, the control system will be overridden permitting the wet well level to be drawn down until the pumps break suction.

B. The pumps will be installed in a reinforced concrete structure designed to provide sufficient space for access to install and remove the equipment. The pumps will obtain the pumped fluid from wet well designed in accordance with ANSI/HI 9.8. In this application, the pumps will be operated at constant speed, responding to a control system that will cycle the pumps in accordance with the specified program.

2.5 MATERIALS

A. Materials specified are considered the minimum acceptable for the purposes of durability, strength, and resistance to erosion and corrosion. The Contractor may propose alternative materials for the purpose of providing greater strength or to meet required stress limitations. However, alternative materials must provide at least the same qualities as those specified for the purpose.

B. Provide materials of construction in accordance with the following table:

Component	Material
Pump and motor casing Rated head < 100 feet	Cast iron, ASTM A48, Class 30 or 35
Discharge elbow	Cast iron, ASTM A48, Class 30 or 35
Inlet nozzle and bell	Cast Iron, ASTM A48, Class 30 or 35 or forged steel
Impeller	Cast duplex stainless steel, ASTM A744 or European standard 1.4474, or Cast duplex stainless steel, ASTM A890 Grade 1B, or Hard Chrome Iron ASTM A532-IIIA
Motor and pump shaft	Stainless steel, ASTM A276 Type 329, 403, 416, 420 or ASTM A479 Type 403, 431
Wearing rings	Stainless steel, ASTM A276 Series 440B or Cast duplex stainless steel, ASTM A890 Grade 1B or 5A
External bolts and nuts	Stainless steel, ASTM A276 Type 316
Guide bar brackets	Stainless steel, ASTM A276 Type 316
Anchor bolts	Stainless steel, ASTM A276 Type 316
Guide rails, lifting assemblies	Stainless steel, ASTM A276 Type 316

2.6 COMPONENTS

A. General:

1. The motor and rotating parts shall be removable from the motor end of the pump. All motor mating surfaces where watertight sealing is required shall be machined and fitted with nitrile O-rings. The pump shall be fitted with a dynamically balanced nonclog impeller designed to pass coarse solids and stringy materials. The pump shall be listed by Factory Mutual or Underwriters Laboratory as conforming in all respects to the requirements in UL 1207.

B. Casing:

1. The volute casing shall be a one-piece casting with a tangential or center discharge nozzle. The volute shall be designed for efficient conversion of kinetic to potential energy and shall have clear passageways designed to pass the solid sphere specified in this Section. The solids passing capability of the furnished equipment will be subjected to a field test in accordance with paragraph 3.03.

2. The solids passing capability of the furnished equipment will be subjected to a field test in accordance with this Section.

3. The cutwater shall be specifically designed for use in fluids with stringy solids and rags. The volute casting shall be specifically designed to bear the loads associated with removal and placement of the pump when submerged or exposed and to withstand the loads imposed by the operations specified in this Section. The discharge nozzle shall be not less than the diameter specified in this Section and shall be reinforced for the loads imposed by the specified conditions of service. The nozzle flange face shall be designed to mate with the discharge fitting specified in this Section. The volute casing shall be drilled and tapped or otherwise fitted with an inlet nozzle conforming to the requirements specified in this Section.

C. Shaft: The pump shaft shall be turned, ground and polished, of proportions suitable for use in the specified application. The shaft shall be of sufficient section to limit deflection at the shaft seal to not more than 4.0 mils when the pump is operating at any continuous-duty point defined by the envelope of conditions specified in this Section. The method for calculating shaft deflection shall be as established in Section 11175. Additionally, under no circumstances shall the distance from the lower bearing and the hub of the impeller exceed two times the diameter of the shaft. The documentation required under Section 11175 shall be included as a submittal.

D. Bearings: Bearings shall be heavy-duty, oil lubricated or permanently greased lubricated anti-friction type double shielded and factory sealed. Bearings shall be designed for an L-10 rating life of at least 50,000 hours at any operating condition specified in this Section. Loads for radial bearing calculations shall be calculated in accordance with this Section. Bearings isolators in accordance with 11175 are not required for submersible pumps.

E. Impeller: The impeller shall be statically balanced, semi-open, multi- vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) vanes shall have screw-shaped leading edges capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. Impellers shall be locked to the shaft and shall be coated with alkyd resin primer.

F. Mechanical Seals:

1. The pump shall be provided with a tandem mechanical seal running in an oil reservoir, composed of two separate lapped face seals. The lower seal unit, between the pump and oil chamber, shall consist of one stationary and one positively driven, rotating tungsten-carbide or silicon-carbide ring, with each pair of rings held in contact by a separate spring. The upper seal unit, between the oil sump and the motor housing, shall consist of one stationary tungsten-carbide or silicon-carbide ring and one positively driven tungsten carbide, or silicon-carbide ring. Ceramic seals will not be acceptable. The seals shall require neither maintenance nor adjustment and shall be easily replaceable. Conventional double mechanical seals with a single or a double spring between the rotating

faces, or that require constant differential pressure to effect sealing and are subject to opening and penetration by pumping forces, will not be acceptable. The pump shall be capable of continuous submergence without loss of watertight integrity to a depth of 65 feet. The mechanical seal shall accommodate the manufacturer's shaft deflection at the seal face and shaft angularity with a safety factor of 3.

2. Each pump shall be provided with a seal lubricant chamber for the shaft sealing system. The seal lubricant chamber shall be designed to assure that an air pocket is provided in the seal lubricant chamber, to absorb the expansion of the seal lubricant due to temperature variations. The drain and inspection plug with positive anti-leak seal shall be easily accessible from the outside.

G. Motor:

1. The pump motor shall be a squirrel-cage induction, shell type design, housed in an air-filled or an oil-filled, watertight chamber, NEMA B type with a service factor of 1.15 based upon nameplate rating. The manufacturer shall furnish an unqualified warranty guaranteeing (full replacement at no cost to the City) the performance of the motors furnished under this project for a period of five years when operating under the specified conditions.
2. The stator winding and stator leads shall be insulated with moisture resistant Class H insulation, which shall be rated at a temperature of 180 degrees C. Motor shall be provided with thermal sensors to protect the motor from excessive heating. Thermal sensors shall be as specified in this Section. The temperature rise of the motor shall not be in excess of that specified in NEMA MG-1 for class B insulating materials when operating continuously under load.
3. Motors shall be Factory Mutual or UL listed in accordance with UL 674 and 1207 for Class I, Group D hazardous atmospheres.
4. The motor shall be designed for continuous duty in air and in 95 degree Fahrenheit water, capable of sustaining a minimum of 10 starts per hour.
5. The junction chamber, containing the terminal board, shall be hermetically sealed from the motor. Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board.
6. Moisture and temperature protection relays shall be furnished and installed separately in local control panel specified under Section 16485.

H. Cooling System:

1. The cooling system may rely on radiation of excess heat energy to the fluid in the wet well or, alternatively, shall be provided a closed circuit circulating system utilizing glycol or heat transfer oil, which shall in turn circulate to a heat exchanger incorporated into the cavity behind the pump impeller. It is specifically required that the cooling system be compatible with the contemplated control schedule, which may require that the motor case to be exposed continuously or intermittently.
2. The cooling jacket shall encircle the stator housing to provide cooling for the motor under all conditions (i.e., submerged or non- submerged).
3. The cooling system shall not employ the pumped fluid to directly cool the motor through wastewater passageways incorporated into the motor shell.

4. The system shall be designed to prevent clogging by virtue of dimensions and configuration and shall be specifically configured to maintain motor temperatures within conservative limits.

I. Temperature Sensors: The stator shall be equipped with three thermal sensors, embedded in the end coils of the stator winding (one sensor in each stator phase). These shall be wired to the specified motor protection relay for motor protection.

J. Moisture Detection:

1. Provide motors with a moisture detection system.
   a. A primary moisture detector shall be provided in the stator housing leakage chamber.
   b. A second moisture detector shall be located in the motor junction box or inspection chamber.
2. All moisture detectors shall be wired to the motor junction box for connection to the specified motor protection relay.
3. Moisture detectors shall be either mechanical float switch or capacitance probe type as recommended by the manufacturer.

K. Motor Protection Relay:

1. Provide motor protection relay to protect motor from high temperature and moisture.
2. During normal pump operation, the temperature switch shall be closed and the leakage switch shall be normally open. Sensor circuit shall operate on 12 or 24 VDC feed from the main relay body. The relay shall be provided with LEDs to indicate status of relay on face for leakage, temperature, and supply voltage.
3. Latch detection of open temperature switch. An external reset shall be required to clear alarm. Retain relay state during power failures for temperature.
4. Moisture detection shall auto reset.
5. Power supply shall be 120 VAC.
6. Provide one SPDT contact for remote over-temperature alarming. Provide one SPDT contact for remote moisture detection alarming.
7. Relay shall be UL or UR approved, suited for panel installation.
8. Relay shall be mounted inside the associated pump's motor controller panel. Mounting shall be DIN rail mount or back panel mount. Coordinate to provide relay for installation at the shop where the associated motor controller is being fabricated. Coordinate size, wiring, and mounting of the relay into the motor controller.
9. Relay manufacturer shall be Xylem-Flygt, ATC Diversified Electronics, Dwyer, or approved substitute.

L. Cables:

1. Cable:
   a. The pump shall have two cables. One cable shall be for power, and one cable shall be for control (the motor thermal sensors and moisture detector). The cable design shall be suitable for installation in a municipal wastewater pumping station. The cable length shall not

exceed the product manufacturer's recommended length. The Contractor shall be responsible for determining the length of cable required to wire the motors and sensors from the wet well to the terminal boxes. The Contractor shall provide additional cable length for slack to allow the pumps to be removed from the wet well. The length of cable for slack shall be based on the pump manufacturer's recommendation.

2. Cable Seal:

   a. The cable entry water seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of individual cylindrical elastomer clamps having a close tolerance fit against the cable conductor insulation and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland, potting chamber or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. If a potting chamber is used, the potting procedure shall employ an epoxy-potting compound combined with a procedure that insures penetration of the compound into the individual cable conductor strands to prevent development of wicking pathways for entrance of water into the motor.

3. Cable Disconnection:

   a. The pump shall be designed such that power/ control cable can be removed from the pump motor without breaking the cable seal. The power/ control cable shall be sealed to a removable motor chamber cap that shall be universally mateable to the same manufacturer's pump series. The pump shall be able to be removed from the wet well and disconnected from the cable by removing the motor chamber cap. A spare removable chamber cap with 15 feet of cable shall be provided.

M. Terminal Boxes: A terminal box shall be provided for each submersible pump. Cords from the pumps shall be connected to the terminal boxes with plugs. The Contractor shall terminate submersible cables into plugs to mate up with receptacles located in the terminal boxes per this section.

1. Boxes, Plugs, and Receptacles:

   a. Class I, Division 1, Group D.

   b. Water tight.

   c. The receptacle/plug shells shall be machined from Stainless Steel type 316.

   d. See the drawings for information about boxes, conduits, and cords.

   e. Terminals per specification Section 16110.

2. Pump terminal box:

   a. Contain a ground stud bonded to the enclosure and support four #8 AWG crimped one hole standard barrel terminal lugs.

   b. Box shall have two receptacles/plugs on the bottom. One receptacle/plug for motor power and one receptacle/plug for motor sensors.

3. Acceptable plug/receptacle manufacturers:

a. Vantage Technologies

b. Or approved substitute

N. Inlet Nozzle: The wet well design has been developed on the basis of a limiting velocity at the pump inlet of 4 feet per second and a confined inlet designed for cleaning by operating the pump until it breaks suction. Inlet nozzles are required for all pumps with entrance velocities exceeding this limitation. The pump casing shall be drilled and tapped to receive an inlet nozzle and bell fitting to extend the pump inlet connection into the confines of the wet well or sump to achieve the floor separation and confined pocket dimensions required by the Hydraulic Institute Intake Standard (ANSI/HI 9.8). The inlet nozzle may be of commercially available forged steel fittings or cast iron and shall have a smooth, flared transition from a bell fitting at the entrance to the nozzle and a smooth, direct entry to the connection at the impeller inlet. The final configuration of the inlet bell and nozzle shall be selected to efficiently convey the pumped fluid into the impeller eye. Dimensions shall be as specified in this Section.

O. Pump Discharge Connection Seal:

1. The connection between the pump discharge connection shall be fitted with a means of sealing. The seal may be either a replaceable dynamic seal or a metal-to-metal seal to effect a complete closure between the pump discharge flange and the mating connection on the anchor fitting described in this Section. Leakage through the seal shall not exceed 1.5 percent of the flow specified for Condition Point A when operating at pump shutoff head and not more than 1 percent of total pump flow at Condition Point B. The seal shall be subject to field test for acceptance in accordance with the requirements of this Section.

2. The dynamic type of seal shall affect a seal meeting the requirements of this paragraph using the head developed by the pump when in operation to expand the sealing device, which may be of metallic or elastomeric construction, against the inner contours of the discharge fitting. The design of the seal shall incorporate features to protect the integrity of the seal during the pump removal/setting process.

P. Pump Anchorage, Guide System and Access Cover:

1. The pump shall be provided with a guide system to allow easy removal of the pump without entering the wet well. The guide rail system may be of either the single or dual rail type. The discharge connection shall be bolted to the structure as indicated and shall serve as a lower attachment for the guide rails. The discharge connection shall be either elbow discharge type, as indicated. The anchorage system shall be designed to transmit the forces specified in this Section safely to the structure. Calculations and supporting documentation justifying the support design shall be provided with the submittals required under Section 11175.

2. The pump and guide rail system shall be designed to automatically connect the pump to the discharge piping when lowered into place on the discharge connection. The design shall be non-sparking and shall conform to UL requirements for installation in a location classified in accordance with NFPA 70, Article 500 for Class 1, Group D, Division 1 locations. The pump shall be easily removable for inspection or service, requiring no bolts, nuts, or other fastenings to be removed for this purpose, and no need for personnel to enter the pump wet well or sump. Sealing of the pumping unit to the discharge connection shall be

accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided to and pressing tightly against the discharge connections. No portion of the pump shall bear directly on the floor of the sump and no rotary motion of the pump shall be required for sealing. Guide bars provided for directing the pump into position or for removing the pump for maintenance shall steer the pump into proper contact with the discharge elbow. Once the pump has been positioned on its support fitting at the discharge fitting, the guide bar system shall not be required for pump support.

3. Access frames and grating furnished by the Contractor shall be as shown on drawings. Dielectric isolation shall be provided for dissimilar metals.

Q. Accessories

1. Pumps shall be provided with lifting cables of compatible diameter with the submitted davit crane and of sufficient length to reach the hand winch of the davit crane (to be coordinated and confirmed with Contractor), guide bars, upper guide bar brackets, intermediate guide bar brackets, cable holder assemblies, safety chain hook assemblies, discharge elbow connections, metric to English pipe increaser, anchor bolts, and all other accessories necessary to complete the installation as specified. All connecting hardware and miscellaneous attachments shall be constructed out of ASTM A276, Type 316 stainless steel. Dielectric isolation shall be provided for dissimilar metals.

2.7 EQUIPMENT AND SYSTEM CONTROLS

A. Section 13300 specifies control system requirements.

2.8 FINISHES

A. Procedures: Section 09800

B. Prime Coat: Shop applied, coating material per 09800

C. Finish Coat: Field applied, coating material per 09800

2.9 SOURCE QUALITY CONTROL

A. Provide non-witnessed factory testing at a location in the Continental United States and in accordance with Section 11175-1.06

B. Submit factory testing results report in accordance with Section 11175.

C. Hydrostatic tests:

1. Factory-test all pressure-sustaining parts in accordance with Section 11175.

D. Performance and NPSH tests:

1. Subject each pump to performance and NPSH testing in accordance with Section 11175 to verify the full range of operating condition

E. Motor tests:

1. First check impeller, motor rating, and electrical connections for compliance with the specifications
2. Subject all motor circuits to electrical resistance tests to confirm functionality

PART 3 - EXECUTION

3.1 EQUIPMENT MOUNTING

F. Procedure: Section 11175

G. Position equipment pad and equipment anchors for final placement of equipment

H. Use a bolting template to position equipment anchors

I. Level mounting plates

J. Pour grout bed supporting each mounting plate

K. Eliminate grout voids below mounting plate

L. Tension equipment anchors

M. Provide a completed Form 11000-A, Section 01999, for each equipment installation

3.2 COATINGS

A. Finish Coating: see paragraph 2.08.

3.3 FIELD QUALITY CONTROL

A. Procedures: Section 01400.

B. Static Solid Pass Test:

1. Upon arrival and before installation in the project, each pump shall be given a solids pass test. The test shall consist of inserting a rigid ball of the diameter specified in paragraph 2.03 in the pump discharge opening. The Contractor shall demonstrate that the ball will pass clear though the pump to the inlet bell with no force other than the weight of the ball used to demonstrate compliance with the requirements of this Section.

C. Vibration Test:

1. Vibration levels shall be determined by affixing suitable sensors to the top of the motor housing in both the x-x (parallel to the nozzle) and y-y (perpendicular to the nozzle) directions. The Contractor or his designated testing agent shall provide all sensors and monitoring equipment.
2. As a condition precedent to final acceptance of the equipment, the pumps shall be individually operated at all specified operating conditions. The Contractor shall provide the means to recirculate pumped fluid or alternatively throttle the pumps to achieve the specified head at specified flow.

3. Vibration levels shall not exceed that specified in paragraph 1.07 when the pump is operating within the manufacturer's listed POR as determined in accordance with Section 11175. When operating at conditions outside the POR, vibration levels shall be no more than 125 percent of that specified in paragraph 1.07.

D. Manufacturer Services:

E. On-Site Inspections and Training: Provide a factory-trained manufacturer's representative at the Site for the following activities. Specified durations do not include travel time to or from the Site.

1. Installation Inspections: Assist, supervise, and inspect the Contractor's activities during installation of submersible sump pumps. Provide 4 hours of installation inspection during installation of each submersible sump pumps.
2. Training Sessions: Provide 2 hours of classroom training.

3.4 SYSTEMS START UP

A. Procedures: Section 01680.

B. Preoperational (factory) testing; See paragraph 2.09.

C. Component testing: Perform the following tests.

1. During initial pump installation, verify on one pump that the crane system has the clearance and capacity to lift the wetted-end from the field mounted pump with pump manufacturer provided lifting cables to accommodate routine pump maintenance.

** END OF SECTION **

SECTION 13301

CONTROL SPECIFICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies controls for the Programmable Logic Controller (PLC) based control system.

B. Control strategies describe sequential and interlocking control functions.

C. The Contractor shall provide the labor and equipment to test the specified control strategies per Section 13305.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CONTROL STRATEGY - DIVERSION GATE (SLG105)

A. P&ID: I-003

B. General Description: The diversion gate isolates the diversion structure from the storm drain system.

C. Control Strategy Overview: The diversion gate operator is equipped with integral controls. The gate is normally open. The gate closes during a storm event when the required storm water volume is captured by the diversion structure.

D. Local Control:

1. Field:

a. Local-Off-Remote (LOR) Switch

1) When the LOR Switch is in the LOCAL position the valve can be opened or closed by using the OSC switch

2) When the LOR switch is in the OFF position the valve shall not operate.

3) When the LOR switch is in the REMOTE position the valve is controlled by the PLC.

b. Open-Stop-Close (OSC) Switch:

1) The OSC switch shall spring return to the STOP position
2) When the OSC switch is held in the OPEN position the valve shall open.

3) When the OSC switch is in the STOP position the valve shall stop and not move.

4) When the OSC switch is in the CLOSE position the valve shall close.

c. Remote Indication – When the LOR switch is in the REMOTE position the valve operator shall indicate that the valve is in remote.

d. Opened Indication – When the valve is in the full opened position the valve operator shall indicate that the valve is in the opened position.

e. Closed Indication - When the valve is in the full closed position the valve operator shall indicate that the valve is in the closed position.

2. Local Control Panel – None

3. Hardwired Interlocks – None

E. Remote Control

1. Control Strategy

a. The diversion gate is normally opened. The gate closes during a storm event after the preset volume of water enters the diversion structure.

b. Remote-Auto Operation

1) When the water level in the wet well and storage structure exceeds a hard coded level (initially 4.24 feet, to be adjusted at startup) a storm event is occurring and the Storm Event Timer shall be started. The Storm Event Timer shall be in hours to the nearest tenth (0.0 – 999.9 hours).
2) When the storm event begins the volume of water that enters the diversion structure shall be totalized.
3) The totalized volume equals the running flow total through FIT-125 (from the start of the storm event) plus the volume of water in the wet well and storage structure.
4) The volume of water in the wet well and storage structure will be calculated by the PLC. The calculation will be the depth of water in the structure as measured by the active level transmitter (LIT-100 or LIT-101) multiplied by the area of the wet well and storage structure. The area of the wet well and storage structure will be provided by the Contractor during construction.
5) When the totalized volume reaches 927, 520 gallons the gate shall close.

6) When the gate is completely closed, the PLC shall start an adjustable timer (initially 24 hours) Gate Closed Timer
7) If the gate is closed for less than 24 hours into the Storm Event (Storm Even Timer) when the Gate Closed Timer expires the gate shall be opened.
8) If the gate is closed 24 hours or more into the storm event (Storm Event Timer) the gate shall remain closed until the storm event is over.
~~9)~~ The storm event ends, and the Storm Event Timer is reset when the pumps have stopped and the water level in SDR 1-3-1 is below a hardcoded level determined at start-up.

c. Remote-Manual Operation

1) The operator shall be able to open and close the diversion gate while in Remote-Manual mode.

2. DCS
a. When the diversion gate is in remote the operator shall be able to toggle the control mode between Remote-Auto and Remote-Manual from the DCS.
b. When in Remote-Manual mode the operator shall be able to open and close the diversion gate from the DCS.
c. The operator shall be able to designate the diversion gate as Out-of-Service from the DCS. When the diversion gate is Out-of-Service the gate shall not operate in either remote control mode.
d. The operator shall be able to reset the Fail to Open and Fail to Close alarms from the DCS.

3. Software Interlocks – None.

4. Alarms

a. Fail to Open – When the gate is commanded to open and does not reach its fully opened position in the allotted time a Fail to Open alarm shall be issued. The allotted time will be determined during startup and shall be 1.25 time longer than the average time for the gate to transition from fully closed to fully open (10 samples). The alarm shall require a reset from the OIT or DCS.

b. Fail to Close – When the gate is commanded to close and does not reach its fully closed position in the allotted time a Fail to Close alarm shall be issued. The allotted time will be determined during startup and shall be 1.25 time longer than the average time for the gate to transition from fully opened to fully closed (10 samples). The alarm shall require a reset from the OIT or DCS.

3.2 CONTROL STRATEGY – DIVERSION PUMPS (P-110, P-120)

A. P&ID: I-003

B. General Description: There are two fixed speed pumps in the diversion structure wetwell. The pumps operate in a Lead-Lag configuration.

C. Control Strategy Overview: The pumps are equipped with a Local Control Panel (LCP) that is located adjacent to the diversion structure. Each of the pumps may be operated locally from the LCP. In REMOTE-AUTOMATIC control the are started and stopped by ball floats

D. Local Control:

1. Field: None

2. Local Control Panel:

a. Refer to the pump control schematic on sheet E-3 of the drawings.

b. The pump control panel has a HAND-OFF-REMOTE switch for each pump.

c. When the HOR switch is in the HAND position the pump shall run provided the wet well is above low-low level and all interlock conditions are satisfied.

d. When the HOR switch is in the OFF position the pump shall not operate.

e. When the HOR switch is in the REMOTE position the pump shall operate when called by the PLC provided all interlock conditions are satisfied.

f. All hardwired interlocks shall be active in all control modes.

3. Hardwired Interlocks: Refer to the pump control schematic on sheet E-3 of the drawings.

E. Remote Control

1. Control Strategy

a. The pumps shall normally operate in REMOTE-AUTO control. The default operating mode of the pumps is REMOTE-AUTOMATIC. On power up or when initially placed in REMOTE the pump shall default to automatic operation.

b. Remote-Auto Operation

1) The lead and lag pump shall initially be selected by PLC logic to equalize run time. The operator may change the lead pump selection at any time.

2) When the level in the wetwell rises above the Lead Pump Start Level of (initially) 3.87 feet the lead pump shall start.

3) When the level in the wet well rises above the Lag Pump Start Level of (initially) 6.62 feet the lag pump shall start.

4) When the level in the wet well falls below the Lead Pump Stop Level of (initially) 1.62 feet the lead pump shall stop.

5) When the level in the wet well falls below (initially) 4.12 feet the lag pump shall stop.

6) The final start and stop levels will be determined by observation during startup and commissioning and hard coded into the PLC after approved by the Engineer.

c. Remote-Manual Operation: The operator can start and stop the pumps from the DCS provided all interlock conditions are satisfied.

2. DCS

a. When a pump is in remote the operator shall be able to toggle the control mode between Remote-Auto and Remote-Manual from the DCS.

b. When in Remote-Manual mode the operator shall be able to start and stop the pump from the DCS.

c. The operator shall be able to designate the pump as Out-of-Service from the DCS. When a pump is Out-of-Service the pump shall not operate in either remote control mode.

d. The operator shall be able to reset the Fail to Start alarm from the DCS.

3. Software Interlocks

a. High Level Interlock – If the Centrate Wetwell is above an operator adjustable high level setpoint the DCS shall issue a High Level Interlock to the diversion structure PLC to prevent the operation of the diversion pumps. The diversion structure pumps shall not operate in any mode when the High Level Interlock is set.

4. Hardwired Interlocks

a. Low-Low Level switch – The pump shall not operate is the level in the wet well is not above the low-low level ball float.

b. High Discharge Pressure switch – The pump is protected by a normally closed high discharge pressure switch. When the switch trips (opens) the pump shall stop. The high pressure shutdown shall require a local reset.

5. Alarms:

a. High-High Level – When the level in the diversion wetwell rises above the High-High Level ball float for 3 seconds an High-High level alarm shall be issued. The High-High alarm shall automatically clear when the wet well level is below the High-High Level for 10 seconds.

b. Low-Low Level – When the level in the diversion wetwell falls below the Low-Low level ball float for 3 seconds a Low-Low alarm shall be issued. The Low-Low alarms shall automatically clear when the level in the wetwell is above the low low level ball float for 30 seconds.

c. Failed to Start- When a pump is called to start and the PLC does not receive a running signal from the pump control panel in 10 seconds a Failed to Start alarm shall be issued. If the lead pump fails to start the lag pump shall be designated as lead. The failed to start alarm can be reset from the OIT or the DCS.

d. Additional alarm shall be issued for inputs from the pump control panel. Refer to the pump control schematic. These alarms shall be reset from the pump control panel.

1) Fault

2) High Temperature

3) Seal Leak

4) High Discharge Pressure

3.3 CONTROL STRATEGY – FLOW METER (FIT-125)

A. P&ID: I-003

B. General Description: Measures the flow produced by the pump station.

C. Control Strategy Overview:

1. Flow totalization will be calculated and maintained by the PLC whenever flow signals exceeds 2-1/2 % of full scale value and analog signal has not failed (refer to CS10). Totalize from 0.0 to 999.9 MGal.

2. A separate storm flow totalization calculation shall be initiated at the start of a storm event as indicated by a signal from the DCS. The storm event calculation shall be reset at the start of a storm event.

3. The storm flow totalization calculation shall calculate the volume of water that passes through the diversion structure beginning from the instant that the storm event is started from the DCS. The calculation will be the volume of water in the wet well and storage structure plus the volume of water (totalized flow) pumped during the storm event. The wet well and storage structure volume calculation

will be based on the as constructed dimensions of the wet well and storage structure and the level in the wet well.

D. Local Control: None

E. Remote Control: None

3.4 CONTROL STRATEGY – LEVEL TRANSMITTERS (LIT-100, LIT-101)

A. P&ID: I-003

B. General Description: Redundant level transmitters continuously monitor the level of the wetwell.

C. Control Strategy Overview:

1. The Operator may select the following from the DCS

a. Level Transmitter 1 In/Out of Service
b. Level Transmitter 2 In/Out of Service

2. The In Service Level Transmitter is used for control. If both Level Transmitters are in service, the average value of the two transmitters is used for control.

3. A deviation alarm shall be generated if the level transmitter outputs are not within acceptable limits (initially 2").

4. The In Service Level Transmitter is used for control and alarming, including calculating the volume of water in the diversion structure.

3.5 CONTROL STRATEGY – LOWER EXPLOSIVE LIMIT DETECTORS (AIT-103, AIT-107, AIT-109)

A. P&ID: I-003

B. General Description: LEL analyzers continuously monitor the methane levels in the wetwell and diversion structure.

C. Control Strategy Overview:

1. An alarm shall be issued when the LEL is reached.

** END OF SECTION **

City of San Diego

CITY CONTACT: Brittany Friedenreich, Senior Contract Specialist, Email: BFriedenreic@sandiego.gov
Phone No. (619) 533-3104

ADDENDUM B

e - Bidding

FOR

METROPOLITAN BIOSOLIDS CENTER (MBC) STORM WATER DIVERSION PROJECT

BID NO.:	**K-22-2096-DBB-3**
SAP NO. (WBS/IO/CC):	**B-19197**
CLIENT DEPARTMENT:	**2000**
COUNCIL DISTRICT:	**6**
PROJECT TYPE:	**BO**

BID DUE DATE:

2:00 PM
JULY 20, 2022

CITY OF SAN DIEGO'S ELECTRONIC BIDDING SITE, PLANETBIDS

http://www.sandiego.gov/cip/bidopps/index.shtml

A. CHANGES TO CONTRACT DOCUMENTS

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

B. BIDDER's QUESTIONS

Q1. For the work located within the MBC facility, the plans call for a lot of work that depends on existing site conditions such as, restoring existing landscaping and irrigation, protecting or replacing existing curb & gutter, protection of existing utilities, salvaging and replacing of wooden planks etc… A site visit is necessary to determine the impacts of the work and potential costs involved. Addendum A mentions that a site visit on Facility grounds is not available, please reconsider this. Can the City arrange for a group site visit or a contact at the facility who can allow access by the contractor in advance of the bid?

A1. Bid as is.

Q2. Spec section 3-10.2 doesn't mention if the City will be performing construction survey and staking for the pipelines. Please confirm if the City will be providing these services.

A2. The City will provide construction staking per Section 3-10.2.

Q3. Summary of work section 01010-2, paragraph 1.5 mentions a field office/trailer. Please confirm if this project requires a field office/trailer. It's also mentioned in 01505-1, paragraph 1.2 A & B. Also mentioned in 01510-4, section 3.6 A. If a field office is required, please provide spec section with specific field office requirements and a bid item.

A3. A field office/ trailer is not required.

Q4. Section 01520, security & safety. What bid item is to be used for the costs for this sections requirements, such as the 24HR full time security guard, entry & access control, security office, reporting etc? Currently there is no bid item that applies to this work.

A4. A 24 hour full time security guard, entry & access control, security office Is not required. Disregard Section 01520, Security and Safety, Part 1 – GENERAL, 1.1 SECURITY PROGRAM, Section A, Subsections 2 through 6, and Section 1.9 PROJECT SITE SECURITY SERVICES AND ACCESS CONTROL, delete in their entirety from Attachment E - Technical Specification as per this Addendum.

Q5. Section 01520, 1.9 D Please confirm that a self contained security office is required.

A5. Security office is not required. Disregard Section 01520, Section 1.9 PROJECT SITE SECURITY SERVICES AND ACCESS CONTROL, delete in its entirety from Attachment E - Technical Specification as per this Addendum.

Q6. There is no Traffic Control bid item, please provide or indicate where these costs should be allocated.

A6. Traffic Control shall be included in the various items of work.

Q7. There is no Temporary Resurfacing (cold mix) bid item, please provide.

A7. Temporary Resurfacing is not anticipated, if necessary include in the various items of work.

Q8. Section 01560-3 Temporary Environmental Controls, Paragraph 1.8 mentions the preservation of cultural and archeological resources. Please confirm if the contractor is provide Archeo, Paleo or Native American monitoring? If so, please provide bid items accordingly.

A8. No monitoring is required, refer to NOE in Appendix A.

C. ATTACHMENTS

1. To **Attachment E, Technicals, SECTION 01520**, **Security and Safety, Part 1 – GENERAL, 1.1 SECURITY PROGRAM, Section A, Subsections 2 through 6,** page 131, **DELETE** in their entirety.

2. To **Attachment E, Technicals, SECTION 01520, Section 1.9, PROJECT SITE SECURITY SERVICES AND ACCESS CONTROL,** pages 134 through 136**, DELETE** in their entirety.

Rania Amen, Director
Engineering & Capital Projects Department

Dated: *July 14, 2022*
San Diego, California

RA/AP/ks

Bid Results

Bidder Details

Vendor Name	Ahrens Mechanical
Address	5959 Mission Gorge Road, Suite 204 San Diego, California 92120 United States
Respondee	Greg Ahrens
Respondee Title	President
Phone	619-487-9036
Email	estimating@ahrensmech.com
Vendor Type	CADIR, DVBE, SDVSB, SLBE
License #	957287
CADIR	1000000554

Bid Detail

Bid Format	Electronic
Submitted	07/20/2022 1:51 PM (PDT)
Delivery Method	
Bid Responsive	
Bid Status	Submitted
Confirmation #	298832

Respondee Comment

Buyer Comment

Attachments

File Title	File Name	File Type
E. Debarment and Suspension Certification - Subcontractors, Suppliers and Manufacturers.pdf	E. Debarment and Suspension Certification - Subcontractors, Suppliers and Manufacturers.pdf	DEBARMENT AND SUSPENSION CERTIFICATION FOR SUBCONTRACTORS, SUPPLIERS AND MANUFACTURERS
D. Debarment and Suspension Certification - Prime Contractor.pdf	D. Debarment and Suspension Certification - Prime Contractor.pdf	DEBARMENT AND SUSPENSION CERTIFICATION FOR PRIME CONTRACTOR
C. Mandatory Disclosure of Business Interests Form.pdf	C. Mandatory Disclosure of Business Interests Form.pdf	MANDATORY DISCLOSURE OF BUSINESS INTERESTS FORM
B. Contractors Cerfication of Pending Actions.pdf	B. Contractors Cerfication of Pending Actions.pdf	CONTRACTOR’S CERTIFICATION OF PENDING ACTIONS
A. Bid Bond.pdf	A. Bid Bond.pdf	Bid Bond

Subcontractors

Showing 11 Subcontractors

Name & Address	Desc	License Num	CADIR	Amount	Type
Condon-Johnson & Associates, Inc 480 Roland Way Suite 200 Oakland, California 94621	Shoring - Subcontractor	300068	1000004443	$891,685.00	
Dick Miller Inc. 930 Boardwalk, Suite H San Marcos, California 92078	Sidewalk, Curb and Gutter, Curb Ramps - Subcontractor	380204	1000004547	$191,548.86	CADIR, DVBE, SDVSB, SLBE, PQUAL, MALE, CAU, Local
Geo-Cell Solutions, Inc. 2668 N. Fordham Fresno, California 93727	Cellular Concrete - Subcontractor	938053	1000001454	$22,200.00	
LC Tree Service 4455 Murphy Canyon Rd Ste 100 San Diego, California 92123	Tree Removal - Subcontractor	979396	1000044782	$130,000.00	PQUAL, SLBE, CADIR, DVBE, MALE, CAU, Local
Makelele Systems Landscape & Mai PO BOX 2044 Makelele Systems San Marcos, California 92079	Irrigation/DG Subcontractor	987557	1000028415	$122,900.00	MBE, CADIR, MALE, LAT, Local
NOVA Services, Inc. DVBE/SLBE 4373 Viewridge Ave Suite B San Diego, California 92123	Special Inspection - Constructor	000000	1000007909	$100,000.00	CADIR, DVBE, SLBE, SDVSB, Local
National Coating & Lining 26713 Madison Ave Murrieta, California 92562	Wet Well Lining - Subcontractor	886430	1000013795	$63,271.00	MALE, CAU
National Electric Works, Inc. 4440 Rainer Ave., Ste. 101 San Diego, California 92120	Electrical and Instrumentation - Subcontractor	591191	1000003595	$788,917.00	NAT, MALE, MBE, CADIR, PQUAL, Local
Parada Painting, Inc. 14281 Palisades Drive,Poway, CA, 92 Poway, California 92064	Coatings - Subcontractor	742112	1000004724	$17,356.00	CADIR, SDB, Local
SealRight Paving, Inc. 9053 Olive Dr. Spring Valley, California 91977	Asphalt - Subcontractor	364113	1000039542	$83,585.93	DBE, MBE, CADIR, MALE, LAT, Local
Solid Structures, Inc. P.O.Box 848 La Mesa, California 91944	Concrete Structures - Subcontractor	758791	1000015100	$124,410.00	ELBE, Local

Line Items

Discount Terms No Discount

Item #	Item Code	Type	Item Description	UOM	QTY	Unit Price	Line Total	Response	Comment
Main Bid							$6,399,932.80		
1	524126		Bonds (Payment and Performance)	LS	1	$69,000.00	$69,000.00	Yes	
2	236220		Building Permits (EOC Type I)	AL	1	$20,000.00	$20,000.00	Yes	
3	237110		Engineering Trench Shoring	LS	1	$29,500.00	$29,500.00	Yes	
4	237110		Engineered Sheeting, Shoring and Bracing (SD Pump Station and Storage)	LS	1	$981,000.00	$981,000.00	Yes	
5	238910		Disposal of Construction and Demolition Waste	TON	487	$47.00	$22,889.00	Yes	
6	237110		Mobilization	LS	1	$110,000.00	$110,000.00	Yes	
7			Field Orders (EOC Type II)	AL	1	$400,000.00	$400,000.00	Yes	
8			Dewatering Permit and Discharge Fees (EOC Type II)	AL	1	$80,000.00	$80,000.00	Yes	
9	237110		Dewatering Non-Hazardous Contaminated Water	LS	1	$23,500.00	$23,500.00	Yes	
10	541330		Specialty Inspection Paid For By the Contractor (EOC Type II)	AL	1	$100,000.00	$100,000.00	Yes	
11	238910		Clearing and Grubbing	LS	1	$163,800.00	$163,800.00	Yes	
12	237110		Additional Bedding	CY	200	$125.00	$25,000.00	Yes	
13	237310		Class 2 Aggregate Base	TON	100	$65.00	$6,500.00	Yes	
14	237310		Asphalt Concrete	TON	52	$345.00	$17,940.00	Yes	
15	237310		Asphalt Pavement Repair	TON	202	$185.00	$37,370.00	Yes	
16	237310		Remove and Replace Existing Sidewalk	SF	4527	$13.40	$60,661.80	Yes	
17	237310		Curb and Gutter (6 Inch Curb, Type G)	LF	1250	$67.00	$83,750.00	Yes	
18	237310		Cross Gutter	SF	545	$31.00	$16,895.00	Yes	
19	237310		Curb Ramps (Type A) with Stainless Steel Detectable Warning Tiles	EA	5	$4,700.00	$23,500.00	Yes	
20	237310		Curb Ramps (Type B) with Stainless Steel Detectable Warning Tiles	EA	2	$4,700.00	$9,400.00	Yes	
21	237310		Curb Ramps (Type C1) with Stainless Steel Detectable Warning Tiles	EA	2	$4,700.00	$9,400.00	Yes	
22	237310		Curb Ramps (Type D) with Stainless Steel Detectable Warning Tiles	EA	2	$3,520.00	$7,040.00	Yes	
23	237110		Abandon and Fill Existing Storm Pipes (12 Inch) Outside of the Trench Limit	LF	25	$150.00	$3,750.00	Yes	
24	237110		Abandon and Fill Existing Storm Pipes (18 Inch) Outside of the Trench Limit	LF	100	$94.00	$9,400.00	Yes	
25	237110		Abandon and Fill Existing Storm Pipes (48 Inch) Outside of the Trench Limit	LF	270	$104.00	$28,080.00	Yes	
26	237110		Abandon Existing Storm Drain Cleanouts and Inlets Outside of the Trench Limit	EA	3	$3,500.00	$10,500.00	Yes	
27	237110		Storm Drains (48 Inch RCP)	LF	95	$520.00	$49,400.00	Yes	
28	237110		Storm Drains (36 Inch RCP)	LF	438	$393.00	$172,134.00	Yes	
29	237110		Storm Drains (30 Inch RCP)	LF	612	$293.00	$179,316.00	Yes	
30	237110		Storm Drains (24 Inch RCP)	LF	30	$245.00	$7,350.00	Yes	
31	237110		Storm Drains (18 Inch RCP)	LF	20	$228.00	$4,560.00	Yes	
32	237110		Sewer Force Main (6 Inch, PVC)	LF	848	$164.00	$139,072.00	Yes	
33	237110		Sewer Main (12 Inch, PVC)	LF	120	$250.00	$30,000.00	Yes	
34	237110		Sewer Lateral Connection	EA	2	$2,500.00	$5,000.00	Yes	
35	237110		Sewer Main Cleanout (12 Inch)	EA	1	$1,200.00	$1,200.00	Yes	
36	237110		Sewer Main Cleanout (6 Inch)	EA	3	$7,800.00	$23,400.00	Yes	
37	237110		Connection to Existing Manhole and Rechanneling	EA	1	$2,400.00	$2,400.00	Yes	
38	237110		Combination Air Valve Assembly (2 Inch, Class 150)	EA	3	$12,800.00	$38,400.00	Yes	
39	237110		Curb Inlet (Type B , L=30 ft)	EA	1	$22,000.00	$22,000.00	Yes	
40	237110		Curb Inlet (Type B , L=18 ft)	EA	2	$19,200.00	$38,400.00	Yes	
41	237110		Storm Drain Clean Out (Type A5)	EA	1	$19,200.00	$19,200.00	Yes	
42	237110		Storm Drain Clean Out (Type A6)	EA	1	$19,500.00	$19,500.00	Yes	
43	237110		Storm Drain Clean Out (Type B5)	EA	4	$26,700.00	$106,800.00	Yes	
44	237310		Removal and Replacement of Existing Thermoplastic Striping and Markings	LS	1	$12,500.00	$12,500.00	Yes	
45	237110		Potholing Existing Utilities Not Shown on Plans (Depth up to 7 ft)	EA	6	$1,000.00	$6,000.00	Yes	
46	561730		Tree Removal and Disposal (Less Than 24 Inch Trunk Diameter)	EA	65	$2,200.00	$143,000.00	Yes	
47	237310		WPCP Implementation	LS	1	$33,200.00	$33,200.00	Yes	
48	541330		WPCP Development	LS	1	$825.00	$825.00	Yes	
49	561730		Irrigation System	LS	1	$62,400.00	$62,400.00	Yes	

Item #	Item Code	Type	Item Description	UOM	QTY	Unit Price	Line Total	Response	Comment
50	561730		Landscape	LS	1	$50,600.00	$50,600.00	Yes	
51	237110		Sewage and Stormwater Bypasses and Pumping Plans (Diversion Plan)	LS	1	$18,300.00	$18,300.00	Yes	
52	237310		Decomposed Granite (6 Inch)	SF	11500	$2.00	$23,000.00	Yes	
53	237310		Site Improvements (West)	LS	1	$7,500.00	$7,500.00	Yes	
54	237310		Site Improvements (Pump Station, Storage and Access Road)	LS	1	$92,400.00	$92,400.00	Yes	
55	237110		Hydrodynamic Separator	LS	1	$181,000.00	$181,000.00	Yes	
56	238910		Precast Concrete Wetwell Pump Station and Above Grade Piping	LS	1	$832,000.00	$832,000.00	Yes	
57	237110		Underground Stormwater Storage Structure and Gas Piping	LS	1	$824,000.00	$824,000.00	Yes	
58	238210		Site Electrical - Panels, Duct Banks, & Cabling	LS	1	$480,500.00	$480,500.00	Yes	
59	238210		Instrumentation	LS	1	$425,700.00	$425,700.00	Yes	

Line Item Subtotals

Section Title	Line Total
Main Bid	**$6,399,932.80**
Grand Total	**$6,399,932.80**