City of San Diego

CONTRACTOR'S NAME: Burtech Pipeline Incorporated
ADDRESS: 1325 Pipeline Drive, Vista, CA 92081
TELEPHONE NO.: 760-634-2822 **FAX NO.:**
CITY CONTACT: Rosa Riego, Senior Contract Specialist, Email: RRiego@sandiego.gov
Phone No. (619) 533-3426
M. Kargar / A. Parra / Y. Kawai

BIDDING DOCUMENTS

e - Bidding

FOR

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT

BID NO.: **K-23-2064-DBB-3-A**
SAP NO. (WBS/IO/CC): **B-20002**
CLIENT DEPARTMENT: **2000**
COUNCIL DISTRICT: **8**
PROJECT TYPE: **CC**

THIS CONTRACT WILL BE SUBJECT TO THE FOLLOWING:

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

BID DUE DATE:
2:00 PM
SEPTEMBER 22, 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:

Kathleen S Haynes

1) For Registered Engineer

08/03/2022

Date

Seal:

Brian Vitelle

2) For City Engineer

08/09/2022

Date

Seal:

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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.	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
10.	Payment & Performance Bond; Certificates of Insurance & Endorsements; and Signed Contract Agreement Page	Within 10 working days of receipt by bidder of contract forms and NOI	AWARDED BIDDER
11.	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 **Storm Water Diversion At The South Bay Water Reclamation Plant**. 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 **$2,940,000**.

4. **BID DUE DATE AND TIME ARE: SEPTEMBER 22, 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 **7.9%**
2. ELBE participation **14.4%**
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:

RRiego@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.

INSTRUCTIONS TO BIDDERS

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
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 56P
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. 7901107899
PREMIUM: $18,940.00
PREMIUM IS FOR CONTRACT TERM AND IS SUBJECT TO ADJUSTMENT BASED ON FINAL CONTRACT PRICE

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

Burtech Pipeline Incorporated, a corporation, as principal, and NATIONWIDE MUTUAL INSURANCE COMPANY, 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 **Two Million Eight Hundred Forty Thousand Six Hundred Fifty Dollars and Zero Cents ($2,840,650.00)** for the faithful performance of the annexed contract, and in the sum of **Two Million Eight Hundred Forty Thousand Six Hundred Fifty Dollars and Zero Cents ($2,840,650.00)** 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: _____

Print Name: Stephen Samara
Principal Contract Specialist
Purchasing & Contracting Department

Date: 12/8/2022

APPROVED AS TO FORM

Mara W. Elliott, City Attorney

By: _____

Print Name: Frank Ahn
Deputy City Attorney

Date: 12/27/2022

CONTRACTOR
BURTECH PIPELINE, INCORPORATED

By: _____

Print Name: DOMINIC J. BURTECH, JR., PRESIDENT

Date: NOVEMBER 7, 2022

SURETY
NATIONWIDE MUTUAL INSURANCE COMPANY

By: _____
Attorney-In-Fact

Print Name: MARK D. IATAROLA, ATTORNEY-IN-FACT

Date: NOVEMBER 7, 2022

500 NORTH BRAND BOULEVARD, SUITE 2000
GLENDALE, CA 91203
Local Address of Surety

715/530-3481
Local Phone Number of Surety

$18,940.00 PREMIUM IS FOR CONTRACT TERM AND IS SUBJECT TO ADJUSTMENT BASED ON FINAL CONTRACT PRICE
Premium

7901107899
Bond Number

CALIFORNIA ALL-PURPOSE 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 11/8/2022 (Date) before me, Arthur Patrick Arquilla, Notary Public (Here Insert Name and Title of the Officer)

Personally appeared Dominica Bertsch (Name(s) of Signer(s))

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 _____ (Signature of Notary Public)

ARTHUR PATRICK ARQUILLA
COMM. #2386204
NOTARY PUBLIC-CALIFORNIA
SAN DIEGO COUNTY
My Comm. Expires January 7 2026

Place Notary Seal Above

---------- **OPTIONAL** ----------

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document _____ Document Date _____

Number of Pages _____ Signer(s) Other Than Named Above _____

Capacity(ies) Claimed by Signer(s)

Signer's Name _____
☐ Corporate Officer—Title(s) _____
☐ Partner ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other _____
Signer Is Representing _____

Signer's Name _____
☐ Corporate Officer—Title(s) _____
☐ Partner ☐ Limited ☐ General
☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian or Conservator
☐ Other _____
Signer Is Representing _____

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT CIVIL CODE § 1189

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 11/07/2022 *Date* before me, TRACY LYNN RODRIGUEZ, NOTARY PUBLIC *Here Insert Name and Title of the Officer*,

personally appeared MARK D. IATAROLA *Name(s) of Signer(s)*,

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.

TRACY LYNN RODRIGUEZ
COMM. # 2318838
SAN DIEGO COUNTY
NOTARY PUBLIC-CALIFORNIA
MY COMMISSION EXPIRES
JANUARY 11, 2024

Place Notary Seal and/or Stamp Above

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 _____
Signature of Notary Public

OPTIONAL

Completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: MARK D. IATAROLA	Signer's Name: _____
☐ Corporate Officer – Title(s): _____	☐ Corporate Officer – Title(s): _____
☐ Partner – ☐ Limited ☐ General	☐ Partner – ☐ Limited ☐ General
☐ Individual ☒ Attorney in Fact	☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian of Conservator	☐ Trustee ☐ Guardian of Conservator
☐ Other: _____	☐ Other: _____
Signer is Representing: _____	Signer is Representing: _____

Power of Attorney

KNOW ALL MEN BY THESE PRESENTS THAT:

Nationwide Mutual Insurance Company, an Ohio corporation

hereinafter referred to severally as the "Company" and collectively as "the Companies" does hereby make, constitute and appoint:
HELEN MALONEY; JOHN G MALONEY; MARK D IATAROLA; SANDRA FIGUEROA; TRACY LYNN RODRIGUEZ;

each in their individual capacity, its true and lawful attorney-in-fact, with full power and authority to sign, seal, and execute on its behalf any and all bonds and undertakings, and other obligatory instruments of similar nature, in penalties not exceeding the sum of

UNLIMITED

and to bind the Company thereby, as fully and to the same extent as if such instruments were signed by the duly authorized officers of the Company; and all acts of said Attorney pursuant to the authority given are hereby ratified and confirmed.

This power of attorney is made and executed pursuant to and by authority of the following resolution duly adopted by the board of directors of the Company:

"RESOLVED, that the president, or any vice president be, and each hereby is, authorized and empowered to appoint attorneys-in-fact of the Company, and to authorize them to execute and deliver on behalf of the Company any and all bonds, forms, applications, memorandums, undertakings, recognizances, transfers, contracts of indemnity, policies, contracts guaranteeing the fidelity of persons holding positions of public or private trust, and other writings obligatory in nature that the business of the Company may require; and to modify or revoke, with or without cause, any such appointment or authority; provided, however, that the authority granted hereby shall in no way limit the authority of other duly authorized agents to sign and countersign any of said documents on behalf of the Company."

"RESOLVED FURTHER, that such attorneys-in-fact shall have full power and authority to execute and deliver any and all such documents and to bind the Company subject to the terms and limitations of the power of attorney issued to them, and to affix the seal of the Company thereto; provided, however, that said seal shall not be necessary for the validity of any such documents."

This power of attorney is signed and sealed under and by the following bylaws duly adopted by the board of directors of the Company.

Execution of Instruments. Any vice president, any assistant secretary or any assistant treasurer shall have the power and authority to sign or attest all approved documents, instruments, contracts, or other papers in connection with the operation of the business of the company in addition to the chairman of the board, the chief executive officer, president, treasurer or secretary; provided, however, the signature of any of them may be printed, engraved, or stamped on any approved document, contract, instrument, or other papers of the Company.

IN WITNESS WHEREOF, the Company has caused this instrument to be sealed and duly attested by the signature of its officer the 20th day of August, 2021.

Antonio C. Albanese, **Vice President** of Nationwide Mutual Insurance Company

ACKNOWLEDGMENT

STATE OF NEW YORK COUNTY OF NEW YORK: ss
On this 20th day of August, 2021, before me came the above-named officer for the Company aforesaid, to me personally known to be the officer described in and who executed the preceding instrument, and he acknowledged the execution of the same, and being by me duly sworn, deposes and says, that he is the officer of the Company aforesaid, that the seal affixed hereto is the corporate seal of said Company, and the said corporate seal and his signature were duly affixed and subscribed to said instrument by the authority and direction of said Company.

Stephanie Rubino McArthur
Notary Public, State of New York
No. 02MC6270117
Qualified in New York County
Commission Expires October 19, 2024

Notary Public
My Commission Expires
October 19, 2024

CERTIFICATE

I, Laura B. Guy, Assistant Secretary of the Company, do hereby certify that the foregoing is a full, true and correct copy of the original power of attorney issued by the Company; that the resolution included therein is a true and correct transcript from the minutes of the meetings of the boards of directors and the same has not been revoked or amended in any manner; that said Antonio C. Albanese was on the date of the execution of the foregoing power of attorney the duly elected officer of the Company, and the corporate seal and his signature as officer were duly affixed and subscribed to the said instrument by the authority of said board of directors; and the foregoing power of attorney is still in full force and effect.

IN WITNESS WHEREOF, I have hereunto subscribed my name as Assistant Secretary, and affixed the corporate seal of said Company this 7TH day of NOVEMBER, 2022.

Assistant Secretary

BDJ 1(08-21)00

ATTACHMENTS

ATTACHMENT A

SCOPE OF WORK

SCOPE OF WORK

1. **SCOPE OF WORK:** The Project involves demolition of the existing Sanitary Sewer Pump Station (SSPS) at the South Bay Water Reclamation Plant (SBWRP) facility, and construction of a new SSPS in its place. Additional improvements associated with the SSPS replacement include installation of a new cast-in-place reinforced concrete wet well and valve vault; installation of two 96-inch diameter diversion structures; installation of two new PVC storm drain pipe segments to connect storm water runoff from the diversion structures to the new SSPS and eventually to the facility Headworks; and installation of new electrical instrumentation and control systems for the new SSPS. The Project also includes landscaping and irrigation system restoration, and partial removal and replacement of existing paved sidewalk and driveway within the perimeter of the facility.

1.1. The Work shall be performed in accordance with:

1.1.1. The Notice Inviting Bids and Plans **42199-1-D through 42199-34-D,** inclusive.

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

See **Appendix E – Location Map**.

3. **CONTRACT TIME:** The Contract Time for completion of the Work shall be **220 Working Days.**

ATTACHMENT B

RESERVED

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 Work Division, Attention Contract Specialist, 1200 3rd Ave., Suite 200, MS 56P, 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 Contractor will obtain the following permits:

    a) Building Permit

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) Report of Geotechnical Investigation Storm Water Diversion at South Bay Water Reclamation Plant (SBWRP), dated April 19, 2021, by Kleinfelder.

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

https://drive.google.com/file/d/1MNFL2mDxCYAgdoL7Dh1poOsso1gcMZ-V/view?usp=sharing

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 Shear Walls for Pump Station

   b) Special Reinforced Concrete Shear Walls for Valve Vault

   c) See Sheet S-2 of plans for complete list

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 issuance of 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.

5-4.2.6 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:

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

b. your products,

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

d. 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.

5-4.5.5 **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.

5-7.1.4 **Emergency Drills.** To the "WHITEBOOK", Item 1, ADD the following:

1. You shall participate in the City's initiated emergency drills. Make yourself familiar with the emergency evacuation routes and procedures in the event of an emergency. Drills are conducted annually and are scheduled a year in advance. Further information prior to bidding is available upon request from our Safety and Security Officer or the Facility Managers for the facility included in the Project. The information includes a listing of dates for upcoming Emergency Evacuation Drills.
2. Reflect the drill activities in the Schedule. Approved delay times caused by unscheduled drills may be added to the Schedule and shall be treated as Extra Work.
3. The payment for complying with this provision shall be included in the Contract Price.

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 Cash Flow Forecast** and use the format shown.

ADD:

6-6.1.1 **Environmental Document.**

1. The City of San Diego has prepared a **Notice of Exception** for **Storm Water Diversion at the South Bay Water Reclamation Plant**, Project No. **B-20002.02.06**, as referenced in the Contract Appendix. You shall comply with all requirements of the **Notice of Exception** 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:

3. The Lump Sum Bid item for ""**96" Diversion Structure with Flexible Duckbill Check Valve**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.1, 96 Diversion Structure with Flexible Duckbill Check Value.

4. The Lump Sum Bid item for "**Pump Station Sheeting & Shoring**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.2, Pump Station Sheeting & Shoring.

5. The Lump Sum Bid item for "**Demolition of Existing Pump Station and Valve Vault**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.3, Demolition of Existing Pump Station and Valve Vault.

6. The Lump Sum Bid item for "**Precast Concrete Packaged Pump Station**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.4, Precast Concrete Packaged Pump Station.

7. The Lump Sum Bid item for "The Lump Sum Bid item for "**Site Electrical - Duct Banks, Pull Boxes & Cabling**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.5, Site Electrical – Duct Banks, Pull Boxes & Cabling.

8. The Lump Sum Bid item for "The Lump Sum Bid item for "**Instrumentation**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.6, Instrumentation.

9. The Lump Sum Bid item for "The Lump Sum Bid item for "**Fiber Optic System Improvements**" shall include all scope referenced in ATTACHMENT E – TECHNICALS, SECTION 01 15 00 Measurement and Payment, Item 1.06 Bid List Item Description, Sub-item A.7, Fiber Optic System Improvements.

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 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 **WPCP.**

TECHNICALS

SECTION 00 01 10

TABLE OF CONTENTS

END OF SECTION

SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Provide the Owner with:
1. Combined storm water and sanitary sewer pump station
2. Valve vault
3. In-line installation of two, 96-inch diversion structures
4. In-kind replacement of 16-foot length,18-inch PVC sanitary sewer from nearest maintenance hole to pump station.
5. 100-foot length of 30-inch PVC Storm Drain from West Diversion Structure to pump station.
6. 15-foot length of 24-inch PVC Storm Drain from East Diversion Structure to pump station.
7. Clearing and grubbing
8. Demolition of existing facilities
9. Maintenance of, and/or highlining of Temporary Bypass for:
   a. 18-inch Sanitary Sewer to headworks:
      (1) Flow Rate: 200 GPM
      (2) Length: 30 feet (approximate)
   b. 24-inch Storm Drain to existing outfall or headworks:
      (1) Flow Rate: 335 GPM
      (2) Length: 60 feet (approximate)
   c. 30-inch Storm Drain to existing outfall or headworks:
      (1) Flow Rate: 920 GPM
      (2) Length: 130 feet (approximate)
   d. 8-inch Excavation Dewatering to headworks:
      (1) Flow Rate: 225 GPM (approximate)
      (2) Length: 50 feet (approximate)
10. The construction of an additional duct bank from the new pump station to the existing UV Control Building.
11. Installation of pipelines, valves, and other related appurtenances within the site.
12. Installation of electrical, instrumentation and control systems.
13. In-kind replacement/salvage of landscaping and irrigation system.
14. In-kind replacement/salvage of curb and sidewalk improvements.
15. Site Restoration to as-found condition.
16. Removal of construction debris.
17. Salvage of designated equipment.

1.02 REFERENCES

A. Work shall be in accordance with:
1. Contract Drawings (Plans),
2. Standard Specifications for Public Works Construction (“Greenbook”) latest edition.
3. San Diego Supplement to the Standard Specifications for Public Works Construction (“Whitebook”) latest edition, Special Provisions, and Technical Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 15 00

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SUBMITTALS

A. Informational Submittals:
   1. Schedule of Values: Submit on Owner's form.
   2. Schedule of Estimated Progress Payments:
      a. Submit with initially accepted Schedule of Values.
      b. Submit adjustments thereto with Application for Payment.
   3. Application for Payment.
   4. Final Application for Payment.

1.02 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of Engineer, provide documentation to support the accuracy of the Schedule of Values.

C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.

D. Lump Sum (LS) Work:
   1. Reflect specified cash and contingency allowances and alternates, as applicable.
   2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.

E. An unbalanced or front-end loaded schedule will not be acceptable.

F. Summation of the complete Schedule of Values representing the Work shall equal the Contract Price.

G. Submit Schedule of Values in a spreadsheet format compatible with latest version of Microsoft Excel.

1.03 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.04 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor.

B. Use detailed Application for Payment Form provided by Owner.

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Engineer.

F. Preparation:
   1. Round values to nearest dollar.
   2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Engineer.

1.05 MEASUREMENT—GENERAL

A. Payment procedures shall be in accordance with the “Greenbook” and the “Whitebook.”

B. Payment for the various items of the Bid Schedule, as further specified herein, shall include compensation to be received by the Contractor for furnishing tools, equipment, supplies, and manufactured articles, and for labor and services, operations, and incidentals appurtenant to items of Work being described here and within the plans, specifications, and Contract Documents, as necessary to complete the various items of the Work in accordance with the requirements of the Contract Documents, including appurtenances thereto, and including costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and costs therefore shall be included in the contract price.

C. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

D. Whenever pay quantities of material are determined by weight, weigh material on scales furnished by Contractor and certified accurate by state agency responsible. Obtain weight or load slip from weigher and deliver to Owner’s representative at point of delivery of material.

E. If material is shipped by rail, car weights will be accepted provided that actual weight of material only will be paid for and not minimum car weight used for assessing freight tariff, and provided further that car weights will not be acceptable for material to be passed through mixing plants.

F. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by Engineer. Each vehicle shall bear a plainly legible identification mark.

G. Haul materials that are specified for measurement by the cubic yard measured in the vehicle in transport vehicles of such type and size that actual contents may be readily and accurately determined. Unless vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. Load vehicles to at least their water level capacity. Loads hauled in vehicles not meeting above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

H. Quantities will be based on ground profiles shown. Field surveys will not be made to confirm accuracy of elevations shown.

I. Where measurement of quantities depends on elevation of existing ground, elevations obtained during construction will be compared with those shown on Drawings. Variations of 1 foot or less will be ignored, and profiles shown on Drawings will be used for determining quantities.

J. Units of measure shown on Bid Form shall be as follows, unless specified otherwise.

Item	Method of Measurement
AC	Acre
CY	Cubic Yard—within limits specified or shown
CY-VM	Cubic Yard—Measured in Vehicle by Volume
EA	Each
GAL	Gallon
HR	Hour
LB	Pound(s)—Weight Measure by Scale
LF	Linear Foot
MFBM	Thousand Foot Board Measure
SF	Square Foot
SY	Square Yard
TON	Ton—Weight Measure by Scale (2,000 pounds)

K. Payment for Lump Sum (LS) Work shown or specified in Contract Documents is included in the Contract Price. Payment will be based on a percentage complete basis for each line item of the accepted Schedule of Values.

L. Each price in the Bid shall constitute full compensation for each item of work completed.

M. The prices for pipe items shall constitute full compensation for pipe, bedding material, laying, jointing, and testing of pipe, excavation, backfill, compaction, excavation support, and clean up.

N. In items involving soil excavation, the price shall be based on excavation of material by means of digging. No separate or additional payment shall be made for removal of rock excavated by digging.

O. Include costs for items and tests required in the Drawings and Specifications. This includes, but is not limited to:
   1. Construction Photographs
   2. Certificate of Design and Proper Installation
   3. Construction Dewatering, Characterization, Treatment and Disposal
   4. Obtaining construction permits required by SFID, or other agency.
   5. Pruning and Protection of Trees and Shrubs

6. Shop Drawing, Work Plan, and sequencing plan Submittals after those required Before and Paid under Mobilization
7. Concrete Testing as Required
8. Cleaning and Testing Newly Installed Utilities
9. Project Signs
10. Site Restoration Not Specifically Included for Payment Elsewhere
11. Preparation and Revisions to the Required CPM Construction Schedule (initial and monthly updates)
12. Project and Utility Coordination
13. Meetings

P. Payment for Lump Sum price items covers labor, materials, and services necessary to furnish and install the following items

1.06 BID LIST ITEM DESCRIPTIONS

A. Payment for lump sum price items covers the labor, materials, and services necessary to furnish and install the following items.
   1. 96" DIVERSION STRUCTURE WITH FLEXIBLE DUCKBILL CHECK VALVE
      a. Measure of Payment: No Measurement shall be made for this item.
      b. Description: Two, 96-inch Precast diversion Structures including a flexible duckbill check valve installed in the outlet line leading to the SSPS and appurtenant work necessary for the complete and operational diversion structure as shown on the plans and specified in the Contract Documents. Contractor shall include excavation fill and disposal of surplus to the pay item for installation of the Diversion Structures.
   2. PUMP STATION SHEETING AND SHORING
      a. Measure of Payment: No Measurement shall be made for this item.
      Description: Price shall constitute full compensation for completion of 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 complete prosecution of the Work, required for temporary or permanent support of structures, pipelines or utilities and required under the provisions of 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.
   3. DEMOLITION OF EXISTING PUMP STATION AND VALVE VAULT
      a. Measure of Payment: No Measurement shall be made for this item.
      b. Description: Includes but is not limited to labor, supervision, materials, equipment, and incidentals required for the Demolition and disposal of the existing items and materials complete as required for the demolition of the facilities as shown on the Drawings.
   4. PRECAST CONCRETE PACKAGED PUMP STATION
      a. Measure of Payment: No Measurement shall be made for this item.
      b. Description: Includes but is not limited to labor, supervision, materials, equipment, and incidentals required for the construction of the pump station including furnishing and installing the packaged pump station, control panel, instrumentation, installation of pump discharge piping, valves, and appurtenances, and appurtenant work necessary for the complete and operational package pump station as shown on the plans and specified in the Contract Documents. 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. Contractor shall include excavation fill and disposal of surplus to the pay item for installation of the Pump Station.

5. SITE ELECTRICAL-DUCT BANKS, PULL BOXES & CABLING
    a. Measure of Payment: No Measurement shall be made for this item.
    b. Description: Procurement and installation of panels, control panels and PLCs not included as part of other bid items; installation of electrical and control ducts, conduits, raceways, junction boxes, switches, circuit breakers, and other components; installation of power, control, and communication wiring and connections to equipment and devices; installation of conduit and electrical equipment support systems and anchors; installation of lighting fixtures and security cameras; electrical studies and appurtenant work necessary for the complete and operational electrical system as shown on the plans and specified in the Contract Documents. as required by the Specifications.
6. INSTRUMENTATION
    a. Measure of Payment: No Measurement shall be made for this item.
    b. Description: Instrumentation not included as part of other bid items.
7. FIBER OPTIC SYSTEM IMPROVEMENTS
    a. Measure of Payment: No Measurement shall be made for this item.
    b. Description: Fiber optic system improvements as shown on Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval.

B. Deferred Submittal: Information submitted by Contractor for portions of design that are to be submitted to permitting agency for approval prior to installation of that portion of the Work, along with Engineer's review documentation that submittal has been found to be in general conformance with Project's design.

C. Informational Submittal: Information submitted by Contractor that requires Engineer's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Electronic Submittals: Submittals may be made in electronic format.
   1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
   2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the document.
   3. PDF files shall be set to open "Bookmarks and Page" view.
   4. Add general information to each PDF file, including title, subject, author, and keywords.
   5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch. No other paper sizes will be accepted.
   6. Submit new electronic files for each resubmittal.
   7. Owner will reject submittal that is not electronically submitted, unless specifically accepted.
   8. Provide Owner with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
   9. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

B. Transmittal of Submittal:
   1. Contractor shall:
      a. Review each submittal and check for compliance with Contract Documents.
      b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
         1) Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Contract Documents.
         2) Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
   2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form in format approved by Owner.

3. Identify each submittal with the following:
    a. Numbering and Tracking System:
        1) Sequentially number each submittal.
        2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
    b. Specification section and paragraph to which submittal applies.
    c. Project title and Engineer's project number.
    d. Date of transmittal.
    e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.

C. Format:
1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual specification section. Do not combine different specification sections together in submittal package, unless otherwise directed in specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

D. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual specification sections.

E. Processing Time:
1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Contractor's submittal and transmit response to Contractor not later than 20 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

F. Resubmittals: Clearly identify each correction or change made.

G. Incomplete Submittals:
1. Engineer will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
    a. Contractor's review stamp; completed and signed.
    b. Transmittal of Contractor's Submittal; completed and signed.
    c. Insufficient number of copies.

H. Submittals not required by Contract Documents:
1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Engineer will keep one copy and return submittal to Contractor.

1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual specification sections.

B. Shop Drawings:
1. Identify and Indicate:
    a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.

b. Equipment and Component Title: Identical to title shown on Drawings.
c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
d. Project-specific information drawn accurately to scale.

2. Manufacturer's standard schematic drawings and diagrams as follows:
   a. Modify to delete information that is not applicable to the Work.
   b. Supplement standard information to provide information specifically applicable to the Work.
3. Product Data: Provide as specified in individual specifications.
4. Deferred Submittal: See Drawings for list of deferred submittals.
   a. Contractor-design drawings and product data related to permanent construction.
      1) Written and graphic information.
      2) Drawings.
      3) Cut sheets.
      4) Data sheets.
      5) Action item submittals requested in individual specification section.
   b. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit required supporting data and drawings for review and acceptance by Engineer. Documentation of review and approval provided on Engineer's comment form, along with completed submittal, will be filed with permitting agency by Owner and approved by permitting agency prior to installation.
5. Foreign Manufacturers: When proposed, include names and addresses of at least two companies that maintain technical service representatives close to Project.

C. Samples:
1. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
   a. Manufacturer name.
   b. Model number.
   c. Material.
   d. Sample source.
2. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
3. Full-size Samples:
   a. Size as indicated in individual specification section.
   b. Prepared from same materials to be used for the Work.
   c. Cured and finished in manner specified.
   d. Physically identical with product proposed for use.

D. Action Submittal Dispositions: Engineer will review, comment, stamp, and distribute as noted:
1. Approved:
   a. Contractor may incorporate product(s) or implement Work covered by submittal.
   b. Distribution: Electronic.
      1) One copy furnished Owner.
      2) One copy furnished Resident Project Representative.
      3) One copy retained in Engineer's file.
      4) Remaining copies returned to Contractor appropriately annotated.
2. Approved as Noted:
   a. Contractor may incorporate product(s) or implement Work covered by submittal, in
   b. Distribution: Electronic.
      1) One copy furnished Owner.
      2) One copy furnished Resident Project Representative.

3) One copy retained in Engineer's file.
4) Remaining copies returned to Contractor appropriately annotated.

3. Partial Approval, Resubmit as Noted:
   a. Make corrections or obtain missing portions and resubmit.
   b. Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
   c. Distribution: Electronic.
      1) One copy furnished Owner.
      2) One copy furnished Resident Project Representative.
      3) One copy retained in Engineer's file.
      4) Remaining copies returned to Contractor appropriately annotated.
4. Revise and Resubmit:
   a. Contractor may not incorporate product(s) or implement Work covered by submittal.
   b. Distribution: Electronic.
      1) One copy furnished Resident Project Representative.
      2) One copy retained in Engineer's file.
      3) Remaining copies returned to Contractor appropriately annotated.

1.04 INFORMATIONAL SUBMITTALS

A. General:
   1. Refer to individual specification sections for specific submittal requirements.
   2. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward copy to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will retain one copy and return remaining copy with review comments to Contractor and require that submittal be corrected and resubmitted.

B. Certificates:
   1. General:
      a. Provide notarized statement that includes signature of entity responsible for preparing certification.
      b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
   2. Welding: In accordance with individual specification sections.
   3. Installer: Prepare written statements on manufacturer's letterhead certifying installer complies with requirements as specified in individual specification section.
   4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
   5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual specification sections.
   6. Manufacturer's Certificate of Compliance: In accordance with Section 01 61 00, Common Product Requirements.
   7. Manufacturer's Certificate of Proper Installation: In accordance with individual specification section.

C. Closeout Submittals: In accordance with Greenbook.

D. Contractor-design Data (related to temporary construction):
   1. Written and graphic information.
   2. List of assumptions.
   3. List of performance and design criteria.

4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual specification section.

E. Deferred Submittals: See Drawings for list of deferred submittals.
   1. Contractor-design data related to permanent construction:
      a. List of assumptions.
      b. List of performance and design criteria.
      c. Summary of loads or load diagram, if applicable.
      d. Calculations.
      e. List of applicable codes and regulations.
      f. Name and version of design software.
      g. Factory test results.
      h. Informational submittals requested in individual specification section.
   2. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit calculations and test results of Contractor-designed components for review by Engineer. Documentation of review and indication of compliance with general design intent and project criteria provided on Engineer's comment form as meets conditions of the Contract, along with completed submittal, will be filed with permitting agency by Owner and approved by permitting agency prior to installation.

F. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual specification section.

G. Operation and Maintenance Data: As required in Section 01 78 23, Operation and Maintenance Data.

H. Payment:
   1. Application for Payment: In accordance with Section 01 15 00 Measurement and Payment.
   2. Schedule of Values: In accordance with Section 01 15 00 Measurement and Payment.
   3. Schedule of Estimated Progress Payments: In accordance with Section 01 15 00 Measurement and Payment.

I. Schedules:
   1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule.
      a. Show for each, at a minimum, the following:
         1) Specification section number.
         2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
         3) Estimated date of submission to Engineer, including reviewing and processing time.
      b. On a monthly basis, submit updated Schedule of Submittals to Engineer if changes have occurred or resubmittals are required.
   2. Progress Schedules

J. Special Guarantee: Supplier's written guarantee as required in individual specification sections.

K. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

L. Submittals Required by Laws, Regulations, and Governing Agencies:
   1. Promptly submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
   2. Transmit to Engineer for Owner's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

M. Test, Evaluation, and Inspection Reports:
   1. General: Shall contain signature of person responsible for test or report.
   2. Factory:
      a. Identification of product and specification section, type of inspection or test with referenced standard or code.
      b. Date of test, Project title and number, and name and signature of authorized person.
      c. Test results.
      d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      e. Provide interpretation of test results, when requested by Engineer.
      f. Other items as identified in individual specification sections.
   3. Field Reports:
      a. Project title and number.
      b. Date and time.
      c. Record of temperature and weather conditions.
      d. Identification of product and specification section.
      e. Type and location of test, Sample, or inspection, including referenced standard or code.
      f. Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
      g. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      h. Provide interpretation of test results, when requested by Engineer
      i. Other items as identified in individual specification sections.

N. Testing and Startup Data: In accordance with Section 01 91 14, Testing, Integration, and Startup

O. Training Data: In accordance with individual specification section.

1.05 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this specification.
   1. Forms: Transmittal of Contractor's Submittal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 33

SPECIAL INSPECTION, OBSERVATION, AND TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section covers requirements for Special Inspection, Observation, and Testing required in accordance with Chapter 17 of the 2019 CBC and is in addition to and supplements requirements included in Statement of Special Inspections shown on Drawings.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
   2. 2019 California Building Code (CBC) by California Building Standards Commission.
   3. International Code Council (ICC):
      a. International Building Code (IBC).
      b. Evaluation Service (ICC-ES) Reports and Legacy Reports.

1.03 SUBMITTALS

A. Informational Submittals:
   1. Contractor's Statement of Responsibility: Form shall be completed by entity responsible for construction of and main seismic-force-resisting system, seismic-resisting component listed in Statement of Special Inspections. Refer to Article Supplements, located at end of section.
   2. Fabricator's Certificate of Compliance: Form shall be completed by entity responsible for shop fabrication of structural load-bearing members and assemblies. Refer to Article Supplements, located at end of section. Form must be submitted no less than 2 weeks prior to commencing fabrication to provide for approval by Authority Having Jurisdiction (AHJ) and scheduling of Special Inspection, where required.

1.04 DEFINITIONS

A. Agencies and Personnel:
   1. Agency Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.
   2. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
   3. Registered Design Professional in Responsible Charge: An individual who is registered or licensed to practice their respective design profession as defined by statutory

requirements of professional registration laws of state or jurisdiction in which Project is to be constructed.

4. Special Inspector: Qualified person employed by Contractor who will demonstrate competence to the satisfaction of AHJ for inspection of a particular type of construction or operation requiring Special Inspection.

B. Statement of Special Inspections: Detailed written procedure contained on Drawings establishing systems and components subject to Special Inspection, Observation, and Testing during construction, type and frequency of testing, extent and duration of Special Inspection, and reports to be completed and distributed by Special Inspector.

C. Special Inspection:
   1. Special Inspection: Inspection required of materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved Contract Documents and referenced standards.
   2. Special Inspection, Continuous: Full-time observation of work requiring Special Inspection by an approved Special Inspector who is present in area where the Work is being performed.
   3. Special Inspection, Periodic: Part-time or intermittent observation of the Work requiring Special Inspection by an approved Special Inspector who is present in area where the Work has been or is being performed, and at completion of the Work.

D. Structural Systems and Components:
   1. Diaphragm: Component of structural lateral load resisting system consisting of roof, floor, or other membrane or bracing system acting to transfer lateral forces to vertical resisting elements of structure.
   2. Drag Strut or Collector: Component of structural lateral load resisting system consisting of diaphragm or shear wall element that collects and transfers diaphragm shear forces to vertical force-resisting elements or distributes forces within diaphragm or shear wall.
   3. Seismic-Force-Resisting System: That part of structural lateral load resisting system that has been considered in the design to provide required resistance to seismic forces identified on Drawings.
   4. Shear Wall: Component of structural lateral load resisting system consisting of a wall designed to resist lateral forces parallel to plane of the wall. Unless noted otherwise on Drawings, load-bearing walls with direct in-plane connections to roof and floors shall be considered to be shear walls.
   5. Wind Force Resisting System: That part of the structural system that has been considered in the design to provide required resistance to wind forces identified on Drawings.

E. Nonstructural Components:
   1. Architectural Component Supports: Structural members or assemblies of members which transmit loads and forces from architectural systems or components to structure, including braces, frames, struts, and attachments.
   2. Electrical Component Supports: Structural members or assemblies which transmit loads and forces from electrical equipment to structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.
   3. Mechanical and Plumbing Component Supports: Structural members or assemblies which transmit loads and forces from mechanical or plumbing equipment to structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

F. Professional Observation:
   1. Does not include or waive responsibility for required Special Inspection or inspections by building official.
   2. Requirements are indicated on Statement of Special Inspections provided on Drawings.
   3. Geotechnical Observation: Visual observation of formational materials exposed during grading and overexcavation of selected subgrade bearing surfaces and installation of deep foundation elements by a registered design professional for general conformance to Contract Documents.
   4. Structural Observation: Visual observation of structural system(s) by a registered design professional for general conformance to Contract Documents.
   5. Observation: Visual observation by registered design professional for general conformance to Contract Documents.

1.05 STATEMENT OF SPECIAL INSPECTIONS REQUIREMENTS

A. Designated Systems for Inspection:
   1. Seismic-force-resisting systems designated under CBC Section 1705 and subject to Special Inspection under Section 1705: See Drawings for basic lateral load resisting systems for each structure and other designated seismic systems.
   2. Wind-force-resisting systems designated under CBC Section 1705: None required.
   3. Architectural, plumbing, mechanical, and electrical Components subject to Special Inspection under CBC Section 1705.12.5 and 1705.12.6 for Seismic Resistance.
   4. As included in Drawings and in support of building permit application, Project-specific requirements were prepared by Registered Design Professional in Responsible Charge.

B. Statement of Special Inspections:
   1. As included on Drawings and in support of building permit application, Project-specific requirements were prepared by Registered Design Professional in Responsible Charge. The following identifies elements of inspection, observation, and testing program to be followed in construction of the Work:
      a. Designated seismic systems and main seismic force resisting systems and components that are subject to Special Inspection and Structural Observation for lateral load resistance.
      b. Special Inspection and testing required by CBC Section 1705 and other applicable sections and referenced standards therein.
      c. Type and frequency of Special Inspection required.
      d. Type and frequency of testing required.
      e. Required frequency and distribution of testing and Special Inspection reports to be distributed by Special Inspector to Construction Manager, Design Engineer, Contractor, building official, and Owner.
      f. Geotechnical Observation to be Performed: Required frequency and distribution of Geotechnical Observation reports by registered design professional to Contractor, building official, and Owner.
      g. Structural Observations to be Performed: Required frequency and distribution of Structural Observation reports by registered design professional to Contractor, building official, and Owner.

C. Special Inspection and associated testing of shop fabrication and field construction will be performed by an approved accredited independent agency or by Authority Having Jurisdiction's (AHJ) approved, qualified inspection staff. Owner will secure and pay for services of agency to perform Special Inspection and associated testing.

D. Code required Special Inspection with associated testing and Professional Observation, as provided in Statement of Special Inspections on Drawings and further provided in this section, is for benefit of Owner and does not:
   1. Relieve Contractor of responsibility for providing adequate quality control measures.
   2. Relieve Contractor of responsibility for damage to or loss of material before acceptance.
   3. Constitute or imply acceptance.
   4. Affect continuing rights of Owner after acceptance of completed Work.

E. The presence or absence of code required Special Inspector and Professional Observer does not relieve Contractor from Contract requirements.

F. Contractor is responsible for additional costs associated with Special Inspection and Testing and Observation when Work is not ready at time identified by Contractor and Special Inspectors and Professional Observer are onsite, but not able to provide contracted services.

G. Contractor is responsible for associated costs for additional Special Inspection and Testing and Professional Observation by Special Inspectors and Professional Observers required because of rejection of materials of in place Work that cannot be made compliant to Contract Document without additional inspections and observation and testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Requirements of the Statement of Special Inspections are provided by the Owner. Other testing and inspections, unless noted otherwise, are provided by Contractor.

B. Provide access to shop or Site for Special Inspection and Testing and Professional Observation requirements.

C. Notify Construction Manager in advance of required Special Inspection and Professional Observation no later than 48 hours prior to date of Special Inspection and Professional Observation.

D. Provide access for Special Inspector to construction documents.

E. Retain special inspection records onsite to be readily available for review.

F. Cooperate with Special Inspector and provide safe access to the Work to be inspected.

G. Submit Fabricator's Certificates of Compliance for approved fabricators.

H. Provide reasonable auxiliary services as requested by the Special Inspector. Auxiliary services required include, but not limited to:
   1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests to assist the Special Inspector in performing test/inspections.
   2. Providing storage space for the Special Inspector’s exclusive use, such as for storing and curing concrete test samples and delivery of samples to testing laboratories.
   3. Providing the Special Inspector with access to approved submittals.
   4. Providing security and protection of samples and test equipment at the Project Site.
   5. Provide samples of materials to be tested in required quantities.

I. When required by Registered Design Professional in Responsible Charge, provide access for plumbing, mechanical and electrical component inspections for those items requiring certification.

J. Materials and systems shall be inspected during placement where Continuous Special Inspection is required.

K. Where Periodic Special Inspection is indicated in the Statement of Special Inspections:
   1. Schedule inspections for either during or at completion of their placement or a combination or both.
   2. Schedule periodically inspected Work (either inspected during or after its placement) so that corrections can be completed and re-inspected before Work is inaccessible.
   3. Sampling a portion of the Work is not allowed. Schedules shall provide for inspection of Work requiring periodic inspection.

3.02 AHJ INSPECTIONS

A. Schedule AHJ inspections required to fulfill Project permit requirements, including to Building and Fire Department inspections associated with Owner or County Building Permits, Fire Protection Permits and Hazardous Materials Permitting.

3.03 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this Specification
   1. Contractor’s Statement of Responsibility.
   2. Fabricator’s Certificate of Compliance

CONTRACTOR'S STATEMENT OF RESPONSIBILITY

_____
(Project)

_____
(Name of Contracting Company)

_____
(Business Address)

(_____) _____ (_____) _____
(Telephone) (Fax)

I, (We) hereby certify that I am (we are) aware of the Special Inspection and Testing and Professional Observation requirements contained in Contract Documents for this Project for seismic force-resisting systems and for components including architectural, mechanical, and electrical components as listed in Statement of Special Inspections on Drawings, and that:

1. I, (We) aware of the systems and the requirements of the special inspection and acknowledge our responsibility in the implementation of the Statement of Special Inspections for the construction of the following systems:

Facility	**Specification**	**Lateral Force-Resisting System**
Pump Station		Special Reinforced Concrete Shear Walls
Valve Vault		Special Reinforced Concrete Shear Walls

2. Control of this Work will be exercised to obtain conformance with Contract Documents approved by building official.

3. Procedures within the Contractor's organization to be used for exercising control of the Work, method and frequency of reporting, and distribution of reports required under Statement of Special Inspections for Project are attached to this statement.

4. I, (We) will provide 48-hour notification to Construction Manager and approved inspection agency as required for structural tests and Special Inspection for Project.

5. The following person is hereby identified as exercising control over requirements of this section for the Work designated above:

Name: _____

Qualifications: _____

_____

_____

(Print name and official title of person signing this form)

Signed by: _____

Date: _____

Project Name: _____

FABRICATOR'S CERTIFICATE OF COMPLIANCE

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per Section 2016 CBC must submit Fabricator's Certificate of Compliance at the completion of fabrication.

_____
(Project)

_____
(Fabricator's Name)

_____
(Business Address)

_____
(Certification or Approval Agency)

_____
(Certification Number)

_____
(Date of Last Audit or Approval)

Description of structural members and assemblies that have been fabricated:

_____

_____

_____

_____

_____

I hereby certify that items described above were fabricated in strict accordance with approved construction documents.

_____
(Name and Title) type or print

_____
(Signature and Date)

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

END OF SECTION

SECTION 01 61 00

COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 DEFINITIONS

A. Products:
   1. New items for incorporation in the Work, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock, and may also include existing materials or components required for reuse.
   2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
   3. Items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.02 DESIGN REQUIREMENTS

A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of the California Building Code (CBC).
   1. Wind: Basic wind speed, V: 115 mph, with exposure category C.
   2. Seismic: Risk Category IV, importance factor, I, of 1.5, Site Class C, mapped maximum considered earthquake, 5 percent damped, spectral response at short periods, Ss, 1.06g, mapped maximum considered earthquake, 5 percent damped, spectral response at a period of 1 second, S1 0.41, unless specified otherwise.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 700 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 32 degrees F to 110 degrees F.

1.04 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:
   1. Furnish as required by individual Specifications.
   2. Schedule:
      a. Ensure that shipment and delivery occurs concurrent with shipment of associated equipment.
      b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
   3. Packaging and Shipment:
      a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
      b. Prominently displayed on each package, the following:
         1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
         2) Applicable equipment description.
         3) Quantity of parts in package.
         4) Equipment manufacturer.
      c. Deliver materials to Site.
   4. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.

D. Request a minimum 7-day advance notice of shipment from manufacturer. Upon receipt of manufacturer's advance notice of shipment, promptly notify Engineer of anticipated date and place of arrival.

E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.05 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.06 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Store in Owner approved storage yards or sheds. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.

B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.

E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.

H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual Specifications.

B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.

C. For convenience in designation in the Specifications and Plans, certain articles, or materials to be incorporated in the work may be designated under a trade name or the name of a manufacturer and its catalog information. The use of an alternative or substitute article or material that is of equal quality ("or equal") and of the required characteristics for the purpose intended will be permitted, subject to the following requirements:
   1. The Contractor is responsible for any changes or outcomes resulting from substitutions including structural, piping, mechanical, electrical, instrumentation, or other such changes whatsoever.
   2. The burden of proof as to the quality and suitability of alternatives must be upon the Contractor and the Contractor must furnish such information as necessary or required by the Specifications to demonstrate the quality and suitability of the proposed alternative. The Owner must be the sole judge as to the quality and suitability of alternative articles or materials and their decision is final.
   3. Whenever a substitution is planned by the Contractor, no tests or action relating to the approval of such substitute material or article will be made until the request for substitution is approved by the Owner. Such request by the Contractor must be made within a minimum of 14 days before procurement or as otherwise specified in the Technical Specifications

D. The Contractor may submit an equal for named manufactures and products, unless otherwise specified. Supplementary information shall be provided by Contractor if requested by Owner for approved equals. The Contractor is responsible for insuring equals are in conformance with the Contract Documents.

E. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.

F. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

G. Provide interchangeable components of the same manufacturer, for similar components, unless otherwise specified.

H. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.

I. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.

J. Safety Guards: Provide for belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

K. Authority Having Jurisdiction (AHJ):
   1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
   2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

L. Equipment Finish:
   1. Provide manufacturer's standard finish and color, except where specific color is indicated.
   2. If manufacturer has no standard color, provide equipment with finish as approved by Owner.

M. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance.

N. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

O. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
   1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 FABRICATION AND MANUFACTURE

A. General:
   1. Manufacture parts to U.S.A. standard sizes and gauges.
   2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
   3. Design structural members for anticipated shock and vibratory loads.
   4. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
   5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:
   1. Require no more than weekly attention during continuous operation.
   2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform.
   3. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
   4. Provide constant-level oilers or oil level indicators for oil lubrication systems.
   5. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor’s control.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.

B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.

D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.03 INSTALLATION

A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer.

F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain a copy of manufacturers' instruction at Site, available for review.

G. For material and equipment specifically indicated or specified to be reused in the Work:
   1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
   2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.04 FIELD FINISHING

A. In accordance with Section 09 90 00, Painting and Coating, and individual Specification sections.

3.05 ADJUSTMENT AND CLEANING

A. Perform required adjustments, tests, operation checks, and other startup activities.

3.06 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

3.07 SUPPLEMENTS

A. The supplement listed below, following "End of Section", is part of this specification.

1. Form: Manufacturer’s Certificate of Compliance.

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER:_____ PRODUCT, MATERIAL, OR SERVICE

PROJECT NAME: _____ SUBMITTED: _____

PROJECT NO:_____

Comments: _____

_____

_____

_____

_____

_____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with applicable requirements. I further certify that the product, material, or service are of the quality specified and conforms in respect with the Contract requirements and are in the quantity shown.

Date of Execution:_____, 20_____

Manufacturer:_____

Manufacturer's Authorized Representative *(print)*: _____

_____

(Authorized Signature)

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual Specification sections.

1.02 DEFINITIONS

A. Preliminary Data: Initial and subsequent submissions for Engineer's review.

B. Final Data: Engineer-accepted data, submitted as specified herein.

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

1.03 SEQUENCING AND SCHEDULING

A. Equipment and System Data:
   1. Preliminary Data:
      a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
      b. Submit prior to shipment date.
   2. Final Data: Submit Instructional Manual Formatted data not less than 30 days prior to installation of equipment or system equipment or system field functional testing. Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.

B. Materials and Finishes Data:
   1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
   2. Final Data: Submit within 10 days after final inspection.

1.04 DATA FORMAT

A. Prepare preliminary data in the form of an instructional manual. Prepare final data on electronic media.

B. Instructional Manual Format:
   1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
   2. Size: 8-1/2 inches by 11-inches, minimum.
   3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
      a. Project title.
      b. Designate applicable system, equipment, material, or finish.
      c. Identity of separate structure as applicable.

d. Identify volume number if more than one volume.
e. Identity of general subject matter covered in manual.
f. Identity of equipment number and Specification section.

4. Spine:
   a. Project title.
   b. Identify volume number if more than one volume.
5. Title Page:
   a. Contractor name, address, and telephone number.
   b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
      1) Identify area of responsibility of each.
      2) Provide name and telephone number of local source of supply for parts and replacement.

C. Table of Contents:
1. Neatly typewritten and arranged in systematic order with consecutive page numbers.
2. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
3. Paper: 20-pound minimum, white for typed pages.
4. Text: Manufacturer's printed data, or neatly typewritten.
5. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
6. Material shall be suitable for reproduction, with quality equal to original.
7. Photocopying of material will be acceptable, except for material containing photographs.

D. Final Compilation Electronic Media Format:
1. Portable Document Format (PDF):
   a. After preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on flash drive.
   b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
   c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

1.05 SUBMITTALS

A. Informational:
1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
   a. Submit two copies for Engineer's review.
   b. If data meets conditions of the Contract:
      1) One copy will be returned to Contractor.
      2) One copy will be forwarded to Resident Project Representative.
      3) One copy will be retained in Engineer's file.
   c. If data does not meet conditions of the Contract:
      1) Copies will be returned to Contractor with Engineer's comments (on separate document) for revision.
      2) Engineer's comments will be retained in Engineer's file.
      3) Resubmit two copies revised in accordance with Engineer's comments.
3. Final Data: Submit two copies in format specified herein.

1.06 DATA FOR EQUIPMENT AND SYSTEMS

A. Content for Each Unit (or Common Units) and System:

1. Product Data:
    a. Include only those sheets that are pertinent to specific product.
    b. Clearly annotate each sheet to:
        1) Identify specific product or part installed.
        2) Identify data applicable to installation.
        3) Delete references to inapplicable information.
    c. Function, normal operating characteristics, and limiting conditions.
    d. Performance curves, engineering data, nameplate data, and tests.
    e. Complete nomenclature and commercial number of replaceable parts.
    f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
    g. Spare parts ordering instructions.
    h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).
2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
    a. Format:
        1) Provide reinforced, punched, binder tab; bind in with text.
        2) Reduced to 8-1/2 inches by 11-inches, or 11-inches by 17-inches folded to 8-1/2 inches by 11-inches.
        3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
        4) Identify Specification section and product on Drawings and envelopes.
    b. Relations of component parts of equipment and systems.
    c. Control and flow diagrams.
    d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
    a. Format:
        1) Organize in consistent format under separate heading for each different procedure.
        2) Provide logical sequence of instructions for each procedure.
        3) Provide information sheet for Owner's personnel, including:
            a) Proper procedures in event of failure.
            b) Instances that might affect validity of guarantee or Bond.
    b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
    c. Operating Procedures:
        1) Startup, break-in, routine, and normal operating instructions.
        2) Test procedures and results of factory tests where required.
        3) Regulation, control, stopping, and emergency instructions.
        4) Description of operation sequence by control manufacturer.
        5) Shutdown instructions for both short and extended duration.
        6) Summer and winter operating instructions, as applicable.
        7) Safety precautions.
        8) Special operating instructions.
    d. Maintenance and Overhaul Procedures:
        1) Routine maintenance.
        2) Guide to troubleshooting.
        3) Disassembly, removal, repair, reinstallation, and re-assembly.
6. Guarantee, Bond, and Service Agreement

B. Content for Each Electric or Electronic Item or System:
   1. Description of Unit and Component Parts:
      a. Function, normal operating characteristics, and limiting conditions.
      b. Performance curves, engineering data, nameplate data, and tests.
      c. Complete nomenclature and commercial number of replaceable parts.
      d. Interconnection wiring diagrams, including control and lighting systems.
   2. Circuit Directories of Panelboards:
   3. Electrical service.
   4. Control requirements and interfaces.
   5. Communication requirements and interfaces.
   6. List of electrical relay settings, and control and alarm contact settings.
   7. Electrical interconnection wiring diagram, including as applicable, single- line, three-line, schematic and internal wiring, and external interconnection wiring.
   8. As-installed control diagrams by control manufacturer.
   9. Operating Procedures:
      a. Routine and normal operating instructions.
      b. Startup and shutdown sequences, normal and emergency.
      c. Safety precautions.
      d. Special operating instructions.
   10. Maintenance Procedures:
      a. Routine maintenance.
      b. Guide to troubleshooting.
      c. Adjustment and checking.
      d. List of relay settings, control and alarm contact settings.
   11. Manufacturer's printed operating and maintenance instructions.
   12. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:
   1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.
   2. Format:
      a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
      b. Each Maintenance Summary may take as many pages as required.
      c. Use only 8-1/2-inch by 11-inch size paper.
      d. Complete using typewriter or electronic printing.
   3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
   4. Recommended Spare Parts:
      a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
      b. "Unit" is the unit of measure for ordering the part.
      c. "Quantity" is the number of units recommended.
      d. "Unit Cost" is the current purchase price.

1.07 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:
   1. Manufacturer's data, giving full information on products:
      a. Catalog number, size, and composition.
      b. Color and texture designations.

c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to product.
   c. Recommended schedule for cleaning and maintenance.

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

1.08 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Specification.
1. Forms: Maintenance Summary Form.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

MAINTENANCE SUMMARY FORM

PROJECT:_____CONTRACT NO.:_____

1. EQUIPMENT ITEM _____
2. MANUFACTURER _____
3. EQUIPMENT/TAG NUMBER(S) _____
4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____
5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____
6. MANUFACTURER'S LOCAL REPRESENTATIVE

   a. Name_____Telephone No. _____

   b.Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	Frequency	Lubricant (If Applicable)
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

8. LUBRICANT LIST

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

SECTION 01 88 15

ANCHORAGE AND BRACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section covers requirements for anchorage and bracing of equipment, distribution systems, and other nonstructural components required in accordance with the California Building Code (CBC), for seismic, wind, gravity, soil, and operational loads.

1.02 REFERENCES

A. Definitions:
   1. Authority Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.
   2. Designated Seismic System: Architectural, electrical, and mechanical system or their components for which component importance factor is greater than 1.0.

B. Related specifications:
   1. 01 45 33 – Special Inspection, Observation, and Testing
   2. 01 61 00 – Common Product Requirements
   3. 05 50 00 – Metal Fabrications

C. Referenced standards:
   1. American Institute of Steel Construction (AISC) 360, Specification for Structural Steel Buildings.
   2. American Society of Civil Engineers (ASCE): ASCE 7, Minimum Design Loads for Buildings and Other Structures.
   3. California Building Code (CBC).

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. General:
   1. Anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of California.
   2. Design anchorage and bracing of architectural, mechanical, and electrical components and systems in accordance with this section, unless a design is specifically provided within Contract Documents or where exempted hereinafter.
   3. Design attachments, braces, and anchors for equipment, components, and distribution systems to structure for gravity, seismic, wind, and operational loading.
   4. Anchor and brace piping and ductwork, whether exempt or not exempt for this section, so that lateral or vertical displacement does not result in damage or failure to essential architectural, mechanical, or electrical equipment.

5. Architectural Components: Includes, but are not limited to, nonstructural walls and elements, partitions, cladding and veneer, access flooring, signs, cabinets, suspended ceilings, and glass in glazed curtain walls and partitions.
6. Provide supplementary framing where required to transfer anchorage and bracing loads to structure.
7. Adjust equipment pad sizes or provide additional anchorage confinement reinforcing to provide required anchorage capacities.
8. Design anchorage and bracing for:
    a. Equipment and components that weigh more than 400 pounds and has a center of mass located 4 feet or more above adjacent finished floor.
    b. Equipment weighing more than 20 pounds that is mounted to the wall or roof/ceiling suspended.
    c. Mechanical and electrical components that are not provided with flexible connections between components and associated ductwork, piping, or conduit.
    d. Distribution systems that weigh more than 5 pounds per foot that are wall mounted or ceiling/roof suspended.
9. Design seismic anchorage and bracing for Designated Seismic Systems regardless of weight or mounting height.
    a. Component Importance Factor:
        1) Per Section 01 61 00 – Common Product Requirements.
10. For components exempted from design requirements of this section, provide bolted, welded, or otherwise positively fastened attachments to supporting structure.

B. Design Loads:
1. Gravity: Design anchorage and bracing for self-weight and superimposed loads on components and equipment.
2. Wind: Design anchorage and bracing for wind criteria provided in Section 01 61 00 – Common Product Requirements and on General Structural Notes on Drawings for exposed architectural components and exterior and wind- exposed mechanical and electrical equipment. Alternately, manufacturer certification may be provided for components such as roofing and flashing to verify attachments meet Project-specific design criteria.
3. Operational:
    a. For loading supplied by equipment manufacturer for CBC required load cases.
    b. Loads may include equipment vibration, torque, thermal effects, effects of internal contents (weight and sloshing), water hammer, and other load-inducing conditions.
    c. Locate braces to minimize vibration to or movement of structure.
    d. For vibrating loads, use anchors meeting requirements of Section 05 50 00, Metal Fabrications, for anchors with designated capacities for vibratory loading per manufacturer's ICC-ES report.
4. Seismic:
    a. Design anchorage and bracing for criteria listed in Section 01 61 00 – Common Product Requirements and the General Structural Notes on the Drawings.

C. Seismic Design Requirements:
1. Nonstructural Components: Design as nonbuilding structures for components with weights greater than or equal to 25 percent of effective seismic weight of overall structure.
2. Analyze local region of body of nonstructural component for load transfer of anchorage attachment if component Ip = 1.5.
3. The following are exempt from requirements for provision of seismic anchorages and bracing, in addition to those items specifically exempted in ASCE 7, Part 13.5 for architectural components and Part 13.6 for electrical and mechanical equipment:

a. Furniture, except storage cabinets and bookshelves over 6 feet tall.
b. Temporary or movable equipment.

4. Provide support drawings and calculations for electrical distribution components if any of the following conditions apply:
   a. Ip is equal to 1.5 and conduit diameter is greater than 2.5-inch trade size.
   b. Ip is equal to 1.5 and the total weight of bus duct, cable tray, or conduit supported by trapeze assemblies exceeds 10 pounds per foot.
   c. Supports are cantilevered up from floor.
   d. Supports include bracing to limit deflection and are constructed as rigid welded frames.
   e. Attachments utilize spot welds, plug welds, or minimum size welds as defined by AISC.
5. Provide support drawings and calculations for electrical distribution components if any of the following conditions apply:
   a. Conduit diameter is greater than 2.5-inch trade size.
   b. Total weight of bus duct, cable tray, or conduit supported by trapeze assemblies exceeds 10 pounds per foot.

1.04 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. List of architectural, mechanical, and electrical equipment requiring Contractor-designed anchorage and bracing, unless specifically exempted.
      b. Manufacturers' engineered seismic and non-seismic hardware product data sealed by a civil or structural engineer registered in the State of California.
      c. Attachment assemblies' drawings including seismic attachments; include connection hardware, braces, and anchors or anchor bolts for nonexempt components, equipment, and systems.
      d. Submittal will be rejected if proposed anchorage method would create excessive stress to supporting member. Revise anchorages and strengthen structural support to eliminate overstressed condition.

B. Informational Submittals:
   1. Anchorage and Bracing Calculations: For attachments, braces, and anchorages, include CBC and Project-specific criteria as noted on General Structural Notes on Drawings, in addition to manufacturer's specific criteria used for design; sealed by a civil or structural engineer registered in the State of California.
   2. Manufacturer's hardware installation requirements.

1.05 SOURCE QUALITY CONTROL

A. Contractor and supplier responsibilities to accommodate Owner-furnished shop fabrication related special inspections and testing are provided in Project's Statement of Special Inspections on Drawings, and Section 01 45 33, Special Inspection, Observation, and Testing.

B. Provide other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

C. Provide Source Quality Control for welding and hot-dip galvanizing of anchors in accordance with Section 05 50 00, Metal Fabrications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Design and construct attachments and supports transferring seismic and non- seismic loads to structure of materials and products suitable for application and in accordance with design criteria shown on Drawings and nationally recognized standards.

B. Provide anchor bolts for anchorage of equipment to concrete in accordance with Section 05 50 00, Metal Fabrications. Provide anchor bolts of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

C. Provide post-installed anchors of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer. Post-installed anchors shall have a current ICC-ES Report for use in cracked concrete and for short-term and long-term loads including wind and earthquake.

D. Do not use powder-actuated fasteners or sleeve anchors for seismic attachments and anchorage where resistance to tension loads is required. Do not use expansion anchors, other than undercut anchors, for non-vibration isolated mechanical equipment rated over 10 horsepower.

PART 3 - EXECUTION

3.01 GENERAL

A. Make attachments, bracing, and anchorage in such a manner that component lateral force is transferred to lateral force resisting system of structure through a complete load path.

B. Design, provide, and install overall seismic anchorage system to provide restraint in directions, including vertical, for each component or system so anchored.

C. Provide snubbers in each horizontal direction and vertical restraints for components mounted on vibration isolation systems where required to resist overturning.

D. Provide piping anchorage that maintains design flexibility and expansion capabilities at flexible connections and expansion joints.
   1. Piping and ductwork suspended more than 12 inches below supporting structure shall be braced for seismic effects to avoid significant bending of hangers and their attachments.

E. Anchor tall and narrow equipment such as motor control centers and telemetry equipment at base and within 12 inches from top of equipment, unless approved otherwise by Engineer.

F. Do not attach architectural, mechanical, or electrical components to more than one element of a building structure at a single restraint location where such elements may respond differently during a seismic event. Do not make such attachments across building expansion and contraction joints.

3.02 INSTALLATION

A. Do not install components or their anchorages or restraints prior to review and acceptance by Engineer and AHJ.

B. Notify Engineer upon completion of installation of seismic restraints in accordance with Section 01 45 33, Special Inspection, Observation, and Testing.

3.03 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. In accordance with Section 05 50 00, Metal Fabrications.

B. Owner-Furnished Quality Assurance, in accordance with 2016 CBC requirements, is provided in Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

C. Provide any other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

SECTION 01 91 14

TESTING, INTEGRATION, AND STARTUP

PART 1 - GENERAL

1.01 SUMMARY

A. The goal of testing, integration, and startup is to verify proper performance and operation of the pump station.

1.02 DEFINITIONS

A. Acceptance Testing: A contractually required, specific and measurable test, often with liquidated damages attached, to demonstrate a system or facility performs to its intended function (e.g., flow amounts, duration and quality criteria are met). Major defects are resolved at this point.

B. Controls Integrator: Entity who is responsible for the programming of the pump station controls systems.

C. Commissioning:
   1. The disciplined and systematic process of assuring that components, subsystems and systems of a constructed unit are designed, installed, tested and operated in conformance with the design intent, and functional intent and operational requirements of the Owner.
   2. This includes:
      a. Proof testing of design intent using static check sheets, dynamic check sheets and defined procedures to ensure compliance with design drawings, data sheets and specifications.
      b. Achieving a smooth and safe transition from an inert state to a completely tested, clean, leak tight, operable and safe unit ready for start-up and performance testing.

D. Components: Individual items of equipment or portions of the Work that when combined with other components make up subsystems or systems. Components may be minor items such as pressure gauges, or they may be significant items such as pump motors.

E. Contract Documents: Construction Contract, Specifications and Drawings.

F. Factory Acceptance Testing (FAT): Testing required to be conducted at the fabricator's/manufacturer's/vendor's off-site locations, witnessed or unwitnessed. Includes all such testing, regardless of the specific descriptive title used for said testing in the Contract Documents.

G. Final Completion: Refer to the Contract Requirements and Supplementary Provisions.

H. Functional Testing: A test of a given component, subsystem or system to confirm its operation meets specifications and Contract requirements. Often a prerequisite to Acceptance Testing.

I. Major Equipment Systems: Systems, subsystems, or major equipment components selected by the Owner as critical to the operation and function of the Work. Major equipment systems are more specifically identified in the Contract Documents.

J. Manufacturer's Installation Inspection: Preliminary inspection conducted by Manufacturer or Manufacturer's accepted representative to confirm proper installation of components, systems, and sub-systems.

K. Mechanical/Electrical Functional Testing: Testing performed to confirm general performance of mechanical and electrical systems. Hydrostatic leak testing of pipes is an example. Electrical testing specified in Division 26, Electrical, shall be considered Mechanical/Electrical Functional Testing.

L. Performance Test: A defined test of a system, systems or facility over a specified period of time to demonstrate the system or facility is fully operational and meets specifications, performance objectives and Contract requirements. Performance testing will be done with clean water and wastewater, as defined with these Contract Documents.

M. Startup: The act of starting or operating a component, subsystem or system and testing its functionality and performance against defined metrics.

N. Systems: A group of related components, equipment or subsystems that perform a defined function or set of functions within a facility.

1.03 SUBMITTALS

A. Action Submittals:
   1. Startup Personnel Qualifications: The qualifications submittal for the Startup Manager and Project Integrator shall be provided at the Preconstruction Conference.
   2. Startup and Test Plans: Submitted within 60 days after Notice to Proceed.
   3. Factory Acceptance Test Plans.
   4. Startup and Testing Schedule:
      a. Schedule shall be a snapshot of the overall Project Schedule.
      b. Schedule may not be a separate schedule from overall Project Schedule.
      c. Schedule shall be submitted in hard copy and electronic version.
   5. Startup Results Submittal:
      a. Include the following:
         1) Results documentation from Factory Acceptance Testing.
         2) Completed test plans (endorsed by Construction Manager and Contractor).

1.04 ORGANIZATION OF STARTUP PHASES

A. The following table summarizes the various phases of startup:

Description	Duration	Preceding Constraints	Comments
Submittals	As required to meet testing schedule		
Factory Acceptance Testing	As required to meet testing schedule	Approved submittals required prior to testing.	

Description	Duration	Preceding Constraints	Comments
Mechanical/Electrical Functional Testing and Equipment Performance Testing	As required to meet testing schedule for individual unit process	Complete FATs. Complete equipment and piping installation. Approved submittals required prior to testing	Includes hydrostatic testing or pipes.

1.05 WORK RELATED TO THE FACILITY

A. During construction, the Owner will conduct integration procedures associated with the pump station and its coordinated operation with the Plant.

1.06 CONTRACTOR STARTUP PERSONNEL

A. Contractor shall provide personnel, both supervisory and from the applicable trades, who are experienced in startup, testing, and commissioning for the execution of the work described in these Contract Documents.

B. Controls Integrator: Assigned duties are those specifically required to plan and execute the installation, interconnection, integration, and startup of the various control devices, panels, components, systems, and subsystems.

1.07 STARTUP AND TEST PLANS

A. The Contractor shall develop specific plans for the testing of elements of the Facility. These plans shall outline the detailed sequence of activities necessary to confirm the proper operation of every component, system, and subsystem.

B. Test plans will be prepared for each phase of startup where testing is required including, but not limited to the following:
   1. Factory acceptance testing.
   2. Manufacturer's installation inspection.
   3. Mechanical/electrical functional testing.
   4. Pump Functional testing.
   5. Pump Performance testing.

C. Test plans will be developed as described below:
   1. The Overall Startup Plan shall include four main sections arranged as follows:
      a. Overall Startup Plan Summary.
      b. Factory Acceptance Testing.
      c. Functional and Performance Testing.
      d. Startup Schedule.
   2. The contents and requirements pertaining to each section are described below.
   3. Overall Startup Plan Summary:
      a. The Overall Startup Plan Summary is the master startup plan document. It includes a summary of testing and startup activities and provides the basic organization of the startup and testing program. It shall be submitted in advance of any other test plans except for Factory Acceptance Test Plans as described herein.
   4. Factory Acceptance Test Plan:

a. The Factory Test Plan shall be a comprehensive description of the complete test setup, procedures, analyses, and reporting program for each factory test required for the Work. Detailed step by step procedures describing activities in the test process shall be included for factory tests, witnessed or unwitnessed. Shop or factory tests, witnessed, or unwitnessed, that require testing to demonstrate compliance with the Contract Documents and require submittal of test results, must have a Factory Acceptance Test Plan accepted by the Engineer at least 4 weeks prior to the test.

b. At a minimum, the following shall be included for each Factory Acceptance Test Plan:
   1) Identification information for the component, subsystem, or system being tested. Applicable tag numbers shall be included.
   2) A narrative description of the purpose and goals of the test.
   3) Pass/Fail criteria.
   4) A listing and copy of pertinent reference documents (Contract Documents and industry standards or specifications applicable to the testing).
   5) Complete description, including drawings, for test stands and/or test apparatuses.
   6) Credentials of test personnel.
   7) Descriptions of test equipment.
   8) Descriptions and product information, including calibration certificates, for test instruments.
   9) Step-by-step detailed procedures of how the test will be conducted. The level of detail shall be sufficient for any witness with a rudimentary technical aptitude to be able to follow the steps and develop confidence that the tests were being performed as planned. Steps are significant, and steps shall be included in the procedures.
   10) Copies of the actual data logs and/or data recording forms that will be used for the test.
   11) A complete disclosure of calculation methodologies.
   12) Sample computations or analyses with results in the same format as the final report. This item is intended to demonstrate how data collected will be used to generate results. A sample shall be included for each type of computation required for the test and analysis of results.
   13) A detailed outline of the final factory testing report.

c. Each factory test shall be described separately. Factory Acceptance Test Plans are the only portion of the Startup and Test Plans that will be accepted prior to acceptance of the Overall Startup Plan Summary.
   Also, Factory Acceptance Test Plans will be allowed to be submitted and reviewed individually. However, the Overall Startup Plan Summary is required to summarize the factory testing program and submittal numbers for individually submitted Factory Acceptance Test Plans shall be accurately accounted for in that document.

D. Contractor shall execute these test plans with the witnessing of the Construction Manager and/or Engineer and/or Owner.

E. For startup and testing purposes, the following designations are made:
   1. Main Unit Processes:
      a. Pump Station:
         1) Pumps and Motors.
      b. Control:
         1) Instruments.
         2) Interconnection and control cables/wiring.

3) Appurtenant communication and interconnection devices and equipment.

2. Auxiliary Systems:
   a. Main Piping:
      1) Suction and discharge pipe valves
      2) Appurtenant instruments, devices, valves, and piping
   b. Building Systems (structures, as applicable):
      1) HVAC
   c. Corrosion Control: Test Stations, Anodes, Coating materials.

F. Contractor shall submit the completed test reports as part of the Startup Results Submittal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL STARTUP AND TESTING REQUIREMENTS

A. Contractor is responsible for the complete testing, check out, startup, and commissioning of elements of the pump station. Startup and Testing Plans and Test Reports shall include specific language to demonstrate that the requirements stated herein are planned, executed, and accomplished. The requirements below are complementary to those indicated elsewhere in the Contract Documents.

B. The Engineer and Construction Manager shall be solely responsible for determining the party responsible for conducting corrective actions and for determining the party responsible for delays.

C. Facility Startup Meetings: Schedule with Owner to discuss test schedule, test methods, materials, facilities operations interface, and Owner involvement.

D. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

E. Owner will:
   1. Provide water, power, and other items as required for startup, unless otherwise indicated.
   2. Operate process units and facility with support of Contractor.

3.02 FACTORY ACCEPTANCE TESTING

A. Contractor shall coordinate the timing and location of Factory Acceptance Testing (FAT) including, but not limited to the following items:
   1. Pumps and Motors.

B. The Contractor will prepare the test plans for each FAT or review manufacturer standard test plans in accordance with these Contract Documents. The Contractor's Startup Manager shall be the lead representative for the development of these test plans.

3.03 MANUFACTURER'S INSTALLATION INSPECTION

A. When Contractor has completed installation of components, systems, or subsystems, they shall schedule a manufacturer inspection. This manufacturer or approved manufacturer's representative shall certify that the component, system, or subsystem is properly installed and that testing of the component, system, or subsystem may commence.

B. Preparation:
   1. Complete installation before testing.
   2. Furnish qualified manufacturers' representatives, when required by individual Specification sections.
   3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Installation Form, when required by individual Specification sections.
   4. Cleaning and Checking: Prior to beginning functional testing:
      a. Calibrate testing equipment in accordance with manufacturer's instructions.
      b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
      c. Lubricate equipment in accordance with manufacturer's instructions.
      d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.
      e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
      f. Check power supply to electric-powered equipment for correct voltage.
      g. Adjust clearances and torque.
      h. Test piping for leaks.
   5. Ready-to-test determination will be by Engineer and Construction Manager based at least on the following:
      a. Acceptable Operation and Maintenance Data.
      b. Notification by Contractor of equipment readiness for testing.
      c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
      d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested, including Membrane Equipment System.
      e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
      f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
      g. Equipment and electrical tagging complete.
      h. Delivery of spare parts and special tools.

3.04 MECHANICAL/ELECTRICAL FUNCTIONAL TESTING

A. After each mechanical system is completely installed, the Contractor shall confirm proper installation according to these Contract Documents. Mechanical system testing shall include, but not be limited to the following system types:
   1. Pumps, Motors, and Drives
   2. Instrumentation
   3. Piping and Appurtenances (buried and exposed).
   4. HVAC systems.

B. After the complete installation of electrical systems (or portions thereof), the Contractor shall conduct testing, including the independent electrical testing, as specified in Division 26, Electrical.

3.05 WITNESSING AND SUPERINTENDENCE

A. The Engineer, Owner, Construction Manager, and others as necessary shall be allowed to witness testing conducted during any phase of startup.

B. The Contractor shall maintain overall superintendence of the Work during each startup phase.

C. The Contractor shall promptly and permanently repair damage to any portion of the Work during startup and testing.
   1. Repair work shall be performed by the manufacturer or with manufacturer's approved published methods.

D. The Contractor shall perform scheduled maintenance in strict compliance with manufacturers' published procedures and with products acceptable to manufacturers.

E. Authorized representatives of equipment suppliers or manufacturers shall certify that corrective actions for defects, malfunctions, faulty equipment operation, calibration, adjustment, or related flaws are complete and acceptable.

F. The Contractor shall keep on 24-hour local standby and provide crews, materials, and equipment required to repair, replace adjust, balance, modify and provide other services as may be required to immediately correct failures or malfunctions of any kind.

END OF SECTION

SECTION 03 01 32

REPAIR OF VERTICAL AND OVERHEAD CONCRETE SURFACES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes repair of vertical and overhead concrete surfaces.

B. This specification will only be used if damage occurs during construction/delivery

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a. 301, Specifications for Structural Concrete.
      b. 506.2, Specification for Shotcrete.
   2. ASTM International (ASTM):
      a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      b. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      c. A615/A615M, Standard Specification for Deformed and Plain Carbon- Steel Bars for Concrete Reinforcement.
      d. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      e. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
      f. C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
      g. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
      h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
      i. C293/C293M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.
      j. C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
      k. C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
      l. C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
      m. C596, Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
      n. C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
      o. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

p. C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
q. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
r. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
s. D4259, Standard Practice for Abrading Concrete.
t. E699, Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

B. Definitions:
1. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.
2. Defective Area: Surface defect such as honeycomb, rock pockets, indentations and surface voids greater than 3/16-inch deep, surface voids greater than 3/4-inch diameter, cracks in liquid containment structures and below grade habitable spaces 0.005-inch wide and wider, cracks in other structures 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances which include but are not limited to fins, form pop-outs, and other projections, and at exposed concrete which includes texture irregularities, stains, and other color variations that cannot be removed by cleaning.
3. High-Pressure Water Blasting: Sometimes referred to as hydro-demolition. Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.
4. Low-Pressure Spray Mortar: Mortar suitable to be applied by low-pressure spraying, and in small areas may be applied by hand troweling.
5. New Concrete: Concrete less than 60 days old forming structures constructed as part of the Work.
6. Rebound: Shotcrete material, mostly aggregates, that bounce off a surface against which shotcrete was projected.
7. Shotcrete: Mortar pumped through hose and projected at high velocity.

C. Related Specifications:
1. 03 21 00 – Steel Reinforcement
2. 03 30 00 – Cast-in-Place Concrete
3. 03 39 00 – Concrete Curing

1.03 SUBMITTALS

A. Action Submittals:
1. Product data sheets for each material supplied.
2. Samples: Mesh reinforcement and mesh anchor.
3. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar for each repair location in existing concrete.

B. Informational Submittals:
1. Repair Mortar System: Manufacturer's preparation and installation instructions.

2. Mesh manufacturer's installation instructions and allowable load criteria.
3. Written description of equipment proposed for concrete removal and surface preparation.
4. Certificates:
    a. Shotcrete Nozzleman: Current ACI Certification for each proposed nozzleman.
    b. Manufacturer's Certificate of Compliance, that proposed repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on vertical and overhead surfaces that are exposed to weather.
    c. Mortar Manufacturer's Certificate of Proper Installation.
5. Statements of Qualification:
    a. Repair mortar system applicator.
6. Field and laboratory test reports.

1.04 QUALITY ASSURANCE

A. Qualifications:
    1. Repair Mortar System Applicator:
        a. For Repair System A – Shotcrete Mortar, trained and qualified applicator recognized or certified by repair mortar system manufacturer.
        b. For Repair System B – Low-Pressure Spray Mortar, in lieu of recognition or certification, demonstrate application of repair mortar manufacturer's system and obtain Certification of Proper Installation, in accordance with Article Manufacturer's Services.

B. Demonstration Mockup for Repair System A – Shotcrete Mortar and Repair System B – Low-Pressure Spray Mortar Repair System:
    1. For each noted type of repair mortar system to be used, prepare one demonstration mockup in vertical orientation of at least 10 feet by 10 feet with average thickness, and containing reinforcement, representative of area being repaired on Project. Alternatively, a repair area in vertical orientation that is representative of areas to be repaired in terms of size, thickness, and reinforcement, may be used for demonstration in lieu of mockups; subject to acceptance by Engineer.
    2. Repair Mortar System Manufacturer's Demonstration:
        a. Schedule time for manufacturer's demonstration of repair system proposed for Project.
        b. Prepare mortar to specified consistency for testing and placement.
        c. Cure portions of each type of surface to be repaired using proposed curing procedure and materials, including overhead and vertical applications.
        d. Prepare surface area in advance of demonstration and obtain manufacturer's acceptance of preparation for each type of application.
        e. Demonstrate the following:
            1) Mixing and application equipment capabilities and procedures, including flow of material from nozzle or sprayer.
            2) Nozzle operator and person in charge of low-pressure sprayer, capabilities and ability to follow prescribed application procedures and properly operate equipment and apply surface repair materials.
        f. Compression Strength Test: Make compression test samples from wet mortar during demonstration placement and deliver to independent testing laboratory for testing at 7 days and 28 days.
        g. Tensile Bond Test: Test in situ for tensile bond at 7 days as specified in Paragraph Direct Tension Bond Test.

C. Where Required by Engineer: Demonstration Mockup for Repair System C – Polymer Modified Repair Mortar System:
   1. Prepare one demonstration mockup in vertical orientation of average size and thickness, and containing reinforcement, representative of area being repaired on Project. Alternatively, a repair area in vertical orientation that is representative of areas to be repaired in terms of size, thickness, and reinforcement, may be used for demonstration in lieu of mockups; subject to acceptance by Engineer.
   2. Repair Mortar System Manufacturer's Demonstration:
      a. Schedule time for manufacturer's demonstration of repair system proposed for Project.
      b. Prepare mortar to specified consistency, for testing and placement.
      c. Cure portions of each type of surface to be repaired using proposed curing procedure and materials, including overhead and vertical applications.
      d. Prepare surface area in advance of demonstration and obtain manufacturer's acceptance of preparation for each type of application.
      e. Demonstrate mixing and application procedures.
      f. Compression Strength Test: Make compression test samples from wet mortar during demonstration placement and deliver to independent testing laboratory for testing at 7 days and 28 days.
      g. Tensile Bond Test: Test in situ for tensile bond at 7 days as specified in Paragraph Direct Tension Bond Test.

D. Pre-repair Conference:
   1. Required Meeting Attendees:
      a. Contractor.
      b. Repair Subcontractor.
      c. Technical representative for repair material manufacturer.
      d. Engineer.
   2. Schedule and conduct prior to conducting mockups and incorporation of respective products into Project. Notify Engineer of location and time.
   3. Agenda shall include, but not limited to:
      a. Review of field conditions. Conduct field observations of Work to be performed.
      b. Based on above observations, repair material manufacturer's technical representative shall confirm material selection and make Project- specific repair method recommendations.
      c. Technical representative for repair material manufacturer shall review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
      d. Other specified requirements requiring coordination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

PART 2 - PRODUCTS

2.01 REPAIR SYSTEM A – SHOTCRETE MORTAR

A. Mortar Materials:
   1. Blend of selected portland cements, microsilica, and specially graded aggregates and fibers applicable for vertical and overhead surfaces.
   2. Materials shall not contain asbestos, chlorides, nitrates, added gypsum, added lime, or high aluminum cements.
   3. Noncombustible before and after cure.
   4. Furnish in factory proportioned unit.
   5. Workability from 1/4-inch in depth and greater.

B. Mixed Mortar Properties:
   1. Working Time: 5 minutes to 10 minutes.
   2. Finishing Time: 10 minutes to 20 minutes.
   3. Color: Dark gray.

C. Cured Mortar Properties:
   1. Compressive strength for 2-inch cubes in accordance with ASTM C109/C109M, or 3-inch cubes in accordance with manufacturer's modification to ASTM C109/C109M:
      a. 7 Days: 6,000 psi minimum.
      b. 28 Days: 7,000 psi minimum.
   2. Flexural Strength (Modulus of Rupture), ASTM C78/C78M or ASTM C348 (Modified) at 28 Days: 1,100 psi minimum.
   3. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 400 psi minimum.
   4. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 800 coulombs maximum.
   5. Mortar shall not produce a vapor barrier.

D. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 211SP.
   2. Sika Corp., Lyndhurst, NJ; SIKACEM 103F.
   3. Euclid Chemical Co., Cleveland, OH; Eucoshot F.
   4. Or approved equal.

2.02 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR

A. One or two-component, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.

B. Cured materials mixed in accordance with manufacturer's instructions shall conform to the following criteria:
   1. Compressive Strength, ASTM C109/C109M at 28 Days: 6,000 psi minimum.
   2. Flexural Strength, ASTM C348 at 28 Days: 1,100 psi minimum.
   3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent, at 28 Days: 3,000 psi minimum.
   4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.
   5. Drying Shrinkage, ASTM C157/C157M Modified at 28 Days or ASTM C531: 0.1 percent maximum.
   6. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 1,000 coulombs maximum.

7. System shall not produce a vapor barrier.
8. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only addition of water.
9. Free of chlorides and other chemicals causing corrosion.

C. Manufacturers and Products:
1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 488CI.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 224.
3. Euclid Chemical Co., Cleveland, OH; Tamms Structural Mortar.
4. Or approved equal.

2.03 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR

A. Polymer-modified, one- or two-component, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar.

B. Cured Mortar Properties:
1. Compressive Strength, ASTM C109/C109M at 28 Days: 7,000 psi minimum.
2. Flexural Strength, ASTM C348 at 28 Days: 1,200 psi minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent at 28 Days: 2,000 psi minimum.
4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 psi minimum.
5. Drying Shrinkage, ASTM C596 at 28 Days: 0.12 percent maximum. Not required for small repair areas approximately 1 square foot in area or less.
6. Freeze Thaw Resistance, ASTM C666/C666M, at 300 Cycles: 90 percent RDM.
7. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 800 coulombs maximum for liquid holding and below grade repairs.

C. Manufacturers and Products:
1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco N 300CI.
2. Sika Corp., Lyndhurst, NJ; SikaTop 123 PLUS.
3. Euclid Chemical Co., Cleveland, OH; DuralTop Gel.
4. Or approved equal.

2.04 REPAIR SYSTEM D – SITE-MIXED PORTLAND-CEMENT MORTAR

A. Mortar Materials:
1. Use same materials as concrete to be repaired with no coarse aggregate, per Section 03 30 00, Cast-in-Place Concrete.
2. For repairs to exposed concrete, make trial batches to check color compatibility of repair mortar with existing surrounding concrete.
3. When repair is too dark, substitute white portland cement for part of the gray portland cement to produce desired color closely matching color of surrounding concrete.

2.05 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 00, Cast-in-Place Concrete.

2.06 REINFORCEMENT

A. Deformed Steel Reinforcement:
   1. Per Section 03 21 00, Steel Reinforcement.

B. Mesh Reinforcement: Welded wire fabric flat sheets with spacing of wires and wire size in accordance with ASTM A185/A185M, wire 75 ksi minimum tensile strength per ASTM A82/A82M, and repair mortar system manufacturer's recommendations.

C. Tie Wire: 16-gauge, galvanized.

2.07 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.
   1. Mixed Bonding Agent Properties:
      a. Pot Life: 75 minutes to 105 minutes.
      b. Contact Time: 24 hours.
      c. Color: Concrete gray.
   2. Cured Cementitious Adhesive Properties:
      a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 psi minimum.
      b. Flexural Strength, ASTM C348: 1,000 psi minimum.
      c. Slant Shear Bond Strength, ASTM C882/C882M at 14 Days:
         1) 2-Hour Open Time: 2,500 psi minimum.
         2) 24-Hour Open Time: 2,000 psi minimum.
      d. Bonding agent shall not produce a vapor barrier.
      e. Compatible with and from same manufacturer as the repair system used.

B. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco P 124.
   2. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
   3. Euclid Chemical Co., Cleveland, OH: Dural Prep AC.
   4. Or approved equal.

2.08 EVAPORATION RETARDANT

A. As specified in Section 03 39 00, Concrete Curing.

2.09 CURING COMPOUND

A. As specified in Section 03 39 00, Concrete Curing.

PART 3 - EXECUTION

3.01 GENERAL

A. New Concrete Work: Repair deficiencies in new concrete structures constructed under this Contract with applicable repair system. Refer to Section 03 30 00, Cast-in-Place Concrete.

3.02 APPLICATION

A. General:
   1. Repair System A: Large areas and number of repair areas.
   2. Repair System B: Medium to large areas and number of repair areas.
   3. Repair System C: Small and limited areas and number of repair areas.
   4. Repair System D: Approval of Engineer required for use.

3.03 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Engineer, and review proposed extent of repair with Engineer.

B. Remove unsound, honeycombed, deteriorated, or otherwise defective areas of concrete from work areas.
   1. Use 8,000 psi minimum high-pressure water blasting machine as required for Site conditions.
   2. Remove concrete to abrade substrate concrete surfaces to a minimum amplitude roughness of 3/16 inch measured between high and low points with a 3-foot-long straightedge, in accordance with ASTM D4259.
   3. Where final surface is required to be flush with existing adjacent surface remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, or scabblers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to reduce formation of micro-fractures in substrate concrete surface.

D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw- cut edge by high-pressure water blasting.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to circumference of exposed steel reinforcement if one or more of the following surface conditions exist:
   1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
   2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.

3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.

J. Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar as required by and in accordance with repair mortar manufacturer's printed instructions.

K. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.04 REINFORCEMENT INSTALLATION

A. Provide steel reinforcement when existing reinforcement is not exposed, and when mortar application is more than 3 inches deep, unless otherwise shown on Drawings.

B. Lap reinforcement mesh a minimum of one mesh spacing and securely fasten mesh to reinforcement with tie wire at intervals no more than 12 inches to prevent movement during application of repair mortar.

C. Coat exposed new steel reinforcement and reinforcement mesh with cementitious reinforcement coating at same time as substrate concrete is coated, as specified below, per repair mortar and cementitious reinforcement coating manufacturers' printed instructions.

3.05 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment, from being damaged by overshooting, rebound, and dust, as applicable for repair mortar system used, from shotcrete mortar or low-pressure spray mortar.

3.06 REPAIR SYSTEM A – SHOTCRETE MORTAR PLACEMENT

A. Apply shotcrete mortar in accordance with manufacturer's instructions.

B. Do not reuse rebound materials.

C. Apply mortar using dry mix process, in accordance with ACI 506.2.

D. Shotcrete mortar shall emerge from nozzle in a steady, uninterrupted flow. If flow becomes intermittent, direct flow away from the Work until flow of mortar becomes constant.

E. Applied Shotcrete Mortar: Minimum thickness of 1-1/2 inches to 2 inches of cover over existing reinforcement, or to level of surrounding concrete surface, whichever results in thicker coat.

F. Nozzle Position: Hold nozzle approximately at right angles to and at a distance from surface in accordance with shotcrete repair mortar system manufacturer's instructions for type of application, nozzle, and air pressure used.

G. Steel Reinforcement Encasement:
   1. Modify procedure of shooting shotcrete mortar to better direct material around reinforcement bars.
   2. Prevent shotcrete mortar from building up on reinforcement steel when shooting on, around, through, and behind steel to eliminate voids.
   3. Provide dense void-free encasement of reinforcement steel.

H. Shotcreting More than One Layer: In accordance with shotcrete repair mortar system manufacturer's printed instructions.

I. Slice off excess material with a wire screed approximately 5 minutes to 10 minutes after initial set.

J. Apply finish to exposed shotcrete mortar surface to match existing surface and in accordance with manufacturer's instructions. Steel trowel finish when finish coat is not applied.

K. Rebound Removal: Continuously throughout shotcrete mortar application, remove rebound, sand, and miscellaneous debris, and dispose offsite at an approved disposal facility.

L. Cure as specified in Article Curing.

3.07 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. After priming prepared substrate concrete surface per manufacturer's recommendations, apply mortar by low-pressure spraying equipment, unless noted otherwise.

C. Bonding Agent:
   1. Use bonding agent when manufacture required for hand applied areas, in accordance with repair mortar manufacturer's instructions.
   2. Application of repair mortar over bonding agent shall be completed within time frame recommended by bonding agent manufacturer.
   3. Consult with manufacturer for optimum and minimum acceptable degrees of surface tackiness of coat.

D. Work mortar firmly and quickly into repair area.

E. Finish repair mortar to match adjacent concrete surface.

F. Cure as specified in Article Curing.

3.08 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. Bond Coat: Apply to prepared substrate concrete surface before application of mortar in accordance with repair mortar manufacturer's printed instructions. Do not apply more bond coat than can be covered with mortar before bond coat dries. Do not retemper bond coat.

C. Place mortar by hand or low-pressure spray and trowel to specified surface finish, in accordance with requirements of repair material's printed instructions.

D. Finish repair mortar to match adjacent concrete surface.

E. Cure as specified in Article Curing, and in accordance with manufacturer's printed instructions.

3.09 REPAIR SYSTEM D – SITE-MIXED PORTLAND-CEMENT REPAIR MORTAR PLACEMENT

A. Use site-mixed portland-cement repair mortar on the following concrete surfaces:
   1. Walls.

B. Prepare mortar to a stiff consistency with no more mixing water necessary for handling and placing.

C. Mix site-mixed portland-cement repair mortar in accordance with requirements of ACI 301.

D. Apply scrub coat of mortar worked into existing substrate surface with a stiff bristled brush. Use of epoxy resin bonding agent is not acceptable.

E. Work mortar firmly and quickly into repair area before scrub slurry coat begins to dry.

F. Finish repair mortar to match adjacent concrete surface.

3.10 CURING

A. Prior to curing, apply water fog to repair mortar system in accordance with repair mortar system manufacturer's printed instructions.

B. Cure in accordance with repair mortar manufacturer's printed instructions.

C. Where permitted by repair mortar manufacturer's printed instructions, commence water curing after repair mortar system application and when curing will not cause erosion of mortar.

D. Continuously water cure repair mortar system for a period of 7 days.

E. Do not cure using curing compound or membrane, unless method is part of repair mortar system manufacturer's printed instructions and approval is obtained from Engineer.

F. Cure intermediate layers of repair mortar in accordance with repair mortar manufacturer's printed instructions.

G. Where curing compound is permitted by repair mortar system manufacturer, apply curing compound in accordance with Section 03 39 00, Concrete Curing.

3.11 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:
   1. Light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
   2. Mark hollow areas for removal and replacement.

B. Compression Strength Test:

1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
2. Obtain production samples of mixed wet mortar materials from nozzle, or mixer, during construction for compliance with Specifications for testing at 7 days, and 28 days.
3. Provide a minimum of three samples for each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing.
4. Record location where repair mortar is being applied at time production samples are obtained.

C. Direct Tension Bond Test:
   1. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
   2. Record locations on in situ bond tests on each type of applied repair mortar.

D. Testing laboratory retained by Owner will provide the following:
   1. Compression Strength Test:
      a. Testing will follow a “modified” ASTM C109/C109M.
      b. A minimum of three production samples of mixed material will be obtained from each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing at 7 days, and 28 days.
      c. Record location where repair mortar is being applied at time production samples are obtained.
   2. Direct Tension Bond Test:
      a. Bond Strength of Repair Mortar to Substrate Concrete: 300 psi minimum in direct tension without failure or movement.
      b. Record locations of Bond Tests on each type of applied repair mortar tested.

E. Retest mortar repairs that do not meet test requirements.

F. Repair and fill holes using same repair mortar where core samples have been removed.

3.12 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge. Remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.13 MANUFACTURER’S SERVICES

A. Provide repair mortar system manufacturer’s representative at Site to review acceptability of surface preparation, mixing and installation assistance, inspection, and Certification of Proper Installation.

3.14 CLEANING

A. Remove overshot shotcrete, Repair System A, low-pressure spray, Repair System B, and site-mixed portland-cement, Repair System D repair mortar and rebound materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of or repair areas, finishing, and curing, and dispose offsite at an approved disposal site.

END OF SECTION

SECTION 03 01 33

REPAIR OF HORIZONTAL CONCRETE SURFACES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes repair of horizontal concrete surfaces.

1.02 REFERENCES

A. Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO): T277, Standard Method of Test for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
   2. ASTM International (ASTM):
      a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      b. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      c. A615/A615M, Standard Specification for Deformed and Plain Carbon- Steel Bars for Concrete Reinforcement.
      d. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      e. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
      f. C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
      g. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
      h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
      i. C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
      j. C469, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
      k. C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
      l. C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
      m. C779/C779M, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
      n. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
      o. C928/C928M, Standard Specification for Packaged, Dry, Rapid- Hardening Cementitious Materials for Concrete Repairs.
      p. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
      q. C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

r. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
s. D638, Standard Test Method for Tensile Properties of Plastics.
t. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
u. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
v. D4259, Standard Practice for Abrading Concrete.
w. E699, Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

B. Definitions:
1. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.
2. Defective Area: Surface defect such as honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4-inch diameter, cracks in liquid containment structures and below grade habitable spaces 0.005-inch wide and wider, cracks in other structures 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances which include but are not limited to fins, form pop-outs, and other projections, and at exposed concrete which includes texture irregularities, stains, and other color variations that cannot be removed by cleaning.
3. High-Pressure Water Blasting (sometimes referred to as hydro-demolition): Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.
4. New Concrete: Concrete less than 60 days old forming structures constructed as part of the Work.

C. Related Specifications:
1. 03 21 00 – Steel Reinforcement
2. 03 30 00 – Cast-in-Place Concrete
3. 03 39 00 – Concrete Curing

1.03 SUBMITTALS

A. Action Submittals:
1. Product data sheets for each material supplied.
2. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar system for each repair location in existing concrete.

B. Informational Submittals:
1. Repair Mortar System: Manufacturer’s preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.
3. Certificates:
a. Manufacturer’s Certificate of Compliance that repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on horizontal surfaces that are exposed to weather.
b. Mortar Manufacturer’s Certificate of Proper Installation.

4. Statements of Qualification:
    a. Repair mortar system applicator.
5. Field and laboratory test results.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Repair Mortar System Applicator: Trained and qualified applicator endorsed by repair mortar system manufacturer.

B. Demonstration Mockup for Repair Mortar:

C. Pre-repair Conference:
1. Required Meeting Attendees:
    a. Contractor.
    b. Repair Subcontractor.
    c. Engineer.
2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include, but not limited to:
    a. Review of field conditions. Conduct field observations of the Work to be performed.
    b. Based on above observations, repair material manufacturer's technical representative shall confirm material selection and make Project specific repair method recommendations.
    c. Technical representative for repair material manufacturer shall review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
    d. Other specified requirements requiring coordination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

PART 2 - PRODUCTS

2.01 REPAIR MORTAR SYSTEM NO. 1—MAGNESIUM PHOSPHATE REPAIR MORTAR

A. One-component, magnesium-ammonium-phosphate concrete mortar.

B. Compressive Strength, ASTM C109/C109M modified:
1. 1 Hour: 2,000 psi minimum.
2. 3 Hours: 5,000 psi minimum.
3. 1 Day: 6,000 psi minimum.
4. 28 Days: 7,500 psi minimum.

C. Flexural Strength, ASTM C78/C78M Modified (3-inch by 4-inch by 16-inch prism) at 1 Day: 550 psi minimum.

D. Modulus of Elasticity, ASTM C469 at 7 Days: 4.18 by 10^6 psi minimum.

E. Freeze-thaw Resistance and Resistance to Deicing Chemicals, ASTM C666/C666M, Procedure A, at 300 Cycles: 80 percent RDM minimum.

F. Sulfate Resistance, ASTM C1012/C1012M, Length Change after 52 Weeks: 0.09 percent maximum.

G. Application Temperature Range: 20 degrees F to 85 degrees F for normal weather applications.

H. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building System, Shakopee, MN; MasterEmaco T 545.
   2. Euclid Chemical Co., Cleveland, OH; Eucospeed MP.
   3. Or approved equal.

2.02 REPAIR MORTAR SYSTEM NO. 2—HIGH EARLY STRENGTH REPAIR MORTAR

A. One-component, fast-setting, high early strength repair mortar.

B. Compressive Strength, ASTM C109/C109M:
   1. 2 Hours: 1,500 psi minimum.
   2. 1 Day: 4,500 psi minimum.
   3. 7 Days: 8,000 psi minimum.
   4. 28 Days: 9,000 psi minimum.

C. Flexural Strength, ASTM C348:
   1. 1 Day: 850 psi minimum.
   2. 7 Days: 1,000 psi minimum.
   3. 28 Days: 1,100 psi minimum.

D. Modulus of Elasticity, ASTM C469:
   1. 1 Day: 3.8 by 10^6 psi minimum.
   2. 28 Days: 4.5 by 10^6 psi minimum.

E. Slant Shear Bond Strength, ASTM C882/C882M (Modified):
   1. 1 Day: 2,500 psi minimum.
   2. 7 Days: 2,900 psi minimum.
   3. 28 Days: 3,100 psi minimum.

F. Splitting Tensile Strength, ASTM C496/C496M:
   1. 1 Day: 850 psi minimum.
   2. 7 Days: 1,200 psi minimum.
   3. 28 Days: 1,300 psi minimum.

G. Freeze-thaw Resistance, ASTM C666/C666M, Procedure A, at 300 Cycles: 98 percent RDM.

H. Chloride Ion Permeability Based on Charge Passed, ASTM C1202 or AASHTO T277, 28 Days: 960 coulombs maximum.

I. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco T 415.
   2. Euclid Chemical Co., Cleveland, OH; VersaSpeed.
   3. Or approved equal.

2.03 REPAIR MORTAR SYSTEM NO. 3—SHRINKAGE COMPENSATED REPAIR MORTAR

A. One-component cement-based, flowable, shrinkage compensated repair mortar system.

B. Compressive Strength, ASTM C109/C109M:
   1. 1 Day: 2,500 psi minimum.
   2. 7 Days: 6,000 psi minimum.
   3. 28 Days: 8,000 psi minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 770 psi minimum.

D. Modulus of Elasticity, ASTM C469 at 28 Days: 5.9 by 10^6 psi minimum.

E. Slant Shear Bond Strength, ASTM C882/C882M Modified:
   1. 7 Days: 2,150 psi minimum.
   2. 28 Days: 3,000 psi minimum.

F. Freeze-thaw Resistance, ASTM C666/C666M, Procedure A, at 300 Cycles: 97.0 percent RDM.

G. Chloride Ion Permeability Based on Charge Passed, ASTM C1202 at 28 Days: 650 coulombs maximum.

H. Sulfate Resistance, ASTM C1012/C1012M after 6 Months: 0.01 percent length change maximum.

I. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 466 CI.
   2. Euclid Chemical Co., Cleveland, OH; Eucocrete Supreme.
   3. Or approved equal.

2.04 REPAIR MORTAR SYSTEM NO. 4—METALLIC AGGREGATE REPAIR MORTAR

A. One-component cement-based, flowable, metallic-aggregate repair mortar system:

B. Compressive Strength, ASTM C109/C109M:
   1. 1 Day: 5,000 psi minimum.
   2. 7 Days: 8,800 psi minimum.
   3. 28 Days: 12,000 psi minimum.

C. Abrasion Resistance, ASTM C779/C779M, Procedure A: Eight times more wear resistance than plain concrete.

D. Density: 215 pound per cubic foot.

E. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; Master T 300.
   2. Euclid Chemical Co. (The), Cleveland, OH; Super Euco-Top.
   3. Or approved equal

2.05 REPAIR MORTAR SYSTEM NO. 5—POLYMER MODIFIED REPAIR MORTAR

A. One or two-component, fast-setting, polymer modified cementitious based repair mortar system.

B. Compressive Strength, ASTM C109/C109M:
   1. 1 Day: 2,500 psi minimum.
   2. 7 Days: 5,000 psi minimum.
   3. 28 Days: 7,000 psi minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 1,500 psi minimum.

D. Slant Shear Bond Strength, ASTM C882/C882M Modified at 28 Days: 2,000 psi minimum.

E. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.

F. Abrasion Resistance Depth of Wear, ASTM C779/C779M, Procedure A, at 60 Minutes: 0.033 inch maximum.

G. Drying Shrinkage, ASTM C157/C157M Modified, at 28 Days: 0.09 percent maximum.

H. Rapid Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 28 Days: Under 850 coulombs maximum.

I. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco T 310 CI.
   2. Euclid Chemical Co., Cleveland, OH; Duraltop Flowable Mortar.
   3. Sika Corp., Lyndhurst, NJ; SikaTop 111 PLUS.
   4. Or approved equal.

2.06 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 00, Cast-in-Place Concrete.

2.07 REINFORCEMENT

A. Deformed Steel reinforcement:
   1. Per Section 03 21 00, Steel Reinforcement.

B. Mesh Reinforcement: Welded wire fabric flat sheets with spacing of wires and wire size in accordance with ASTM A185/A185M, wire 75 ksi minimum tensile strength per ASTM A82/A82M, and repair mortar system manufacturer’s recommendations.

C. Tie Wire: 16-gauge, galvanized.

2.08 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.
   1. Mixed Bonding Agent Properties:
      a. Pot Life: 75 minutes to 105 minutes.
      b. Contact Time: 24 hours.
      c. Color: Concrete gray.
   2. Cured Cementitious Adhesive Properties:
      a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.
      b. Flexural Strength, ASTM C348: 1,000 psi minimum.
      c. Slant Shear Bond Strength, ASTM C882/C882M:
         1) 2-Hour Open Time: 2,500 psi minimum.

2) 24-Hour Open Time: 2,000 psi minimum.
3. Bonding agent shall not produce a vapor barrier.
4. Compatible with, and from same manufacturer as the repair mortar system used.

B. Manufacturers and Products:
1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco P 124.
2. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
3. Euclid Chemical Co., Cleveland, OH; Dural Prep AC.
4. Or approved equal.

2.09 EPOXY BONDING AGENT

A. Two-component, moisture insensitive, 100 percent solids epoxy resin.

B. Tensile Strength, ASTM D638, at 14 Days: 4,400 psi minimum.

C. Elongation at Break, ASTM D638: 1.49 percent minimum.

D. Compressive Strength, ASTM D695, at 28 Days for Application Temperature of 73 Degrees F to 77 Degrees F: 8,000 psi minimum.

E. Bond Strength, ASTM C882/C882M, at 14 Days: 1,800 psi minimum.

F. Pot Life, at 73 Degrees F to 77 Degrees F: 75 minutes minimum.

G. Manufacturers and Products:
1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco ADH 326 when ambient temperature is 73 degrees F or higher, or approved equal.

2.10 EVAPORATION RETARDANT

A. As specified in Section 03 39 00, Concrete Curing.

2.11 CURING COMPOUND

As specified in Section 03 39 00, Concrete Curing.

PART 3 - EXECUTION

3.01 GENERAL

A. New Concrete Work: Repair deficiencies in new concrete structures constructed under this Contract with applicable repair system.

3.02 APPLICATION

A. General:
1. Repair Mortar System No. 1: Patches, joints, and overlays 1/2-inch to 3-inches thick. Return to service in 1 hour.
2. Repair Mortar System No. 2: Patches, joints, or overlays 1/2-inch to 3-inches thick. Return to service in 3 hours to 7 days.
3. Repair Mortar System No. 3: Patches, joints, or overlays 1-inch thick or greater. Return to service in 7 days or more.

4. Repair Mortar System No. 4: Heavy-duty joints or overlays 2-inches thick or greater. Return to service in 7 days or more.
5. Repair Mortar System No. 5:
    a. Patches and Overlays: 1/4-inch to 3-inches thick.
    b. Return to service for foot traffic in 4 hours; wheel traffic in 7 days.
    c. Working Time: 30 minutes at 70 degrees F.
    d. Application Temperature Range: 45 degrees F to 90 degrees F.

3.03 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Engineer. Review proposed extent of repair with Engineer.

B. Remove unsound, deteriorated, or otherwise defective areas of concrete from Work areas.
1. Use 8,000 psi minimum high-pressure water blasting machine, as appropriate to suit Site conditions.
2. Remove concrete to abrade substrate concrete surface to a minimum amplitude roughness of 3/16-inch measured between high and low points with a 3-foot-long straightedge, in accordance with ASTM D4259.
3. Where final surface is required to be flush with existing adjacent surface, remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, scabblers, or scarifiers unless water blasting is not permitted or practical because of Site conditions or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to reduce formation of micro-fractures in substrate concrete surface.

D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw- cut edge by high-pressure water blasting.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to entire circumference of exposed steel reinforcement if one or more of the following surface conditions exist:
1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.
3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.

J. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System Nos. 1, 2, 3, and 5: Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar, as required by and in accordance with repair mortar manufacturer's printed instructions.

K. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System No. 4 Repair Mortar: Dry, in accordance with material manufacturer's printed instructions.

L. Spalled Joints:
   1. Saw cut edge 1-inch deep and 6 inches back from old joint.
   2. Remove unsound concrete and concrete between saw cut and joint.
   3. Place wood or fiber spacer to thickness of joint at joint line.

M. Overlays:
   1. Square cut edges to a minimum of 1/4-inch deep.
   2. Do not feather edge area.
   3. Perform special preparation recommended by mortar manufacturer.

N. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.04 REINFORCEMENT INSTALLATION

A. Provide steel reinforcement when existing steel reinforcement is not exposed and when mortar application is more than 4 inches deep, unless otherwise shown on Drawings.

B. Replace deteriorated steel reinforcement with new steel reinforcement equivalent in cross-sectional area to original steel reinforcement. Weld new bars to existing where indicated.

C. Fasten steel reinforcement to chairs with tie wire to prevent from moving during placement of repair mortar.

D. Lap reinforcement mesh a minimum of one mesh spacing and securely fasten mesh to steel reinforcement fastened to mesh anchors, with tie wire at intervals no more than 12 inches to prevent movement during application of repair mortar.

E. Coat exposed new and existing steel reinforcement with cementitious reinforcement coating at the same time as substrate concrete is coated, as specified below, per repair mortar and cementitious reinforcement coating manufacturers' printed instructions.

3.05 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment from spillage of repair mortar and dust, as applicable for repair mortar system used.

3.06 PLACEMENT

A. Repair Mortar System Nos. 1, 2, 3, and 5:
   1. Remove standing and free water from prepared area.

2. Apply bond scrub coat of mortar to prepared surface in accordance with manufacturer's instructions. Do not apply more scrub coat of mortar than can be covered with repair mortar before scrub coat begins drying.
3. Immediately place mixed repair mortar into prepared area from one side to the other side.
4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
5. Level repair mortar and screed to elevation of existing concrete.
6. Finish to same texture as existing concrete around patch.
7. Repair Mortar System No. 5 screed or use self-leveling mixture to obtain a uniform and plane surface.

B. Repair Mortar System No. 4:
1. Remove free water from prepared area.
2. Apply bonding agent to prepared surface in accordance with manufacturer's instructions. Do not apply more bonding agent than can be covered with mortar before bonding agent cures, past tacky to the touch.
3. Immediately place mixed repair mortar into prepared area from one side to the other side.
4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
5. Level repair mortar and screed to elevation of existing concrete.
6. Finish to same texture as existing concrete around patch.

C. Joint Repair:
1. Remove joint spacer when repair mortar is hard enough that a pointed trowel will penetrate surface less than 1/2-inch.
2. When repair mortar is cured and ready for use, fill joint in accordance with repair mortar system manufacturer's instructions.

3.07 FINISHING

A. Spray full strength evaporation retardant on fresh concrete to prevent rapid drying during hot and windy weather.

3.08 CURING

A. Repair Mortar System No. 1:
1. No curing is required.
2. Protect from rain immediately after placing.
3. Liquid-membrane curing compounds or plastic sheeting may be used in accordance with repair mortar manufacturer's instructions to protect the surface from precipitation.
4. Never wet cure.

B. Repair Mortar System Nos. 2, 3, 4, or 5: Apply curing compound in accordance with Section 03 39 00, Concrete Curing.

3.09 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:
1. Chain drag or light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
2. Mark hollow areas for removal and replacement.

B. Compression Strength Test:

1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
2. Obtain production samples of mixed materials from mixer during construction for compliance with Specifications.
3. Provide minimum of three samples for each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater for testing.
4. Record location where repair mortar is being applied at time production samples are obtained.

C. Direct Tension Bond Test:
   1. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
   2. Record locations on in situ bond tests on each type of applied repair mortar.

D. Testing laboratory retained by Owner will provide the following:
   1. Compression Strength Test:
      a. Testing will follow a “modified” ASTM C109/C109M.
      b. A minimum of three production samples of mixed material will be obtained from each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing at 7 days, and 28 days. Record location where repair mortar is being applied at time production samples are obtained.
   2. Direct Tension Bond Test:
      a. Bond Strength of Repair Mortar to Substrate Concrete: 300 psi minimum in direct tension without failure or movement.
      b. Record locations of bond tests on each type of applied repair mortar tested.

E. Retest mortar repairs that do not meet test requirements.

F. Repair and fill holes using same repair mortar where core samples have been removed.

3.10 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge, remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.11 MANUFACTURERS’ SERVICES

A. Provide mortar manufacturer’s representative at Site to advice on product selection, review acceptability of surface preparation, mixing and installation assistance, inspection, and Certification of Proper Installation.

3.12 CLEANING

A. Remove excess repair mortar materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of repair areas, finishing, and curing, and dispose offsite at approved disposal site.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes concrete forming and accessories.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a. 117, Specification for Tolerances for Concrete Construction and Materials.
      b. 301, Specifications for Structural Concrete.
      c. 318, Building Code Requirements for Structural Concrete and Commentary.
   2. NSF International (NSF): 61, Drinking Water System Components - Health Effects.

B. Definitions:
   1. Architectural Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.
   2. Defective Areas: See definition in Section 03 30 00, Cast-in-Place Concrete.
   3. Exposed Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.

C. Related Specifications:
   1. 03 30 00 – Cast-in-Place Concrete
   2. 01 45 33 - Special Inspection, Observation, and Testing

1.03 DESIGN REQUIREMENTS

A. Design formwork in accordance with ACI 301 and ACI 318 to provide concrete finishes specified in Section 03 30 00, Cast-in-Place Concrete.

B. When high-range water reducer (superplasticizer) is used in concrete mix, form design shall account for increased hydrostatic pressures.

C. Joints in forms shall be watertight, meaning no seepage through forms during wet concreting.

D. Limit panel deflection to $1/360^{th}$ of each component span to achieve tolerances specified.

E. Form liner designer shall verify compatibility of proposed concrete mix with proposed form liner.

1.04 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Formwork drawings and calculations sealed by a State of California licensed professional engineer.
   2. Product Data:
      a. Form release agent.
      b. Form ties.

c. Products to be used for sealing tie holes.

B. Informational Submittals:
1. Statement of qualifications for formwork designer.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Formwork Designer: Formwork, falsework, and shoring design shall be designed by a State of California licensed professional engineer.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Wall Forms and Underside of Slabs and Beams:
1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in “new and undamaged” condition, of sufficient strength and surface smoothness to produce specified finish.
2. Where steel forms are used, treat steel surfaces to prevent rusting using products approved for use on steel forms.

B. Column Forms:
1. Rectangular Columns: As specified for walls.
2. Circular Columns: Fabricated steel or fiber-reinforced plastic with bolted sections or spirally wound laminated fiber form. Internally treat with release agent for full height of column.

C. Sandblasted Surface Forms: Medium density overlay plywood for flat concrete surfaces to be sandblasted.

D. Painted Surface Forms: High-density overlay plywood for flat concrete surfaces to be painted.

E. Other Forms: Materials as specified for wall forms.

2.02 ACCESSORIES

A. Form Release Agent:
1. Material:
a. Shall not bond with, stain, or adversely affect concrete surfaces.
b. Shall not impair subsequent treatments of concrete surfaces when applied to forms.
c. Ready-to-use water based material formulated to reduce or eliminate surface imperfections.
d. Contain no mineral oil or organic solvents.
2. Manufacturers and Products: Not for surfaces exposed to potable water.
a. BASF, Shakopee, MN; MBT MasterFinish RL 211.
b. Cresset Chemical Company; Crete-Lease 20-VOC-Xtra.
c. Or approved equal.
3. Manufacturers and Products: For use with potable water structures. Environmentally safe, meeting local, state, and federal regulations and usable in potable water facilities. Certified as meeting NSF 61.
a. Atlas Tech Products; Atlas Bio-Guard.
b. Dayton Superior; Dayton Bio-Release EF.
c. Hill and Griffith Company; Grifcote LV-50-Plus.

d. Or approved equal.

B. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on sides prohibiting loss of paste or water between the two surfaces.

C. Form Snap-Ties:
   1. Material: Steel.
   2. Spreader Inserts:
      a. Conical or spherical type.
      b. Design to maintain positive contact with forming material.
      c. Furnish units that will leave no metal closer than 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.
   3. Wire ties not permitted.
   4. Flat bar ties for panel forms; furnish plastic or rubber inserts with minimum 1.5-inch depth and sufficient dimensions to permit patching of tie hole.

D. Form Snap-Ties with Water Stop: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
   1. Integral steel waterstop 0.103-inch thick and 0.625-inch diameter tightly and continuously welded to tie.
   2. Neoprene waterstop 3/16-inch thick and 15/16-inch diameter whose center hole is one half diameter of tie, or molded plastic water stop of comparable size.
   3. Orient waterstop perpendicular to tie and symmetrical about center of tie.
   4. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

E. Through-Bolts:
   1. At Contractor's option, may be used as alternate to form snap-tie or form snap-tie with waterstop.
   2. Tapered minimum 1-inch diameter at smallest end.
   3. Elastic Vinyl Plug For Through-Bolt Tie Holes:
      a. Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal; forms watertight seal.
      b. Manufacturers and Products:
         1) Dayton Superior, Miamisburg, OH; A58 Sure Plug.
         2) Greenstreak Group, Inc., St Louis, MO; X-Plug.
         3) Or approved equal.

PART 3 - EXECUTION

3.01 FORM SURFACE PREPARATION

A. Prior to coating surface, thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants.

B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by manufacturer.

C. Steel Forms: Apply form release agent as soon as they are cleaned to prevent discoloration of concrete from rust.

3.02 ERECTION

A. General: In accordance with ACI 301, unless otherwise specified.

B. Beveled Edges (Chamfer):
   1. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
   2. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Engineer's approval of size prior to placement of beveled edge.

C. Wall Forms:
   1. Do not reuse forms with damaged surfaces.
   2. Locate form ties and joints in uninterrupted uniform pattern.
   3. Inspect form surfaces prior to installation to ensure conformance with specified tolerances.

D. Curb, Sidewalk, and Driveway Forms:
   1. Provide standard steel or wood forms.
   2. Set forms to true lines and grades, and securely stake in position.

E. Form Tolerances: Provide forms in accordance with ACI 117 and ACI 318, and the following tolerances for finishes specified:
   1. See the Schedule of Concrete Finishes in Section 03 30 00, Cast-in-Place Concrete, for beam, column, and wall types related to required form tolerances.
   2. Wall Tolerances:
      a. Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.
      b. Wall Type W-A:
         1) Plumb within 1/4 inch in 10 feet or within 1 inch from top to bottom for walls over 40 feet high.
         2) Depressions in Wall Surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions.
      c. Wall Type W-B:
         1) Plumb within 1/8 inch in 10 feet or within 1/2 inch from top to bottom for walls over 40 feet high.
         2) Depressions in Wall Surface: Maximum 1/8 inch when 10-foot straightedge is placed on high points in all directions.
      d. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
      e. Form Offset: Between adjacent pieces of formwork, facing material shall not exceed 1/4 inch.
   3. Beams and Columns Tolerances:

a. Exposed Straight Horizontal and Vertical Surfaces: Flat planes within tolerances specified.
b. Lateral Alignment:
    1) Centerlines shall be within plus or minus 1/2 inch from dimensions shown.
    2) At intersections, centerlines shall intersect within plus or minus 1/2 inch of dimensions shown.
c. Beam Type B-A:
    1) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
    2) Elevations: Within plus or minus 1/2 inch, except where tops of beams become part of finished slab. In this case refer to slab tolerances.
d. Column Type C-A:
    1) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
    2) Plumb within 1/4 inch in 10 feet in all directions with maximum 1/2 inch out-of-plumb at top with respect to bottom.

3.03 FORM REMOVAL

A. Nonsupporting forms, sides of beams, walls, columns, and similar parts of Work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:
    1. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
    2. Curing and protection operations are maintained.

B. Elevated Structural Slabs or Beams: In accordance with ACI 318 and at such time as concrete has reached compressive strength equal to 80 percent of specified 28-day compressive strength as determined by test cylinders.

C. Form Ties: Remove conical inserts or through bolts and plug holes as specified in Section 03 30 00, Cast-in-Place Concrete.

3.04 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with CBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan on Drawings. ContractorAll responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

SECTION 03 15 00

CONCRETE JOINTS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes concrete joints and accessories.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. A36/A36M, Specification for Carbon Structural Steel.
      b. A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      c. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      d. A767/A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
      e. C920, Specification for Elastomeric Joint Sealants.
      f. D226, Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
      g. D227, Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing.
      h. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
      i. D1056, Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
      j. D1171, Standard Guide for Evaluating Nonwoven Fabrics.
      k. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
      l. D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
      m. D2240, Standard Test Method for Rubber Property – Durometer Hardness.
   2. Corps of Engineers (COE): CRD-C-572, Corps of Engineers Specifications for Polyvinylchloride Waterstop.
   3. NSF International (NSF): 61, Drinking Water System Components - Health Effects.

B. Related Specifications:
   1. 01 45 33 – Special Inspection, Observation, and Testing
   2. 03 21 00 – Steel Reinforcement
   3. 03 30 00 – Cast-in-Place Concrete
   4. 07 92 00 – Joint Sealants

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Waterstop: Details of splices, method of securing and supporting waterstop in forms to maintain proper orientation and location during concrete placement.

b. Construction Joints, Expansion Joints and Control Joints: Layout and location for each type. Include joints locations shown on Drawings, additional required joint locations and any proposed alternate locations.

2. Product Data:
   a. Waterstops.
   b. Bond breaker.
   c. Premolded joint fillers.
   d. Pourable joint fillers.
   e. Preformed control joints.
   f. Epoxy-coated dowels.
   g. Roofing felt.
   h. Accessories not specified in other sections.
3. Samples: PVC waterstop splice, joint, and fabricated cross of each size, shape, and fitting of waterstop.

B. Informational Submittals:
1. Certification:
   a. Joint Filler(s) for Potable Water Structures: Confirmation material is certified to meet requirements of NSF 61.
   b. Letter stating compatibility between liquids being contained and materials used for:
      1) Waterstops.
      2) Joint fillers.
   c. Manufacturer's application instructions for:
      1) Bonding agent.
      2) Bond breaker.
2. Manufacturer's written instructions for product shipment, storage, handling, installation/application, and repair for:
   a. Waterstops.
   b. Bond breaker.
   c. Bonding agent.
   d. Premolded joint fillers.
   e. Pourable joint fillers (sealant proportions not required as products used only as a filler).
   f. Preformed control joints.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Verify delivered materials are in accordance with Specifications, regulatory agencies, and Manufacturer's product data sheets prior to unloading and storing onsite.

B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight or as required by Manufacturer.

PART 2 - PRODUCTS

2.01 PLASTIC WATERSTOP

A. Extruded from elastomeric plastic compound of which basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.

B. Specific Gravity: Approximately 1.37.

C. Shore Durometer Type A Hardness: Approximately 80.

D. Performance Requirements: COE Specification CRD-C-572.

E. Type Required in Expansion, Contraction, and Control Joints: 6 inches wide or 9 inches wide with center bulb and parallel longitudinal ribs or protrusions on each side of strip center, as indicated on Drawings.

F. Type Required in Construction Joints: Flat ribbed, 6 inches wide with parallel longitudinal ribs or protrusions on each side of strip center, as indicated on Drawings.

G. Corrugated or tapered type waterstops are not acceptable.

H. Thickness: Constant from bulb edge (or center of waterstop) to outside stop edge.

I. Minimum Weight per Foot of Waterstop:
   1. 0.50 pound for 3/16 inch by 4 inches.
   2. 1.60 pounds for 3/8 inch by 6 inches.
   3. 2.30 pounds for 3/8 inch by 9 inches.

J. Factory Fabrications: Use only factory fabrications for intersections, transitions, and changes of direction.

K. Manufacturers and Products for Center Bulb Type:
   1. Use same manufacturers for flat ribbed profile:
      a. Vinylex Corp., St Louis, MO.; No. RB638H (6 inches by 3/8 inch) and No. RB938H (9 inches by 3/8 inch).
      b. Greenstreak, St. Louis, MO; Style No. 702, (4 inches by 3/16 inch), Style 732 (6 inches by 3/8 inch) and Style 735 (9 inches by 3/8 inch).
      c. Durajoint, Garrettsville, OH.; Type 3, (4 inches by 3/16 inch,), Type 9 (6 inches by 3/8 inch), and Type 10 (9 inches by 3/8 inch).
      d. BoMetals, Carrollton, GA.: No. RCB-4316LB (4 inches by 3/16 inch), No. RCB-638LB (6 inches by 3/8 inch) and No. RCB-938NT (9 inches by 3/8 inch).
      e. Dacon Plastics LLC, Jacksonville, TX; No. RCB11, (4 inches by 3/16 inch), No. RCB17 (6 inches by 3/8 inch) and No. RCB18 (9 inches by 3/8 inch).
      f. Or approved equal.

2.02 HYDROPHILIC WATERSTOP

A. For use at construction joints only, where new concrete is placed against existing concrete where shown on Drawings.

B. Material shall be a nonbentonite hydrophilic rubber compound.

C. Manufacturers and Products:

1. Greenstreak Plastic Products, St. Louis, MO; Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive and sealant.
2. Adeka Ultra Seal, JLM Associates, Spearfish, SD; MC-2010M with 3M-2141 adhesive and P-201 sealant.
3. Or approved equal.

2.03 INJECTION-TYPE WATERSTOP

A. Reinjectable waterstop hose system for use where shown on Drawings.

B. Reinjectable Water Stop Hose:
   1. Fabricated of polyvinyl chloride (PVC) compound.
   2. Contain discharge openings to allow for disbursement of an injection material into expansion joint.
      a. Discharge openings designed to be sealed tight during concreting operation to prevent entry of mixing water and cement slurry.
   3. Allows free and uniform discharge of injection material over entire length of hose during injection process.
   4. Able to be internally cleaned by using water and vacuum pressure.

C. Injection Material: Hydrophilic or hydrophobic resin grout for use in expansion joints as recommended by reinjectable waterstop hose manufacturer.

D. Manufacturers and Products:
   1. Greenstreak/BBZ, St. Louis, MO.; Fuko Injection Hose System with Multigel 850.
   2. Deneef Construction Chemicals, Inc., Houston, TX.; TRIOject Injection Hose System with Hydro Active Grout.
   3. Or approved equal.

2.04 RETROFIT PVC WATERSTOP

A. Material: See Article Plastic Waterstop.

B. Factory Fabrications: Use only factory fabrications for intersections, transitions, and changes of direction.

C. Stainless Steel Batten Bar: AISI Type 304. Size and configuration in accordance with manufacturer's instructions.

D. Manufacturers and Products:
   1. Vinylex Corp., St Louis, MO; No. RET638 (6 inches by 3/8 inch) and No. RET912 (9 inches by 3/8 inch).
   2. Greenstreak, St. Louis, MO; Style 609 (6 inches by 3/8 inch) and Style 667 (9 inches by 1/2 inch).
   3. BoMetals, Carrollton, GA; No. RF-912 (9 inches by 1/2 inch).
   4. Or approved equal.

2.05 BOND BREAKER

A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape. Same width as joint that will adhere to premolded joint material or concrete surface.

B. Use bond prevention material as specified in Section 03 30 00, Cast-in-Place Concrete, except where bond breaker tape is specifically called for on Drawings.

2.06 PREMOLDED JOINT FILLER

A. Bituminous Type: ASTM D994 or ASTM D1751.

B. Sponge Rubber:
   1. Neoprene, closed-cell, expanded; ASTM D1056, Type 2C5, with compression deflection, 25 percent deflection (limits), 119 kPa to 168 kPa (17 psi to 24 psi) minimum. Use in joints for potable and nonpotable water containment structures.
   2. Manufacturer and Product: Monmouth Rubber and Plastics, Corp, Long Branch, NJ; Durafoam DK5151 or approved equal.

2.07 POURABLE JOINT FILLERS

A. General:
   1. Although product is a sealant, it is being specified as a filler to prevent debris accumulation and allow expansion and contraction under shrinkage and thermal loads. It does not need to meet proportional sealant geometry requirements.
   2. For Potable Water Containment structures, meet requirements of NSF 61.

B. Filler for Potable or Non-Potable Water Containment Structures:
   1. Multicomponent sealant, self-leveling or nonsag as required for level, sloping, or vertical joints.
   2. Color: White.
   3. Manufacturer and Product: Sika Corp., Lyndhurst, NJ; Sikaflex-2c SL or approved equal.

C. Filler for Nonpotable Water Containment Structures Only:
   1. Pourable, two-component, cold-applied compound meeting ASTM C920, Type M, Grade P, Class 25, Use T.
   2. Color: Black.
   3. Manufacturer and Product: W.R. Meadows, Inc., Elgin, IL; Gardox or approved equal.

2.08 STEEL EXPANSION JOINT DOWELS

A. Dowels: ASTM A36/A36M round smooth steel bars.

B. Bar Coating: Factory-applied epoxy coating and factory or field applied lubrication coating conforming to ASTM A775.

2.09 ACCESSORIES

A. Joint Sealant:
   1. Polyurethane as specified in Section 07 92 00, Joint Sealants.

B. One-Part Polyurethane, Immersible:
   1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
   2. Capable of being continuously immersed in water.
   3. Manufacturers and Products for Nonsag:
      a. Sika Chemical Corp.; Sikaflex-1a.
      b. Tremco; Vulkem 116.
      c. Or approved equal.
   4. Manufacturers and Products for Self-leveling:
      a. BASF; Sonneborn, SL-1.
      b. Tremco; Vulkem 45.

c. Sika Chemical Corp.; Sikaflex 1c SL.
d. Or approved equal.

C. Roofing Felt: ASTM D226, Type II, 30-pound asphalt-saturated or equal weight of ASTM D227 coal-tar saturated felt.

D. Steel Reinforcement: As specified in Section 03 21 00, Steel Reinforcement.

E. Nails: Galvanized, as required for securing premolded joint filler.

F. Galvanized Rebar at Control Joints: ASTM A767/A767M and ASTM A615/A615M Grade 60 prior to galvanizing.

G. Ties for PVC Waterstop: “Hog Rings” or grommets for each edge at 12-inch maximum spacing.

PART 3 - EXECUTION

3.01 GENERAL

A. Commence concrete placement after joint preparation is complete.

B. Time Between Concrete Pours: As specified in Section 03 30 00, Cast-in-Place Concrete.

3.02 SURFACE PREPARATION

A. Construction Joints: Prior to placement of abutting concrete, clean contact surface.
1. Remove laitance and spillage from steel reinforcement and dowels.
2. Roughen surface to minimum of 1/4-inch amplitude:
a. Sandblast after concrete has fully cured.
b. Water blast after concrete has partially cured.
c. Green cut fresh concrete with high-pressure water and hand tools.
3. Perform cleaning so as not to damage waterstop, if one is present.

B. Expansion Joint:
1. Use wire brush or motorized device to mechanically roughen and thoroughly clean concrete surfaces on each side of joint from plastic waterstop to top of joint.
2. Use dry, high-pressure air to remove dust and foreign material, and dry joint.
3. Prime surfaces as required before placing joint filler.
4. Avoid damage to waterstop.

C. Contraction Joint and Control Joint:
1. Coat concrete surfaces above and below plastic waterstop with bond breaker.
2. Do not damage or coat waterstop.

D. Construction Joint with Hydrophilic Waterstop:
1. Follow hydrophilic waterstop manufacturer’s written instructions.
2. Clean debris, dirt, dust, and foreign material from concrete surface. Concrete surface must be smooth, clean, and dry. Grind concrete as required.

3.03 INSTALLATION OF WATERSTOPS

A. General:

1. Continuous waterstop shall be installed in construction joints in walls and slabs of water holding basins and channels and in walls of below grade structures, unless specifically noted otherwise.
2. Join waterstop at intersections to provide continuous seal.
3. Center waterstop on joint.
4. Secure waterstop in correct position. Tie waterstop to steel reinforcement using grommets, “Hog Rings,” or tiewire at maximum spacing of 12 inches. Do not displace waterstop during concrete placement.
5. Repair or replace damaged waterstop.
6. Place concrete and vibrate to obtain impervious concrete in vicinity of joints.
7. Joints in Footings and Slabs:
    a. Ensure that space beneath horizontal waterstop is completely filled with concrete.
    b. During concrete placement, make visual inspection of waterstop area.
    c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift ribbed waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.

B. Plastic Waterstops:
1. Install in accordance with manufacturer’s written instructions.
2. Splice in accordance with waterstop manufacturer’s written instructions using Teflon-coated thermostatically controlled heating iron at approximately 380 degrees F.
    a. Allow at least 10 minutes before new splice is pulled or strained in any way.
    b. Finished splices shall provide cross section that is dense and free of porosity with tensile strength of not less than 80 percent of unspliced materials.
    c. Use only factory made waterstop fabrications for intersections, changes of directions and transitions.
    d. Field splice permitted only for straight butt welds.

C. Hydrophilic Waterstop:
1. Install in accordance with manufacturer’s written instructions.
2. Provide minimum of 2-1/2 inches of concrete cover over waterstop. When structure has two layers of steel reinforcement, locate centered between layers of steel or as shown.
3. Apply adhesive to concrete surface and allow to dry for specified time before applying waterstop strip.
4. Lap ends of waterstop strip together at splices and corners and join with sealant.
5. Verify that waterstop is anchored firmly in place before placing concrete. Do not allow vibrator to come into contact with waterstop.
6. Lap hydrophilic waterstop 2 feet minimum with intersecting plastic waterstops.

D. Injection-Type Waterstop:
1. Install reinjectable waterstop hose in accordance with manufacturer’s instructions.
2. After concrete has been placed and cured for a minimum of 28 days, inject specified injection material into reinjectable waterstop hose in accordance with manufacturer’s instructions.
3. Upon completion of injection process, clean out remaining injection material in hose in accordance with manufacturer’s instructions to allow for future injections.

E. Split Face PVC Waterstop: Install split face PVC waterstop in accordance with manufacturer’s instructions.

F. Retrofit PVC Waterstop:
1. Install retrofit PVC waterstop in accordance with manufacturer’s instructions.

2. Prepare surface of existing concrete in accordance with manufacturer's instructions. Apply a bed of epoxy, approximately 1/8 inch thick and slightly wider than waterstop base, to concrete surface.
3. Place the retrofit waterstop in place prior to the curing of the epoxy, securing waterstop with stainless steel batten bars and stainless steel post-installed anchors. Fasten one side at a time, making sure retrofit profile is positioned to eliminate any air pockets or voids between waterstop and existing concrete.
4. Butt splice by thermally fusing the free ends together prior to attaching to wall in accordance with manufacturer's instructions.

3.04 EXPANSION JOINT INSTALLATION

A. Premolded Joint Filler:
   1. Sufficient in width to completely fill joint space where shown.
   2. Install per manufacturer's written instructions.
   3. If waterstop is in joint, cut premolded joint filler to butt tightly against waterstop and concrete face.
   4. Precut premolded joint filler to required depth at locations where joint filler or sealant is to be applied.
   5. Form cavities for joint filler with either precut, premolded joint filler, or smooth removable accurately shaped material. Entire joint above waterstop, in slabs, shall be formed and removed so that entire space down to waterstop can be filled with the pourable joint filler.
   6. Vibrate concrete thoroughly along joint form to produce dense, smooth surface.

B. Bituminous Type Premolded Joint Filler:
   1. Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.
   2. Secure premolded joint filler in forms before concrete is placed.

C. Sponge Rubber Joint Filler: Install per manufacturer's written instructions.

D. Pourable Joint Filler:
   1. General:
      a. Install in accordance with the manufacturer's written instructions, except as specified below:
         1) Apply primer prior to pouring joint filler.
         2) Fill entire joint above the waterstop with joint filler as shown.
         3) Use masking tape on top of slabs at sides of joints, clean spillage. Remove masking tape afterwards.
         4) Sealant products used as fillers need not meet sealant geometry parameters. Do not use backing rods.

E. Steel Expansion Joint Dowels:
   1. Install coated and lubricated bars parallel to wall or slab surface and in true horizontal position perpendicular to joint in both plan and section view, so as to permit joint to expand or contract without bending dowels.
   2. Secure dowels tightly in forms with rigid ties.
   3. Install steel reinforcement in concrete as shown.

3.05 CONTRACTION JOINT INSTALLATION

A. Place bond breaker above and below waterstop.

B. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

3.06 CONTROL JOINT INSTALLATION

A. Locate steel reinforcement as shown.

B. Install waterstop.

C. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

D. Install bond breaker to concrete surfaces above and below waterstop.

3.07 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

3.08 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with CBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

SECTION 03 21 00

STEEL REINFORCEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes steel reinforcement

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a. 117, Specification for Tolerances for Concrete Construction and Materials.
      b. 315, Details and Detailing of Concrete Reinforcement.
      c. 318, Building Code Requirements for Structural Concrete and Commentary.
      d. 350, Code Requirements for Environmental Engineering Concrete Structures.
      e. SP-66, Detailing Manual.
   2. American Welding Society (AWS): D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
   3. ASTM International (ASTM):
      a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      b. A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      c. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
      d. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      e. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      f. A767/767M, Standard Specification for Zinc-Coated (Galvanized) Steel bars for Concrete Reinforcement
      g. A775/A775M, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   4. Concrete Reinforcing Steel Institute (CRSI):
      a. Placing Reinforcing Bars.
      b. Manual of Standard Practice.
   5. International Code Council (ICC): Evaluation Services Report.
   6. Wire Reinforcement Institute (WRI): WWR-500, Manual of Standard Practice, Structural Welded Wire Reinforcement.
   7. California Building Standards Commission (CBSC): California Building Code (CBC).

B. Related Specifications:
   1. 01 45 16.13, Contractor Quality Control
   2. 01 45 33, Special Inspection, Observation, and Testing

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings prepared in accordance with CRSI Manual of Standard Practice and ACI SP-66:
    a. Bending lists.
    b. Placing drawings.
2. Welded, metallic sleeve splice, and mechanical threaded connection.

B. Informational Submittals:
1. Lab test reports for steel reinforcement showing stress-strain curves and ultimate strengths.
2. Mechanical Threaded Connections:
    a. Current ICC Evaluation Services Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.
    b. Verification device threads have been tested and meet requirements for thread quality, in accordance with manufacturer's published methods.
    c. Manufacturer's instructions.
3. Welding Qualification: Prior to welding, submit welder qualifications and nondestructive testing procedures.
4. Test results of field testing.

1.04 QUALITY ASSURANCE

A. Welder Qualifications: Certified in accordance with AWS D1.4/D1.4M.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Unload, store, and handle bars in accordance with CRSI publication "Placing Reinforcing Bars."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars:
1. Includes stirrups, ties, and spirals.
2. ASTM A615/A615M, Grade 60, where welding is not required.
3. ASTM A706/A706M, Grade 60, for reinforcing to be welded and reinforcing in structural columns and walls.
4. ASTM A767/767M, Grade 60, for galvanized bars.

B. Mechanical Splices and Connections:
1. Metal Sleeve Splice:
    a. Furnish with cast filler metal, capable of developing, in tension or compression, 125 percent of minimum tensile strength of bar.
    b. Manufacturer and Product: Erico Products, Inc., Cleveland, OH; Cadweld T-Series or approved equal.
2. Mechanical Threaded Connections:
    a. Furnish metal coupling sleeve with internal threads engaging threaded ends of bars developing in tension or compression 125 percent of yield strength of bar.
    b. Manufacturers and Products:
        1) Erico Products, Inc., Cleveland, OH; Lenton Reinforcing Steel Couplers.
        2) Erico Products, Inc., Cleveland, OH; Lenton Lock Mechanical Rebar Splicing System.
        3) Richmond Screw Anchor Co., Inc., Fort Worth, TX; Richmond DB-SAE Dowel Bar Splicers.

4) Or approved equal.

C. Welded Wire Fabric:
   1. ASTM A185 or ASTM A497 and ACI 318, using ASTM A82 wire of 75 ksi minimum tensile strength.
   2. Furnish flat sheets only, rolled sheets not permitted.

2.02 ACCESSORIES

A. Tie Wire:
   1. Black, soft-annealed 16-gauge wire.
   2. Nylon-, epoxy-, or plastic-coated wire.

B. Bar Supports and Spacers:
   1. Use precast concrete bar supports and side form spacers, unless noted otherwise. Do not use other types of supports or spacers.
   2. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports.
   3. Use only precast concrete bar supports where concrete surfaces are exposed to weather, earth, water, chloride intrusion, or corrosive chemicals. Bar supports shall be nonconductive and have geometry and bond characteristics that deter movement of moisture from the surface to the reinforcement.
   4. Precast concrete supports shall have same minimum strength and shall be made from same materials as that of the concrete in which they are to be embedded. Precast concrete supports shall be cast and properly cured for at least 7 days before use and shall have a wire or other device cast into each block for the purpose of attaching them securely to steel reinforcement.
   5. In Beams, Columns, Walls, and Slabs Exposed to View after Form Removal: Use small precast concrete blocks made of same color as concrete in which they are embedded.
   6. Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports do not possess necessary geometry, strength, or stiffness.
   7. Precast Concrete Supports:
      a. Total bond precast, high-performance concrete bar supports as supplied by:
         1) Con Sys Inc., Pinawa, MB, Canada.
         2) Dayton Superior, Miamisburg, OH, Dobies.

2.03 FABRICATION

A. Follow CRSI Manual of Standard Practice.

B. Bend bars cold.

PART 3 - EXECUTION

3.01 PREPARATION

A. Notify Construction Manager when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.

B. Clean reinforcing bars of loose mill scale, oil, earth, and other contaminants.

3.02 INSTALLATION

A. Bundle or space bars, instead of field bending where construction access through reinforcing is necessary.

B. Spacing and Positioning: Conform to ACI 318.

C. Location Tolerances: In accordance with CRSI publication, “Placing Reinforcing Bars.”

D. Splicing:
   1. Follow ACI 318.
   2. Use lap splices, unless otherwise shown or permitted in writing by Engineer.
   3. Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar.
   4. Stagger splices in adjacent bars where indicated and as shown on the Drawings.

E. Mechanical Splices and Connections:
   1. Use only in areas specifically approved in writing by Engineer.
   2. Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICC Evaluation Services Report or equivalent code agency report.
   3. For metal sleeve splice, follow manufacturer’s installation recommendations.
   4. Maintain minimum edge distance and concrete cover.

F. Tying Reinforcing Bars:
   1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars to hold them firmly at required spacing.
   2. Bend tie wire away from concrete surface to provide clearance of 1 inch from surface of concrete to tie wire.

G. Reinforcement Around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut for opening. Extend steel reinforcing a standard lap length beyond opening at each end.

H. Welding Reinforcement:
   1. Only ASTM A706/A706M bars may be welded.
   2. Do not perform welding until welder qualifications are approved.

I. Straightening and Rebending: Field bending of steel reinforcement bars is not permitted.

J. Unless permitted by Engineer, do not cut reinforcing bars in field.

3.03 WELDED WIRE FABRIC INSTALLATION

A. Use only where specifically shown.

B. Extend fabric to within 2 inches of edges of slab and lap splices at least 1-1/2 courses of fabric or minimum 8 inches.

C. Tie laps and splices securely at ends and at least every 24 inches with tie wire.

D. Place welded wire fabric on concrete blocks and rigidly support equal to that provided for reinforced bars. Do not use broken concrete, brick, or stone.

E. Follow ACI 318 and WRI WWR-500.

F. Do not use fabric that has been rolled. Install flat sheets only.

3.04 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with CBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete.

1.02 REFERENCES

A. Abbreviations and Acronyms:

B. Definitions:
1. Architectural Concrete: Concrete indicated as such in Contract Documents. Requires specified care in selection of concrete materials, forming, placing, and finishing in order to obtain desired architectural appearance.
2. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.
3. Contractor's Licensed Design Engineer: Individual representing Contractor who is licensed to practice engineering as defined by statutory requirements of professional licensing laws in state or jurisdiction in which Project is to be constructed.
4. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4-inch in diameter, cracks in liquid containment structures and below grade habitable spaces that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.
5. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained.
6. Hot Weather: As defined in ACI 305.1.
7. Hydraulic Structure: Liquid containment structure.
8. New Concrete: Less than 60 days old.

C. Related Specifications:
1. 03 01 32 – Repair of Vertical and Overhead Concrete Surfaces
2. 03 01 33 – Repair of Horizontal Concrete Surfaces
3. 03 10 00 – Concrete Forming and Accessories
4. 03 15 00 – Concrete Joints and Accessories
5. 03 39 00 – Concrete Curing
6. 03 62 00 - Grouting
7. 03 64 23 – Crack Repair Epoxy Injection Grouting

D. Reference Standards
1. American Concrete Institute (ACI):
   a. 117, Specification for Tolerances for Concrete Construction and Materials.

b. 214R, Guide to Evaluation of Strength Test Results of Concrete.
c. 301, Specifications for Structural Concrete.
d. 304.2R, Placing Concrete by Pumping Methods.
e. 305.1, Specification for Hot Weather Concreting.
f. 306.1, Standard Specification for Cold Weather Concreting.
g. 309R, Guide for Consolidation of Concrete
h. 315, Details and Detailing of Concrete Reinforcement.
i. 318, Building Code Requirements for Structural Concrete
j. 350, Code Requirements for Environmental Engineering Concrete Structures
k. 350.1, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures.
l. CP-1, Technical Workbook for ACI Certification of Concrete Field Testing Technician – Grade 1.

2. ASTM International (ASTM):
   a. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. C33/C33M, Standard Specification for Concrete Aggregates.
   c. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   d. C40, Test Method for Organic Impurities in Fine Aggregates for Concrete.
   e. C42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   f. C88, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   g. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   h. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
   i. C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   j. C138, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   k. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
   l. C150/C150M, Standard Specification for Portland Cement.
   m. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   n. C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
   o. C231/C231M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   p. C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
   q. C289, Test Method for Potential Alkali Silica Reactivity of Aggregates (Chemical Method).
   r. C309, Liquid Membrane-Forming Compounds for Curing Concrete.
   s. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
   t. C595/C595M, Standard Specification for Blended Hydraulic Cements.
   u. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   v. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   w. C979/C979M, Standard Specification for Pigments for Integrally Colored Concrete.
   x. C989, Standard Specification for Slag Cement for Use in Concrete and Mortars.
   y. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.

z. C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
aa. C1074, Standard Practice for Estimating Concrete Strength by the Maturity Method.
bb. C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
cc. C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
dd. C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures.
ee. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
ff. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
gg. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
hh. C1582/C1582M, Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete.
ii. C1602/C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
jj. D1751, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
kk. D4580, Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.
ll. E329, Standard Specification for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction.
mm. E1155, Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

3. National Ready Mixed Concrete Association (NRMCA).

1.03 SUBMITTALS

A. Action Submittals:
1. Mix Designs:
a. Contain proportions of materials and admixtures to be used on Project, signed by mix designer.
b. Documentation of average strength for each proposed mix design in accordance with ACI 301.
c. Manufacturer's Certificate of Compliance for the following:
1) Portland cement.
2) Fly ash.
3) Aggregates, including specified class designation for coarse aggregate.
4) Admixtures.
5) Concrete producer has verified compatibility of constituent materials in design mix.
d. Test Reports:
1) Cement: Chemical analysis report.
2) Supplementary Cementitious Materials: Chemical analysis report and report of other specified test analysis.
3) Water-Soluble Chloride-Ion Content in Hardened Concrete: Unless otherwise permitted, in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.
4) Shrinkage Test Results: In accordance with ASTM C157/C157M as modified herein.

e. Aggregates:
    1) Coarse Aggregate Gradation: List gradings and percent passing through each sieve.
    2) Fine Aggregate Gradation: List gradings and percent passing through each sieve.
    3) Deleterious substances in fine aggregate per ASTM C33/C33M, Table 2.
    4) Deleterious substances in coarse aggregate per ASTM C33/C33M, Table 4.
    5) Test Reports:
        a) Alkali Aggregate Reactivity: Aggregate shall be classified as nonpotentially reactive in accordance with Article Concrete Mix Design. Include documentation of test results per applicable standards.
f. Admixtures:
    1) Manufacturer's catalog cut sheets and product data sheets for each admixture used in proposed mix designs. Chloride ion content must be included.

2. Product Data: Specified ancillary materials.
3. Detailed plan for curing and protection of concrete placed and cured in cold weather. Details shall include, but not be limited to, the following:
    a. Procedures for protecting subgrade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.
    b. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.
    c. Methods for temperature protection during placement.
    d. Types of covering, insulation, housing, or heating to be provided.
    e. Curing methods to be used during and following protection period.
    f. Use of strength accelerating admixtures.
    g. Methods for verification of in-place strength.
    h. Procedures for measuring and recording concrete temperatures.
    i. Procedures for preventing drying during dry, windy conditions.
4. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F. Plan shall include, but not be limited to, the following:
    a. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.
    b. Use of retarding admixture.
    c. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.
    d. Types of shading and wind protection to be provided.
    e. Curing methods, including use of evaporation retardant.
    f. Procedures for measuring and recording concrete temperatures.
    g. Procedures for preventing drying during dry, windy conditions.
5. Thermal Control Plan: For concrete sections with a minimum specified dimension that is greater than 2 feet 6 inches.
6. Concrete repair techniques.

B. Informational Submittals:
1. Preinstallation Conference minutes.
2. Manufacturer's application instructions for bonding agent and bond breaker.
3. Manufacturer's Certificate of Compliance to specified standards:
    a. Bonding agent.
    b. Repair materials.
4. Statement of Qualification:
    a. Batch Plant: Certification as specified herein.
    b. Mix designer.

c. Installer.
d. Testing agency.
5. Field test reports.
6. Recorded temperature data from concrete placement where required.
7. Tightness test results.
8. Concrete Delivery Tickets:
   a. For each batch of concrete before unloading at Site.
   b. In accordance with ASTM C94/C94M, including requirements 14.2.1 through 14.2.10.
   c. Indicate amount of mixing water withheld and maximum amount that may be permitted to be added at Site.

1.04 QUALITY ASSURANCE

A. Concrete construction shall conform to requirements of ACI 117 and ACI 301, except as modified herein.

B. Qualifications:
1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.
3. Testing Agency: Unless otherwise permitted, an independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Thermal Control Plan: When required, shall include the following minimum requirements:
1. Calculated or measured adiabatic temperature rise of concrete.
2. Upper limit for concrete temperature at time of placement.
3. Description of specific measures and equipment that will be used to ensure maximum temperature in placement will not exceed specified maximum temperature limit.
4. Calculated maximum temperature in placement based on expected conditions at time of placement and use of proposed measures to control temperatures.
5. Description of specific measures and equipment that will be used to ensure temperature difference will not exceed specified temperature difference limit.
6. Calculated maximum temperature difference in placement based on expected conditions at time of placement and use of proposed measures to control temperature differences.
7. Description of equipment and procedures that will be used to monitor and log temperatures and temperature differences.
8. Drawing showing locations for temperature sensors in placement.
9. Description of format and frequency of providing temperature data to Engineer.
10. Description of measures to address and reduce excessive temperatures and temperature differences, if they occur.
11. Description of curing procedures, including materials and methods, and curing duration.

12. Description of formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit, and how curing will be maintained.
13. Alternate temperature limits when permitted by Engineer.
    a. Determination of alternate temperature limits shall be based on detailed thermal and crack analyses.
    b. Analyses shall be stamped by Contractor's Licensed Design Engineer.
14. If concrete design mixture is changed, thermal control plan must be updated.

D. Preinstallation Conference:
1. Required Meeting Attendees:
    a. Contractor, including pumping, placing and finishing, and curing subcontractors.
    b. Ready-mix producer.
    c. Admixture representative.
    d. Testing and sampling personnel.
    e. Engineer.
2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include:
    a. Admixture types, dosage, performance, and redosing at Site.
    b. Mix designs, test of mixes, and Submittals.
    c. Placement methods, techniques, equipment, consolidation, and form pressures.
    d. Slump and placement time to maintain slump.
    e. Finish, curing, and water retention.
    f. Thermal control plan.
    g. Protection procedures for weather conditions.
    h. Other specified requirements requiring coordination.
    i. Conference minutes shall be provided by the Contractor within 5 days after the conference to participants and parties affected by meeting decisions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cementitious Materials:
   1. Cement:
      a. Portland Cement: Unless otherwise specified, conform to requirements of ASTM C150/C150M.
      b. Blended Hydraulic Cement:
         1) Unless otherwise specified, conform to requirements of ASTM C595/C595M.
         2) Portland cement used in blended hydraulic cement, conform to requirements of ASTM C150/C150M.
      c. Furnish from one source.
   2. Supplementary Cementitious Materials (SCM):
      a. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:
         1) ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 4 percent.

B. Aggregates: Furnish from one source for each aggregate type used in a mix design.
   1. Normal-Weight Aggregates:
      a. In accordance with ASTM C33/C33M, except as modified herein.
         1) Class Designation: 4S unless otherwise specified.
      b. Free of materials and aggregate types causing pop-outs, discoloration, staining, or other defects on surface of concrete.
      c. Alkali Silica Reactivity: See Article Concrete Mix Design.
   2. Fine Aggregates:
      a. Clean, sharp, natural sand.
      b. ASTM C33/C33M.
      c. Limit deleterious substances in accordance with ASTM C33/C33M, Table 2 and as follows:
         1) Limit material finer than 75-µm (No. 200) sieve to 3 percent mass of total sample.
         2) Limit coal and lignite to 0.5 percent.
   3. Coarse Aggregate:
      a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
      b. Limit deleterious substances in accordance with ASTM C33/C33M, Table 4 for specified class designation.

C. Admixtures: Unless otherwise permitted, furnish from one manufacturer.
   1. Characteristics:
      a. Compatible with other constituents in mix.
      b. Contain at most, only trace amount chlorides in solution.
      c. Do not use admixtures known to be toxic after concrete is 30 days.
      d. Furnish type of admixture as recommended by manufacturer for anticipated temperature ranges.
   2. Air-Entraining Admixture: ASTM C260/C260M.
   3. Water-Reducing Admixture: ASTM C494/C494M, Type A or Type D.
      a. Manufacturers and Products:
         1) BASF Admixtures Inc., Shakopee, MN; Pozzolith Series or PolyHeed Series.
         2) Euclid Chemical Co., Cleveland, OH; Eucon Series.

3) W. R. Grace & Co., Cambridge, MA; Daracem Series or Mira Series.
4) Or approved equal.

4. Retarding Admixture: ASTM C 494/C 494M, Type B.
5. Accelerating Admixture: ASTM C 494/C 494M, Type C.
6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F or Type G.
   a. Manufacturers and Products:
      1) BASF Admixtures Inc., Shakopee, MN; Glenium Series, PS 1460, or Rheobuild 1000.
      2) Euclid Chemical Co., Cleveland, OH; Eucon Series or Plastol Series.
      3) W. R. Grace & Co., Cambridge, MA; ADVA Series, Daracem Series, or EXP 950.
      4) Or approved equal.
7. Plasticizing Admixture: ASTM C1017/C1017M, Type I or Type II.
8. Corrosion Inhibiting Admixtures: ASTM C1582/C1582M.
9. Shrinkage Reducing Admixture:
   a. Manufacturers and Products:
      1) BASF Admixtures Inc., Shakopee, MN; Tetraguard AS20.
      2) Euclid Chemical Co., Cleveland, OH; Eucon SRA Series.
      3) W. R. Grace & Co., Cambridge, MA; Eclipse Series.
      4) Or approved equal.
10. Do not use calcium chloride as an admixture.

D. Water and Ice: Mixing water for concrete and water used to make ice shall be potable water, unless alternative sources of water are permitted.
   1. Water from alternative sources shall comply with requirements of ASTM C1602/C1602M, and concentration of chemicals in combined mixing water shall be less than:
      a. Chloride Content: 500 ppm.
      b. Sulfate Content as SO_4: 3,000 ppm.
      c. Alkalis as (Na_2O + 0.658 K_2O): 600 ppm.
      d. Total Solids by Mass: Less than 50,000 ppm.

2.02 ANCILLARY MATERIALS

A. Bonding Agent: Unless otherwise specified, in accordance with the following:
   1. ASTM C881/C881M, Type V.
   2. Two-component, moisture insensitive, 100 percent solids epoxy.
   3. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
   4. Manufacturers and Products:
      a. BASF Building Systems Inc., Shakopee, MN; Concresive Standard LVI.
      b. Euclid Chemical Co., Cleveland, OH; Euco # 352 Epoxy System LV.
      c. Prime Resins, Conyers, GA; Prime Bond 3000 to 3900 Series.
      d. Sika Chemical Corp., Lyndhurst, NJ; Sikadur 32 Hi-Mod.
      e. Or approved equal.

B. Bond Breaker:
   1. Nonstaining type, providing positive bond prevention.
   2. Manufacturers and Products:
      a. Dayton Superior Corporation, Kansas City, KS; EDOCO Clean Lift Bond Breaker.
      b. Nox-Crete Products Group, Omaha, NE; Silcoseal Select.
      c. Or approved equal

C. Repair Material:
   1. In accordance with requirements of Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.
   2. In accordance with requirements of Section 03 01 33, Repair of Horizontal Concrete Surfaces.

D. Repair Material:
   1. Contain only trace amounts of chlorides and other chemicals that can potentially cause steel to oxidize.
   2. Where repairs of exposed concrete are required, prepare mockup using proposed repair materials and methods, for confirmation of appearance compatibility prior to use.
   3. Obtain Manufacturer's Certificate of Compliance that products selected are appropriate for specific applications.
   4. Repair mortar shall be site mixed.
   5. Prepare concrete substrate and mix, place, and cure repair material in accordance with manufacturer's written recommendations.
   6. Manufacturers and Products:
      a. BASF Building Systems Inc., Shakopee, MN; EMACO S-Series products.
      b. Sika Chemical Corp., Lyndhurst, NJ; SikaTop-Series.
      c. Or approved equal.

E. Crack Repair: In accordance with requirements of Section 03 64 23, Crack Repair Epoxy Injection Grouting.

2.03 CONCRETE MIX DESIGN

A. General:
   1. See Supplement at the end of this section for mix design requirements for each class of concrete used on Project.
   2. Prepare design mixtures for each type and strength of concrete, selecting and proportioning ingredients in accordance with requirements of ACI 301, unless otherwise specified.
   3. Selection of constituent materials and products in mix design are optional, unless specified otherwise.
   4. Unless otherwise permitted, use water-reducing admixture or water-reducing admixture and high-range, water-reducing admixture in pumped concrete, in concrete with a water-cementitious materials ratio below 0.50, and in concrete that is part of a liquid-containment structure.
   5. Unless otherwise permitted, use water-reducing admixture and high-range, water-reducing admixture in columns, piers, pilasters, and walls.
   6. Use water-reducing admixture or high-range, water-reducing admixture to achieve fresh properties that facilitate handling, placing, and consolidating of concrete, and specified hardened properties.
   7. Use water-reducing and retarding admixture when anticipated high temperatures, low humidity, or other adverse placement conditions can adversely affect fresh properties of concrete.
   8. Unless otherwise specified, desired fresh properties of concrete shall be determined by Contractor, and coordinated with concrete producer. Fresh properties of concrete shall remain stable to satisfaction of Contractor, for duration of placement and consolidation, and shall remain in conformance with requirements of Contract Documents.

B. Potential alkali-aggregate reactivity of concrete:
   1. Do not use aggregates known to be susceptible to alkali-carbonate reaction (ACR).

2. Aggregates shall have been tested to determine potential alkali-aggregate reactivity in concrete in accordance with ASTM C1260 or ASTM C1567.
   a. Aggregates that indicate expansion greater than 0.10 percent at 16 days after casting shall not be used unless they have been shown to be nondeleteriously reactive in accordance with ASTM C227 or ASTM C1293, with less than 0.04 percent expansion at 1 year for cement-aggregate combinations or less than 0.04 percent expansion at 2 years for combinations with pozzolan or slag.
   b. Alkali content of cement used in proposed concrete mixture shall not be greater than alkali content of cement used in test for potential alkali-aggregate reactivity.
   c. Use low-alkali cement or incorporate pozzolans into concrete mixture as necessary to satisfy testing for potential alkali reactivity.

C. Proportions:
   1. Design mix to meet aesthetic, durability, and strength requirements.
   2. Where fly ash is included in mix, fly ash, as a percent by weight of total cementitious materials, shall not exceed 15 percent.

D. Concrete Shrinkage Limits: Where shrinkage limits are specified, design mix for following shrinkage limits and test in accordance with ASTM C157/C157M, with the following modifications:
   1. Prisms shall be moist cured for 7 days prior to 28-day drying period.
   2. Comparator reading at end of 7-day moist cure shall be used as initial length in length change calculation.
   3. Reported results shall be average of three prisms.
   4. If shrinkage of a specimen departs from average of that test age by more than 0.004 percent, disregard results obtained from that specimen.
   5. Unless otherwise specified, results at end of 28-day drying period shall not exceed 0.040 percent if 3-inch prisms are used, or exceed 0.038 percent if 4-inch prisms are used. Aggregate will be rejected if test values exceed these limits.

E. Slump Range at Site:
   1. Prior to submitting mix design, consult with concrete producer and select a target slump value at point of delivery, for each application of each design mix. Unless otherwise permitted, target slump value will then be enforced for duration of Project.
   2. Unless otherwise permitted, target slump value is 4-inches at point of delivery, for concrete without high-range, water reducing admixture.
   3. Design mixes that include a high-range, water-reducing admixture shall have a minimum slump of 2-inches prior to addition of admixture. Unless otherwise permitted, slump shall be 8-inches maximum at point of delivery, for concrete with a high-range, water-reducing admixture.
   4. Slump tolerance shall meet requirements of ACI 117.

F. Combined Aggregate Gradation:
   1. Combined Gradation Limits: Limits shown are for coarse aggregates and fine aggregates mixed together (combined). Select one of the gradations shown in the following table:

Sieve Sizes	Combined Gradation Percentage Passing		
	1-1/2"Max.	1"Max.	3/4"Max.
2"	100	-	-
1-1/2"	95 - 100	100	-
1"	65 - 85	90 - 100	100
3/4"	55 - 75	70 - 90	92 - 100

Sieve Sizes	Combined Gradation Percentage Passing		
	1-1/2"Max.	1"Max.	3/4"Max.
1/2"	-	-	68 - 86
3/8"	40 - 55	45 - 65	57 - 74
No. 4	30 - 45	31 - 47	38 - 57
No. 8	23 - 38	23 - 40	28 - 46
No. 16	16 - 30	17 - 35	20 - 36
No. 30	10 - 20	10 - 23	14 - 25
No. 50	4 - 10	2 - 10	5 - 14
No. 100	0 - 3	0 - 3	0 - 5
No. 200	0 - 2	0 - 2	0 - 2

2.04 CONCRETE MIXING

A. General: In accordance with ACI 301, except as modified herein.

B. Truck Mixers:
   1. For every truck, test slump of samples taken per ASTM C94/C94M, paragraph 12.5.1.
   2. Where specified slump is more than 4-inches, and if slump tests differ by more than 2-inches, discontinue use of truck mixer, unless causing condition is corrected and satisfactory performance is verified by additional slump tests.

2.05 TEMPERATURE LIMITS

A. For concrete sections with a minimum specified dimension that is greater than 2 feet 6 inches, and unless otherwise permitted:
   1. Provide documentation that maximum concrete temperature in structure will not exceed 158 degrees Fahrenheit, and maximum temperature differential between center of section and external surfaces of concrete will not exceed 35 degrees Fahrenheit.

2.06 SOURCE QUALITY CONTROL

A. Source Quality Control Inspection: Construction Manager shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in this section.

PART 3 - EXECUTION

3.01 PLACING CONCRETE

A. Preparation: Meet requirements ACI 301, except as modified herein.

B. Inspection: Notify Construction Manager and Special Inspector at least 1 full working day in advance before starting to place concrete.

C. Placement into Formwork:
   1. Where vapor retarder or barrier is required, coordinate subgrade preparation with requirements in Division 07 of Specifications.
   2. Reinforcement: Secure in position before placing concrete.
   3. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs which shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
   4. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
   5. Use placement devices, for example chutes, pouring spouts, and pumps as required to prevent segregation.
   6. Vertical Free Fall Drop to Final Placement:
      a. Forms 8 Inches or Less Wide: 5 feet.
      b. Forms Wider than 8 Inches: 8 feet, except as specified.
   7. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
      a. Limit free fall to prevent segregation caused by aggregates hitting steel reinforcement.
   8. Do not use aluminum conveying devices.
   9. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
   10. Joints in Footings and Slabs:
      a. Ensure space beneath plastic waterstop completely fills with concrete.
      b. During concrete placement, make visual inspection of entire waterstop area.
      c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, and place remaining concrete to full height of slab.
      d. Apply procedure to full length of waterstop.
   11. Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.
   12. Cure concrete as specified in Section 03 39 00, Concrete Curing.

D. Conveyor Belts and Chutes:
   1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
   2. Do not use chutes longer than 50 feet.
   3. Minimum Slopes of Chutes: Angled to allow concrete to readily flow without segregation.
   4. Conveyor Belts:
      a. Approved by Engineer.
      b. Wipe clean with device that does not allow mortar to adhere to belt.
      c. Cover conveyor belts and chutes.

E. Retempering: Not permitted for concrete where cement has partially hydrated.

F. Pumping of Concrete:
   1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
   2. Minimum Pump Hose (Conduit) Diameter: 4-inches.
   3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

G. Concrete sections with a minimum specified dimension that is greater than 2 feet 6 inches:
   1. Cure and protect concrete in accordance with accepted thermal control plan and as follow:
      a. Minimum curing period shall be 14 days.
      b. Unless otherwise permitted, preserve moisture by maintaining forms in place.
   2. Strength measurement shall be representative of in-place concrete within 2-inches of concrete surface.
   3. Concrete strength shall be verified through correlation of concrete temperature and compressive strengths established by cylinder compressive tests and in accordance with ASTM C1074.
   4. Unless otherwise specified, control concrete temperatures to within specified limits from time concrete is placed until time internal temperature has cooled from its maximum, such that difference between average daily ambient and maximum internal concrete temperature at time of protection removal, is less than specified temperature difference limit.
   5. Unless otherwise specified, place one temperature sensor at center of mass of placement and one temperature sensor at a depth 2-inches from center of nearest exterior surface. Place additional sensor at each location to serve as a backup in event that other temperature sensor fails. In addition, provide temperature sensor in shaded location for monitoring ambient onsite temperature.
      a. Unless otherwise specified, monitor temperatures hourly using electronic sensors capable of measuring temperature from 32 degrees F to 212 degrees F to an accuracy of 2 degrees F.
      b. Ensure temperature sensors are operational before placing concrete.
      c. Unless otherwise specified, provide data from sensors to Construction Manager on a daily basis, until requirements are met.
      d. Compare temperatures and temperature differences with maximum limits specified in Article Temperature Limits every 12 hours, unless otherwise permitted. If either exceeds specified limits, take immediate action as described in accepted thermal control plan to remedy situation. Do not place additional mass concrete until cause of excessive temperature or temperature difference has been identified and corrections are accepted.

H. Maximum Size of Concrete Placements:
   1. Limit size of each placement to allow for strength gain and volume change as a result of shrinkage.
   2. Locate expansion, control, and contraction joints where shown on Drawings.
   3. Construction Joints: Unless otherwise shown or permitted, locate construction joints as follows:
      a. Locate construction joints as shown on Drawings or where approved in joint location submittal required in Section 03 15 00, Concrete Joints and Accessories.
      b. Provide vertical construction joints in walls and slabs at maximum spacing of 40 feet, unless shown or approved otherwise.
      c. When vertical expansion, contraction, or control joint spacing does not exceed 60 feet, intermediate construction joints are not required.

d. Uniformly space vertical construction joints within straight sections of walls and slabs, avoiding penetrations.

4. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
5. Should placement sequence result in cold joint located below finished water surface, install waterstop in joint.

I. Minimum Time between Adjacent Placements:
1. Construction or Control Joints: 7 days unless otherwise specified.
2. Construction joint between top of footing or slab, and column or wall: As soon as can safely be done without damaging previously cast concrete or interrupting curing thereof, but not less than 24 hours.
3. Expansion or Contraction Joints: 1 day.
4. For columns and walls with a height in excess of 10 feet, wait at least 2 hours before depositing concrete in beams, girders, or slabs supported thereon.
5. For columns and walls 10 feet in height or less, wait at least 1 hour prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.

J. Consolidation and Visual Observation:
1. Consolidation Equipment and Methods: ACI 301.
2. Provide at least one standby vibrator in operable condition at Site prior to placing concrete.
3. Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.
4. Vibrate concrete in vicinity of joints to obtain impervious concrete.

K. Hot Weather:
1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:
a. Maintain concrete temperature below 90 degrees F at time of placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
b. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
2. Concrete Curing: As specified in Section 03 39 00, Concrete Curing.

L. Cold Weather Placement:
1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:
a. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.
b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.
c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to surfaces including reinforcement and other embedded items.
d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.
e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.

f. Cure concrete as specified in Section 03 39 00, Concrete Curing.
    1) Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 psi or design compressive strength if less than 3,500 psi.
2. Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during specified curing period.
3. External Heating Units: Do not exhaust heater flue gases directly into enclosed area as it causes concrete carbonation as a result of concentrated carbon dioxide.
4. Maintain curing conditions as specified in Section 03 39 00, Concrete Curing.

3.02 CONCRETE BONDING

A. Construction Joints in New Concrete Members:
1. Prepare surface of construction joint as specified in Section 03 15 00, Concrete Joints and Accessories.
2. Horizontal Construction Joints Containing Waterstop in New Concrete Walls:
    a. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that air and rock pockets have been eliminated.

B. Construction Joints at Existing Concrete:
1. Thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 1/4-inch.
2. Saturate surface with water for 24 hours prior to placing new concrete.

3.03 REPAIRING CONCRETE

A. General:
1. Inject cracks that leak with crack repair epoxy as specified in Section 03 64 23, Crack Repair Epoxy Injection Grouting.
2. Repair defective areas of concrete.
3. Repair horizontal concrete surfaces in accordance with Section 03 01 33, Repair of Horizontal Concrete Surfaces.
4. Repair vertical and overhead concrete surfaces in accordance with Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.
5. Repair concrete surfaces using specified materials. Select system, submit for review, and obtain approval from Engineer prior to use.
6. Develop repair techniques with material manufacturer on surface that will not be visible in final construction prior to starting actual repair work and show how finish color will blend with adjacent surfaces. Obtain approval from Engineer.
7. Obtain quantities of repair material and manufacturer’s detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.
8. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

B. Tie Holes:
1. Unless otherwise specified, fill with specified repair material.
    a. Prepare substrate and mix, place, and cure repair material per manufacturer’s written recommendations.
2. When required, color of tie-hole patch shall match adjacent concrete.

C. Alternate Form Ties, Through-Bolts:
   1. Mechanically roughen entire interior surface of through hole.
   2. Apply bonding agent to roughened surface and drive elastic vinyl plug to half depth.
   3. Dry pack entire hole from both sides of plug with nonshrink grout, as specified in Section 03 62 00, Grouting.
   4. Use only enough water to dry pack grout.
   5. Dry pack while bonding agent is still tacky.
   6. If bonding agent has dried, remove bonding agent by mechanical means and reapply new coat of bonding agent.
   7. Compact grout using steel hammer and steel tool to drive grout to high density.
   8. Cure grout with water.
   9. When specified, color of alternate form tie-hole patch shall match adjacent concrete.

D. Exposed Metal Objects:
   1. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to depth of 1-inch and then cutting or removing metal object.
   2. Repair area of chipped-out concrete as specified for defective areas.

E. Blockouts at Pipes or Other Penetrations: Where shown install in accordance with requirements of Drawings.

3.04 CONCRETE WALL FINISHES

A. Type W-1 (Ordinary Wall Finish):
   1. Patch tie holes.
   2. Knock off projections.
   3. Repair defective areas.
   4. Inject cracks in accordance with requirements of Section 03 64 23, Crack Repair Epoxy Injection Grouting.

B. Type W-2 (Smooth Wall Finish):
   1. Patch tie holes.
   2. Grind off fins and other projections.
   3. Repair defective areas to provide smooth uniform appearance.
   4. Inject cracks in accordance with requirements of Section 03 64 23, Crack Repair Epoxy Injection Grouting.

C. Type W-4 (Finish for Cementitious Coatings):
   1. In accordance with requirements for Type W-2 except as follows:
      a. Leave surface ready for cementitious coating as specified in Division 9 - Finishes.

D. Type W-5 (Finish for Painting):
   1. In accordance with requirements for Type W-2 except as follows:
      a. Leave surface ready for painting as specified in Division 9 - Finishes.

3.05 CONCRETE SLAB FINISHES

A. General:
   1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
   2. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.

3. Finish slab in accordance with specified slab finish.
4. Do not dust surfaces with dry materials nor add water to surfaces.
5. Cure concrete as specified in Section 03 39 00, Concrete Curing.

B. Type S-1 (Steel Troweled Finish):
   1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation.
   2. Wood float to true, even plane with no coarse aggregate visible.
   3. Use sufficient pressure on wood floats to bring moisture to surface.
   4. After surface moisture has disappeared, hand steel trowel concrete to produce smooth, smooth dense surface, free from trowel marks.
   5. Provide light steel-troweled finish (two trowelings) at air-entrained slabs. Provide hard steel-troweled finish (ringing sound from the trowel) for nonair-entrained slabs.
   6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
   7. Power Finishing:
      a. Approved power machine may be used in lieu of or in addition to hand finishing in accordance with directions of machine manufacturer.
      b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
      c. Do first steel troweling for slab S-1 finish by hand.

C. Type S-2 (Wood Float Finish):
   1. Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
   2. Wood float finish to compact and seal surface.
   3. Remove laitance and leave surface clean.
   4. Coordinate with other finish procedures.

D. Type S-3 (Underside Elevated Slab Finish): When forming is removed, grind off projections on underside of slab and repair defective areas, including small shallow air pockets where schedule of concrete finishes requires:
   1. Prepare surfaces to match Type W-2 (Smooth Wall Finish).

E. Type S-5 (Broomed Finish):
   1. Finish as specified for Type S-1 floor finish, except use only a light-steel troweled finish, and then finish surface by drawing fine-hair broom lightly across surface.
   2. Broom in same direction and parallel to expansion joints, or, in case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

F. Type S-6 (Sidewalk Finish):
   1. Slope walks down 1/4-inch per foot away from structures, unless otherwise shown.
   2. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
   3. Broom surface at right angles to direction of traffic or as shown.
   4. Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with grooving tool.

G. Concrete Curbs:
   1. Float top surface of curb smooth, and finish discontinuous edges with steel edger.
   2. After concrete has taken its initial set, remove front form and give exposed vertical surface an ordinary wall finish, Type W-1.

3.06 CONCRETE SLAB TOLERANCES

A. Slab Tolerances:
   1. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
   2. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
   3. Slab Type S-A: Steel gauge block 5/16-inch thick.
   4. Slab Type S-B: Steel gauge block 1/8-inch thick.

B. Slab Elevation and Thickness:
   1. Finish Slab Elevation: Slope slabs to floor drains and gutter. Slabs shall adequately drain regardless of tolerances.
   2. Thickness: Maximum 1/4-inch minus or 1/2-inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2-inch plus.

3.07 BEAM AND COLUMN FINISHES

A. Type B-1: Match wall Type W-1.

B. Type B-2: Match wall Type W-2.

C. Type B-3:
   1. Repair rock pockets.
   2. Fill air voids.
   3. Match wall Type W-4.

D. Type C-1: Match wall Type W-1.

E. Type C-2: Match wall Type W-2.

F. Type C-3:
   1. Fill air pockets.
   2. Match wall Type W-4.

3.08 BACKFILL AGAINST STRUCTURES

A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.

B. Refer to General Structural Notes on the Drawings for additional requirements, including elevated slab and diaphragm completion prior to backfill.

C. Unless otherwise permitted, place backfill simultaneously on both sides of structure, where such fill is required, to prevent differential pressures.

3.09 FIELD QUALITY CONTROL

A. General:
   1. Provide adequate facilities for safe storage and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
   2. Unless otherwise specified, sample concrete for testing for making test specimens, from point of delivery.

3. When concrete is pumped, sample and test air content at point of delivery and at point of placement.
4. Evaluation will be in accordance with ACI 301 and Specifications.
5. Test specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
6. Frequency of testing may be changed at discretion of Engineer.
7. Pumped Concrete: Take concrete samples for slump, ASTM C143/C143M, and test specimens, ASTM C31/C31M and ASTM C39/C39M, and shrinkage specimens (ASTM C157/C157M) at placement (discharge) end of line.
8. If measured air content at delivery is greater than specified limit, check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, concrete has failed to meet requirements of Contract Documents. If measured air content is less than lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If check test of adjusted mixture fails, concrete has failed to meet requirements of Contract Documents. Concrete that has failed to meet requirements of Contract Documents shall be rejected.

B. Concrete Strength Test:
1. Unless otherwise specified, one specimen at age of 7 days for information, and two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 28 days for acceptance.
2. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified in Section 03 39 00, Concrete Curing, by 7 additional days.
3. Provide a minimum of one spare test specimen per sample. Test spare cylinder as directed by Engineer.
4. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals in accordance with ACI 301 to ensure continued compliance with these specifications.

C. Shrinkage Tests:
1. When required to conform to shrinkage limits, collect actual concrete materials being batched and before liquids have been added to mix.
2. Mix sampled material in a laboratory at proportions matching batched concrete.
3. Test shrinkage characteristics when compression test cylinders are made.
4. Concrete Shrinkage Limits: Test in accordance with ASTM C157/C157M, with the following modifications:
    a. Prisms shall be moist cured for 7 days prior to 28-day drying period.
    b. Comparator reading at end of 7-day moist cure shall be used as initial length in length change calculation.
    c. Reported results shall be average of three prisms.
    d. If drying shrinkage of a specimen departs from average of that test age by more than 0.004 percent, disregard results obtained from that specimen.
    e. Results at end of 28-day drying period shall not exceed 0.040 percent if 3-inch prisms are used, or exceed 0.038 percent if 4-inch prisms are used.
    f. If 7-day or 14-day shrinkage tests results exceed shrinkage limits established by design mix testing, furnish additional 14 days of water curing beyond original curing period, for concrete surfaces of hydraulic structures represented by prisms. Modify concrete mix design to reduce shrinkage prior to casting additional concrete on Project.

D. High-Range, Water-Reducer (Superplasticizer) Admixture Segregation Test: Test each truck prior to use on Project.

1. Segregation Test Objective: Concrete with 4-inch to 8-inch slump shall stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.
2. Test Procedure: Make slump test and check for excessive slump and observe to see if mortar or moisture flows from slumped concrete.
3. Reject concrete if mortar or moisture separates and flows out of mix.

E. Cold Weather Placement Tests:
1. During cold weather concreting, cast cylinders for field curing as follows. Use method that will produce greater number of specimens:
   a. Six extra test cylinders from last 100 cubic yards of concrete.
   b. Minimum three specimens for each 2 hours of placing time or for each 100 cubic yards.
2. These specimens shall be in addition to those cast for lab testing.
3. Protect test cylinders from weather until they can be placed under same protection provided for concrete of structure that they represent.
4. Keep field test cylinders in same protective environment as parts of structure they represent to determine if specified strength has been obtained.
5. Test cylinders in accordance with applicable sections of ASTM C31/C31M and ASTM C39/C39M.
6. Use test results to determine specified strength gain prior to falsework removal or for prestressing.

F. Tolerances:
1. Walls: Measure and inspect walls for compliance with tolerances specified in Section 03 10 00, Concrete Forming and Accessories.
2. Slab Finish Tolerances and Slope Tolerances:
   a. Slab Flatness and Levelness: Make measurements within 72 hours of concrete placement.
      1) Flatness measurements are not applicable to unshored form surfaces or shored form surfaces after removal of shores.
      2) Levelness measurements are not applicable to cambered or sloped surfaces.
   b. Slab flatness and levelness shall be determined in accordance with ASTM E1155.

3.10 MANUFACTURER'S SERVICES

A. Provide representative at Site for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
1. Concrete Producer Representative:
   a. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
   b. Establish control limits on concrete mix designs.
   c. Provide equipment for control of concrete redosing for air entrainment or high-range, water-reducing admixture, superplasticizers, at Site to maintain proper slump and air content if needed.
2. Admixture Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.
3. Bonding Agent Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.

3.11 PROTECTION OF INSTALLED WORK

A. After curing as specified in Section 03 39 00, Concrete Curing, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage as a result of other construction work.

B. Repair areas damaged by construction, using specified repair materials and approved repair methods.

3.12 SCHEDULE OF CONCRETE FINISHES

A. Form Tolerances: As specified in Section 03 10 00, Concrete Forming and Accessories.

B. Provide concrete finishes as scheduled:

Area	Type of Finish	Required Form Tolerances
Exterior Wall Surfaces		
Above-grade/exposed (above point 6" below finish grade)	W-2	W-B
Above-grade/covered with brick veneer or other finish material	W-1	W-A
Backfilled/waterproofed (below point 6" below finish grade)	W-1	W-A
Backfilled/not waterproofed (below point 6" below final grade)	W-1	W-A
Walls to receive cementitious coatings	W-4	W-B
Interior Wall Surfaces		
Buildings, pipe galleries, and other dry areas/not painted or coated	W-2	W-A
Buildings, pipe galleries, and other dry areas/painted or coated	W-5	W-A
Exterior Slabs		
Roof slab/exposed	S-5	S-B
Roof slab/covered with roofing material	S-1	S-A
Top of footing	S-2	S-A
Stairs and landings	S-5	S-B
Sidewalks	S-6	S-B
Other exterior slabs	S-5	S-A
Interior Slabs		
Buildings, pipe galleries, and other dry areas	S-1	S-B
Slabs to receive mortar setting bed for tile	S-2	S-A
Slabs to receive resilient flooring or carpet	S-1	S-A

Area	Type of Finish	Required Form Tolerances
Hydraulic channels	S-1	S-A
Underside of elevated slabs	S-3	S-A
Beams and Columns		
Beams/coated	B-3	B-A
Beams/not coated	B-2	B-A
Columns/coated	C-3	C-A
Columns/not coated	C-2	C-A

3.13 SUPPLEMENTS

A. Requirements of concrete mix designs following "End of Section," are a part of this Specification and supplement requirements of Part 1 through Part 3 of this section:
   1. Concrete Mix Design, Class A.
   2. Concrete Mix Design, Class B.
   3. Concrete Mix Design, Class C

3.14 CONCRETE MIX DESIGN, CLASS A

A. Mix Locations:
   1. Foundation, floor slabs, columns, walls and other concrete items not specified elsewhere.

B. Mix Properties:
   1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.42.
   2. Minimum concrete compressive strength (f'c) shall be 4,000 psi at 28 days.
   3. Maximum aggregate size shall be 1-inch.
   4. Designed to conform to shrinkage limits.
   5. Air-entraining admixtures are prohibited in concrete mixtures and total air content shall not be greater than 3 percent, for the following:
      a. Slabs to receive hard-troweled finish.
      b. Slabs to receive dry shake floor hardener.
      c. Slabs to receive topping placed monolithically as two-course floor on top of plastic concrete.
   6. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.‡	Air Content (%)*
1	3.0-5.0
‡See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations. *Tolerance of air content is +1-1/2 percent.	

7. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
    a. Fly Ash and other Pozzolans: 15 percent.
    b. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
        1) Fly ash and other pozzolans in Type IP, blended cement, ASTM C595/C595M.
8. Provide cementitious materials in accordance with one of the following:
    a. ASTM C150/C150M Type II/V
9. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:
    a. 650 pounds per cubic yard.

C. Refer to PART 1 through PART 3 of this section for additional requirements.

3.15 CONCRETE MIX DESIGN, CLASS B

A. Mix Locations:
1. Site, sidewalks, and other miscellaneous nonstructural concrete.

B. Mix Properties:
1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.50.
2. Minimum concrete compressive strength (f'c) shall be 3,000 psi at 28 days.
3. Maximum aggregate size shall be 1-inch.
4. Designed to conform to shrinkage limits.
5. Air-entraining admixtures are prohibited in concrete mixtures and total air content shall not be greater than 3 percent, for the following:
    a. Slabs to receive hard-troweled finish.
    b. Slabs to receive dry shake floor hardener.
    c. Slabs to receive topping placed monolithically as two-course floor on top of plastic concrete.
6. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.‡	Air Content (%)*
1	3.0-5.0
‡See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations. *Tolerance of air content is +1-1/2 percent.	

7. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
    a. Fly Ash and other Pozzolans: 15 percent.
    b. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
        1) Fly ash and other pozzolans in Type IP, blended cement, ASTM C595/C595M.
8. Provide cementitious materials in accordance with one of the following:
    a. ASTM C150/C150M Type II/V
9. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:

a. 520 pounds per cubic yard.

C. Refer to PART 1 through PART 3 of this section for additional requirements.

3.16 CONCRETE MIX DESIGN, CLASS C

A. Mix Locations:
1. Lean Concrete.

B. Mix Properties:
1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.50.
2. Minimum concrete compressive strength (f'c) shall be 2,000 psi at 28 days.
3. Maximum aggregate size shall be 1-1/2 inch.
4. Designed to conform to shrinkage limits.
5. Air-entraining admixtures are prohibited in concrete mixtures and total air content shall not be greater than 3 percent, for the following:
   a. Slabs to receive hard-troweled finish.
   b. Slabs to receive dry shake floor hardener.
   c. Slabs to receive topping placed monolithically as two-course floor on top of plastic concrete.
6. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.‡	**Air Content (%)***
1-1/2	3.0-5.0
‡See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations. *Tolerance of air content is +1-1/2 percent.	

7. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
   a. Fly Ash and other Pozzolans: 25 percent.
   b. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
      1) Fly Ash and other Pozzolans in Type IP, blended cement, ASTM C595/C595M.
8. Provide cementitious materials in accordance with one of the following:
   a. ASTM C150/C150M Type II/V
9. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:
   a. 376 pounds per cubic yard.

C. Refer to PART 1 through PART 3 of this section for additional requirements.

END OF SECTION

SECTION 03 39 00

CONCRETE CURING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes concrete curing.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI): 308.1, Specification for Curing Concrete.
   2. ASTM International (ASTM):
      a. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      b. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

B. Related Specifications:
   1. Section 03 30 00 – Cast-in-Place Concrete

1.03 SUBMITTALS

A. Action Submittals:
   1. Manufacturers' data indicating compliance with the requirements specified herein for the following products:
      a. Evaporation retardant.
      b. Curing compound.
      c. Penetrating water repellent sealer.
      d. Clear liquid densifier.
   2. Curing methods proposed for each type of element such as slab, walls, beams, and columns in each facility.

B. Informational Submittals:
   1. Manufacturer's Certificate of Compliance, for the following:
      a. Curing compound showing moisture retention requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Curing Compound:
   1. Water-based, high-solids content, nonyellowing, curing compound meeting requirements of ASTM C309 Type I, Class A.
   2. Manufacturers and Products:
      a. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
      b. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
      c. Vexcon Chemical, Inc.; Philadelphia, PA; Starseal 1315.
      d. Dayton Superior; Safe Cure and Seal 1315 EF.
      e. BASF Construction Chemicals., Shakopee, MN; MasterKure CC 200WB.
      f. Euclid Chemical Co., Cleveland, OH; EucoCure VOX.
      g. Euclid Chemical Co., Cleveland, OH; Kurez VOX White Pigmented.
      h. Or approved equal.

B. Evaporation Retardant:
   1. Optional: Fluorescent fugitive dye color tint that disappears completely upon drying.
   2. Manufacturers and Products:
      a. BASF Construction Chemicals, Shakopee, MN; MasterKure ER 50.
      b. Euclid Chemical Co., Cleveland, OH; Eucobar.
      c. Or approved equal.

C. Penetrating Water Repellent Sealer: Water based, ready to use, single component, silane/siloxane, penetrating, clear water repellant sealer.
   1. Viscosity: 50 cps.
   2. Flash Point: 200 degrees F.
   3. NCHRP No. 244 Reduction in Chloride Content:
      a. Average: 82 percent.
      b. Minimum Required: 75 percent.
   4. NCHRP No. 244 Reduction in Weight Gain:
      a. 21 Days: 85 percent.
      b. VOCs: 50 g/l.
      c. Depth of Penetration: 1/4-inch.
   5. Manufacturers and Products:
      a. BASF Construction Chemicals, Shakopee MN; MasterProtect H 400.
      b. Euclid Chemical Co.; Baracade WB 244.
      c. Or approved equal.

D. Clear Liquid Densifier:
   1. Colorless, aqueous solution of magnesium fluorosilicate.
   2. Each gallon of solution shall contain a minimum of 2 pounds of fluorosilicate compound.
   3. Manufacturers and Products:
      a. BASF Construction Chemicals, Shakopee, MN; MasterKure HD 300WB.
      b. Euclid Chemical Co., Cleveland, OH; Surfhard.
      c. Or approved equal.

E. Water: Clean and potable, containing less than 500 ppm of chlorides.

PART 3 - EXECUTION

3.01 CONCRETE CURING

A. General:
   1. Cure concrete in accordance with project specifications and ACI 308.1.
   2. Where surfaces are to receive coatings, painting, cementitious material, or other similar finishes, use only water curing procedures. Refer to Interior Finish Schedule for surfaces to receive coatings.
   3. Where curing compound cannot be used, water curing as described below or special methods using moisture shall be agreed upon by Engineer prior to placing concrete.
   4. As required in Section 03 30 00, Cast-in-Place Concrete, if result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified below, by 7 additional days.

B. Use one of the following methods as approved by Engineer:
   1. Vertical Surfaces
      a. Method 1: Leave concrete forms in place and keep surfaces of forms and concrete wet for 7 days.
      b. Method 2: Continuously sprinkle with water 100 percent of exposed surfaces for 7 days starting immediately after removal of forms.
      c. Method 3: Apply curing compound, where allowed, immediately after removal of forms.
   2. Horizontal Surfaces:
      a. Method 1: Protect surface by water ponding, completely cover the surface, for 7 days.
      b. Method 2: Cover with burlap or cotton mats and keep continuously wet for 7 days.
      c. Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet for 7 days.
      d. Method 4: Continuously sprinkle exposed surface for 7 days.
      e. Method 5: Apply curing compound, where allowed, immediately after final finishing when surface will no longer be damaged by traffic.

3.02 EVAPORATION RETARDANT APPLICATION

A. Use on flatwork when environmental conditions are anticipated to cause rapid drying of the concrete surface.

B. Spray onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture.

C. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

3.03 PENETRATING WATER REPELLENT SEALER APPLICATION

A. Apply where indicated on Interior Finish Schedule.

B. Before application and with Work above completed, water cure concrete walls and floors for a minimum of 28 days to receive sealer, keep clean, unpainted, and free from membrane curing compounds.

C. Concrete to receive penetrating sealer shall be dry for a minimum 24 hours immediately prior to application.

D. Apply per manufacturer's recommendations utilizing low pressure airless spray equipment.
   1. Actual coverage and number of coats to be determined by field test sample application and water absorption testing. Final approval by Owner is required.

E. Apply at a coverage rate of 125 square feet per gallon to 200 square feet per gallon. Cure penetrating sealer on slabs for the minimum time recommended by manufacturer prior to allowing foot or vehicular traffic.

3.04 CLEAR LIQUID DENSIFIER APPLICATION

A. Apply where indicated in Interior Finish Schedule.

B. Before application and with Work above completed, water cure concrete walls and floors for a minimum of 28 days to receive sealer, keep clean, unpainted, and free from membrane curing compounds.

C. Apply liquid densifier evenly, using three coats, allowing 24 hours between coats.
   1. First coat 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength, mix with water.
   2. Apply each coat so as to remain wet on surface for 15 minutes.
   3. Apply approved liquid densifier in accordance with manufacturer's instructions.
   4. After final coat is completed and dry, remove surplus liquid densifier from surface by scrubbing and mopping with water.

3.05 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

B. Provide penetrating water repellent sealer manufacturer's representative to demonstrate proper application of product.

C. Provide clear liquid densifier manufacturer's representative to demonstrate proper mixing and application of product.

D. Provide curing compound manufacturer's representative to demonstrate proper application of curing compound to show coverage in one coat.

END OF SECTION

SECTION 03 48 00

PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the pump station wet well, valve vault, diversion structure and associated appurtenances, joints, and connections.

1.02 REFERENCES

A. Related Specifications:
   1. 01 45 33 – Special Inspection Observation and Testing

B. Reference Standards
   1. American Concrete Institute (ACI):
      a. ACI 318/318R

   2. ASTM International (ASTM):
      a. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
      b. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      c. C387/C387M, Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
      d. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
      e. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
      f. C858, Standard Specification for Underground Precast Concrete Utility Structures.
      g. D4101, Standard Specification for Propylene Injection and Extrusion Materials.
   3. Standard Specifications for Public Works Construction (“Greenbook”).
   4. San Diego Supplement to the Standard Specifications for Public Works Construction (“Whitebook”) latest edition

1.03 SUBMITTALS

A. Product Data:
   1. Precast concrete items; show materials of construction by ASTM reference and grade.
   2. Joint sealants.

B. Shop Drawings
   1. Detailed drawings showing complete information for fabrication including, but not limited to:
      a. Member dimensions and cross sections; location, size, and type of reinforcement, including additional reinforcement.
      b. Layout dimensions and identification of each precast unit.
      c. Welded connections indicated by AWS standard symbols.
      d. Details of connections, joints, accessories, and openings or inserts.

e. Watertight joint details.
f. Location and details of anchorage devices.
g. Access door details.
h. Details of ladder and pull-up extension.

C. Certificates
1. Manufacturer's certification that vault design and manufacture comply with referenced ASTMs (for example, ASTM C857 and ASTM C858).

D. Source Quality Control Submittals
1. West Diversion Structure design calculation shall be signed by a structural engineer registered in the State of California.
2. East Diversion Structure design calculation shall be signed by a structural engineer registered in the State of California.
3. Sanitary Sewer Pump Station design calculation shall be signed by a structural engineer registered in the State of California.
4. Sanitary Sewer Valve Vault design calculation shall be signed by a structural engineer registered in the State of California.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer will be qualified in manufacturing diversion structures equipment like those indicated for this Project and that have a record of successful in-service performance. Manufacturer must be able to meet the standards and requirements listed herein.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store each unit in a manner that will prevent cracking, distortion, warping, straining and other physical damage, and in a manner to keep marking visible.

B. Lift and support each unit only at designated lifting points and supporting points as shown on Shop Drawings.

1.06 WARRANTY

A. Manufacturer Warranty
1. The equipment will be warranted for a period of one (1) year from substantial completion, to be free from defects in workmanship, design, or material. If the equipment should fail during the warranty period due to a defective part(s), it will be replaced, and the unit(s) restored to service at no expense to the Owner.

2. This warranty will not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with the warranties made under the requirements of Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Precast materials and manufacturing methods will conform to ASTM C-857 & C-478.

B. Concrete will have a minimum compressive strength of 4000-psi at 28 days with 0.45 maximum water/cementitious materials ratio.

C. The Portland Cement used in the precast section will meet the requirements of Type II/V High Sulfate resistant cement in accordance with ASTM Class M C-150

2.02 MANUFACTURERS

A. Manufacturer List: Materials, equipment, and accessories specified in this section shall be products of:
   1. Oldcastle Precast.
   2. Jensen Precast.
   3. Hanson Pipe and Precast.
   4. Or Approved Equal

2.03 DESIGN CRITERIA

A. Requirements:
   1. In the event of a conflict between or among standards, the more stringent standard shall govern.
   2. Comply with ASTM C858, except as modified herein.
   3. Reinforcing Steel:
      a. Deformed Bars: ASTM A615/A615M, Grade 60.
      b. Welded Wire Fabric: ASTM A497/A497M.
   4. Nominal Dimensions: As shown on Drawings.
   5. Construction: Rigid type and behave monolithically.
   6. Design Loads: As determined by ASTM C857, and by using Site-specific values below.
      a. Active Earth Pressure Coefficient: As described in Geotechnical Report
      b. Groundwater Level: 15 ft deep
      c. Live Loads: AASHTO HS20-44 truck loading plus impact
      d. Designed to avoid flotation with a factor of safety equal to 1.2.
   7. Design shall accommodate additional stresses or loads that may be imposed during factory precasting, transporting, erection, and placement.
   8. Blockouts for penetrations shall be as shown on Drawings.
   9. Sealant:
      a. Nonswelling preformed joint sealants to provide a lasting, watertight bond.
      b. Manufacturer and Product: Henry Company; RAM-NEK or approved equal.
   10. Mortar: Comply with ASTM C387/C387M, Type S or use Type I grout as specified in Section 03 62 00, Grouting.

B. Mark each member or element to indicate location in the structure, top surface, and date of fabrication.

C. Vault Floor:
   1. Slope of vault floor shall be as shown on Drawings.

2.04 FINISHES

A. Coatings and Paints see Specification Section 03 30 00.

2.05 WATERPROOFING

A. Exterior Waterproofing per Whitebook Sections 201-10.4 and 306-16.4 is required on portions of Diversion structures and Wet Well located below 40 feet MSL.

2.06 ACCESSORIES

A. Ladder
   1. Provide vault with galvanized steel ladder. Conform to requirements of Section 05 50 00, Metal Fabrications. Provide with pull-up extension.
   2. Meet OSHA 29 CFR 1910.27 and OSHA 29 CFR 1926.502 requirements.

B. Hatches: Manufacturer's Standard.
   1. Pipe connections to vault: will comply with the Standard Specifications for Public Works Construction and the City of San Diego's Standard Specifications for Public Works Construction.

C. Weir: 304 Stainless Steel or Aluminum Plate per manufacturer recommendation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions
   1. Contractor to verify vertical dimensions of precast pieces in the field.
   2. Verify subbase elevation before placing precast components or backfilling.
   3. Possible Settlement: If subgrade is encountered that may require removal to prevent structure settlement, notify Engineer. Engineer will determine depth of over excavation and means of stabilizing subgrade prior to structure installation.

3.02 INSTALLATION

A. Install in accordance with manufacturers printed instructions, if no manufacturer instructions for installation are available, install in compliance with the Standard Specifications for Public Works Construction and the City of San Diego's Standard Specifications for Public Works Construction.
   1. Apply Butyl Mastic and/or grout to seal joints of structure.
   2. Contractor to grout pipe penetrations in field as necessary.
   3. Contractor to adjust frame/cover elevation in field as necessary.

B. Interface with Other Work
   1. Remove and keep water clear from excavation during construction.
   2. Excavation: As specified in Section 31 23 16, Excavation.
   3. Backfill: As specified in Section 31 23 16, Excavation

3.03 FIELD TESTS AND INSPECTIONS

A. See Specification Section 01 45 33 "Special Inspections Observation and Testing" for special inspections and testing requirements.

END OF SECTION

SECTION 03 62 00

GROUTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grouting.

1.02 REFERENCES

A. Abbreviations and Acronyms:

B. Definitions:

C. Related Specifications:
   1. 03 10 00 – Concrete Form Accessories
   2. 03 30 00 – Cast-in-Place Concrete

D. Reference Standards
   1. American Society for Testing and Materials International (ASTM)
      a. C230, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.
      b. C307, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
      c. C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
      d. C579, Standard Test Methods for Compressive Grout Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes.
      e. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
      f. C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
      g. C940, Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
      h. C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
      i. C1181, Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.
      j. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

1.03 SUBMITTALS

A. Action Submittals:
   1. Product data of grouts.
   2. Proposed method for keeping existing concrete surfaces wet prior to placing nonshrink grout.
   3. Forming method for fluid grout placements.

4. Curing method for grout.

B. Informational Submittals:
   1. Manufacturer's Written Instructions:
      a. Adding fiber reinforcing to batching.
      b. Mixing of grout.
   2. Manufacturer's proposed training schedule for grout work.
   3. Manufacturer's Certificate of Compliance.
      a. Grout free from chlorides and other corrosion-causing chemicals.
      b. Nonshrink grout properties of Category II and Category III, verifying expansion at 3 days or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
   4. Manufacturer's Certificate of Proper Installation.
   5. Statements of Qualification: Grout manufacturer's representative.
   6. Test Reports:
      a. Test report for 24-hour evaluation of nonshrink grout.
      b. Test results and service report from demonstration and training session.
      c. Field test reports and laboratory test results for field-drawn Samples.
   7. List of Contractor's equipment installation staff trained by grout manufacturer's representative in:
      a. Nonshrink grout installation and curing.
      b. Epoxy grout installation and curing.

1.04 QUALIFICATIONS

A. Grout Manufacturer's Representative:
   1. Authorized and trained representative of grout manufacturer.

B. For grout suppliers not listed herein, provide completed 24-hour Evaluation of Nonshrink Grout Test Form, attached at the end of this section.
   1. Provide independent testing laboratory test results for testing conducted within last 18 months.

PART 2 - PRODUCTS

2.01 NONSHRINK GROUT AND EPOXY GROUT SCHEDULE

A. Furnish nonshrink grout (Category I, II, and III) and epoxy grout for applications as indicated in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40 deg F to 100 deg F	20 Min.	Greater Than 20 Min.
Precast joints	I or II		II
Column baseplates	I or II		II
Machine bases 25 hp or less	II	II	II
Bases for precast wall sections	II	II	II
Form Tie-Through bolt openings	II	II	II
Machine bases 26 hp and up	III or Epoxy Grout	III or Epoxy Grout	III or Epoxy Grout

2.02 NONSHRINK GROUT

A. Category I:
   1. Nonmetallic and nongas-liberating.
   2. Prepackaged natural aggregate grout requiring only the addition of water.
   3. Test in accordance with ASTM C1107/C1107M:
      a. Grout shall have flowable consistency.
      b. Flowable for 15 minutes.
   4. Grout shall not bleed at maximum allowed water.
   5. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
   6. Manufacturers and Products:
      a. BASF Building System, Inc., Shakopee, MN; MasterFlow 100.
      b. Euclid Chemical Co., Cleveland, OH; NS Grout.
      c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
      d. US MIX Co., Denver, CO; US SPEC GP Grout.
      e. Five Star Products Inc., Fairfield, CT; Five Star Grout.
      f. Or approved equal.

B. Category II:
   1. Nonmetallic, nongas-liberating.
   2. Prepackaged natural aggregate grout requiring only the addition of water.
   3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
   4. Test in accordance with ASTM C1107/C1107M:

a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
b. Temperatures of 40 degrees F, 80 degrees F, and 90 degrees F.

5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
   a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 928.
   b. Five Star Products Inc., Fairfield, CT; Five Star Fluid Grout 100.
   c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
   d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
   e. US MIX Co., Denver, CO; US SPEC MP Grout.
   f. Or approved equal.

C. Category III:
1. Metallic and nongas-liberating.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M:
   a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
   b. Temperatures of 40 degrees F and 100 degrees F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturer and Product:
   a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 885.
   b. Euclid Chemical Co, Cleveland, OH; Hi-Flow Metallic Grout.
   c. Or approved equal.

2.03 EPOXY GROUT

A. High-strength, nonshrink, high-temperature epoxy grouting material developed for the support of heavy equipment with vibratory loads.

B. Three-component mixture of a two-component epoxy resin system (100 percent solids) with a graded, precision aggregate blend.

C. Premeasured, prepackaged system.

D. Flowable.

E. Minimum compressive strength in accordance with ASTM C579 Method B, 9,500 psi at 75 degrees F at 7 days, 11,000 psi at post cure.

F. Maximum creep resistance in accordance with ASTM C1181 at 600 psi, 140 degrees F; 6.0 by 10^{-3} in/in.

G. Minimum bond strength in accordance with ASTM C882, 2,000 psi.

H. Minimum tensile strength in accordance with ASTM C307, 2,000 psi.

I. Maximum coefficient of thermal expansion in accordance with ASTM C531 at 73 degrees F to 210 degrees F, 23.0 by10^{-6} in/in/degrees F.

J. Working Time: Minimum 2 hours at 50 degrees F; 1.5 hours at 70 degrees F; 50 minutes at 90 degrees F.

K. Good chemical resistance.

L. Good effective bearing area.

M. Noncorrosive.

N. Moisture insensitive.

O. Modify resin and aggregate content where recommended by epoxy grout manufacturer to provide desired epoxy grout flow properties.

P. Manufacturer and Product:
   1. BASF Building System, Inc., Shakopee MN; MasterFlow 648.
   2. Euclid Chemical Co., Cleveland, OH; E^3-G.
   3. Dayton Superior Corp., Miamisburg, OH; Pro-Poxy 2000 Normal Set.
   4. Five Star Products Inc., Fairfield, CT; DP Epoxy Grout.

   Or approved equal.

PART 3 - EXECUTION

3.01 GROUT

A. General: Mix, place, and cure grout in accordance with grout manufacturer's representative's training instructions.

B. Epoxy Grout: Concrete slab shall be fully cured for 28 days to ensure excess water has evaporated. Test concrete surface for moisture in accordance with ASTM D4263 before epoxy grout is placed.

C. Form Tie-Through Bolt Holes: Provide nonshrink grout, Category II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes; coordinate dry pack dense grout application with vinyl plug in Section 03 10 00, Concrete Forming and Accessories, and bonding agent in Section 03 30 00, Cast-in-Place Concrete.

D. Form Snap-Tie Hole: Fill tie hole in accordance with requirements of Section 03 30 00, Cast-in-Place Concrete.

3.02 GROUTING MACHINERY FOUNDATIONS

A. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material. Surface roughness in accordance with manufacturer's written instructions.

B. Clean metal surfaces of paint, oil, grease, loose rust, and other foreign material that will be in contact with grout.

C. Sandblast to bright metal all metal surfaces in contact with epoxy grout in accordance with manufacturer's written instructions.

D. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts. Remove wedges after grout is set and pack void with grout.

E. Form with watertight forms at least 2-inches higher than bottom of plate.

F. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions.

G. If grout cannot be placed from one edge and flowed to the opposite edge, air vents shall be provided through the plate to prevent air entrapment.

H. Radius corners of grout pad.

I. Install expansion joints for epoxy grout placement in accordance with manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. General:
   1. Performed by Project representative's inspection staff.

2. Perform the following quality control inspections. The grout manufacturer's representative shall accompany the Project representative's inspection staff on the first installation of each size and type of equipment.

B. Evaluation and Acceptance of Nonshrink Grout:
   1. Inspect the surface preparation of concrete substrates onto which nonshrink grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
   2. Inspect preparation and application of nonshrink grout form work for conformance to the manufacturer's recommendations.
   3. Conduct a final review of completed nonshrink grout installation for conformance to these Specifications.
   4. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
   5. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with ASTM C1107 C1107M.
   6. For large grout applications, make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
   7. Consistency: As specified in Article Nonshrink Grout. Flow cone test in accordance with ASTM C939. Grout with consistencies outside range requirements shall be rejected.
   8. Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates shall be rejected.
   9. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.
   10. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
   11. Perform bleeding test in accordance with ASTM C940 to demonstrate grout will not bleed.
   12. Store cubes at 70 degrees F.
   13. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C1107/C1107M.
   14. Grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

C. Evaluation and Acceptance of Epoxy Grout:
   1. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer's requirements.
   2. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
   3. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.
   4. Inspect the epoxy-primed metallic substrate for coverage and adhesion.
   5. Inspect preparation and application of epoxy grout form work for conformance to the manufacturer's recommendation.
   6. Verify consistency obtained is sufficient for the proper field placement at the installed temperatures.
   7. Inspect and record that the "pot life" of epoxy grout materials is not exceeded during the installation.
   8. Inspect epoxy grout for cure.
   9. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.

10. Conduct a final review of completed epoxy grout installation for conformance to these Specifications.
11. Compression tests and fabrication of specimens for epoxy grout shall be made in accordance with ASTM C579, Method B, at intervals during construction as selected by the Project representative. A set of three specimens shall be made for testing at 7 days, and each earlier time period as appropriate.
12. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C579.
13. Grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

3.04 MANUFACTURER'S SERVICES

A. General:
   1. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer's representative. Allow 2-week notice to grout manufacturer's representative for scheduling purposes.
   2. Provide and conduct onsite, demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of grout.
   3. Necessary equipment and materials shall be available for demonstration.
   4. Conduct training prior to equipment mount installation work on equipment pads.
   5. Training for each type of grout shall be not less than 4 hours' duration.

B. Nonshrink Grout Training:
   1. Training is required for Type III grout installations.
   2. Provide nonshrink grout installation training by the qualified grout manufacturer's representative for Contractor's workers that will be installing nonshrink grout for baseplates and equipment mounts. Schedule training to allow Engineer's attendance.
   3. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, such as, baseplates and form tie-through bolt holes to provide actual on-the-job training.
   4. Use minimum of two bags for each grout Category III. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1 day, 3 days, and 28 days. Use remaining grout for final Work.
   5. Include recommended grout curing methods in the training.
   6. Transport test cubes to independent test laboratory and obtain test reports.
   7. Training by manufacturer's representative does not relieve Contractor of overall responsibility for this portion of the work.
   8. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

C. Epoxy Grout Training:
   1. Provide epoxy grout installation training by the qualified epoxy grout manufacturer's representative for Contractor's workers that will be installing epoxy grout for equipment mounts. Schedule training to allow Engineer's attendance.
   2. Include training in:
      a. Performance testing such as compressive strength testing of the epoxy grout.
      b. Aspects of using the products, from mixing to application.
   3. Transport test cubes to independent test laboratory and obtain test reports.
   4. Training by manufacturer's representative does not relieve Contractor of overall responsibility for this portion of the work.

5. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

3.05 SUPPLEMENTS

A. The supplement listed below, following “End of Section,” is part of this Specification.
   1. 24-hour Evaluation of Nonshrink Grout Test Form and Grout Testing Procedures.

END OF SECTION

SUPPLEMENT 1

_____

(Test Lab Name)

_____

(Address)

_____

(Phone No.)

24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is to establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain three bags of each type of grout.

1. From intended grout supplier for Project.
2. Three bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

A.	Product data and warranty information contained in company literature and data?	Yes_____ No_____
B.	Literature and bag information meet specified requirements?	Yes_____ No_____
C.	Manufacturer guarantees grout as specified in Article Guarantee?	Yes_____ No_____
D.	Guarantee extends beyond grout replacement value and allows participation with Contractor in replacing and repairing defective areas?	Yes_____ No_____
E.	Water demands and limits printed on bag?	Yes_____ No_____
F.	Mixing information printed on the bag?	Yes_____ No_____
G.	Temperature restrictions printed on bag?	Yes_____ No_____

*Rejection of a grout will occur if one or more answers are noted NO.

GROUT TESTING PROCEDURES

A. Bagged Material:

1. List lot numbers. _____
2. List expiration date. _____
3. Weigh bags and record weight. _____

Owner's Representative will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of three bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in 10-gallon pail.
2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
3. Use maximum water allowed per water requirements listed in bag instructions.
4. Mix grout to maximum time listed on bag instructions.
5. In accordance with ASTM C939 (flow cone) determine time of mixed grout through the flow cone. _____ seconds
6. Add water to attain 20- to 30-second flow in accordance with ASTM C939.
7. Record time of grout through cone at new water demand. _____ seconds
8. Record total water needed to attain 20- to 30-second flow. _____ pounds
9. Record percent of water. _____ percent

C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, ASTM C1107/C1107M will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:

1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
3. Cover top of both cans with glass or plastic plate preventing evaporation.
4. Maintain 38 degrees F to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
5. Visually check for bleeding of water at 15-minute intervals for 2 hours.
6. Perform final observation at 24 hours.

If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and Category III):

1. Divide the remaining grout into two 3-gallon cans. Place the cans into the 40-degree F and 90-degree F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4-inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.
2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take an ASTM C939 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 degrees F and 90 degrees F.
    a. 20 min _____, sec. @ 40 degrees F.
    b. 40 min _____, sec. @ 40 degrees F.
    c. 60 min _____, sec. @ 40 degrees F.
    d. 20 min _____, sec. @ 90 degrees F.
    e. 40 min _____, sec. @ 90 degrees F.
    f. 60 min _____, sec. @ 90 degrees F.

Category II and Category III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

_____ _____

Qualified Disqualified

F. 24-hour Strength Test:

1. Using grout left in mixing cans in accordance with ASTM C1107/C1107M for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.
2. Store cubes at 70 degrees F for 24 hours.
3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24-hour compressive strengths are less than 2,500 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for use on the Project for the application indicated in Nonshrink Grout Schedule.

_____ _____

Signature of Independent Testing Laboratory Date Test Conducted

SECTION 03 64 23

CRACK REPAIR EPOXY INJECTION GROUTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes crack repair epoxy injection grouting.

B. This specification will only be used if damage occurs during construction/delivery.

1.02 REFERENCES

A. Definitions:
   1. Crack: Complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing.
   2. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.
   3. Hydraulic Structure: Liquid containment structure and/or structure designed to mitigate liquid infiltration.
   4. Injection: Method of bonding together, addressing or eliminating leakage through cracks or joints by installing resin under pressure to fill the void in crack or joint.
   5. Joint: A planned and formed discontinuity in concrete structure at junction of adjacent and sequential concrete placements and may contain embedded waterstops.
   6. Leak or Leakage: Crack or joint exhibiting presence of moisture, sign of efflorescence, intermittently wet to touch, or continuous flow of liquid.
   7. Narrow Cracks: Width equal to or less than 0.015-inch.
   8. Wide Cracks: Wider than 0.015-inch.

B. Related Specifications:
   1. 03 01 32 - Repair of Vertical and Overhead Concrete Surfaces
   2. 03 01 33 - Repair of Horizontal Concrete Surfaces
   3. 03 30 00 - Cast-in-Place Concrete

C. Reference Standards
   1. American Society for Testing and Materials International (ASTM)
      a. C882, Standard Specification for Test Method for Bond Strength of Epoxy Resin System Used with Concrete by Slant Shear.
      b. D570, Standard Test Method for Water Absorption of Plastics.
      c. D638, Standard Test Method for Tensile Properties of Plastics.
      d. D648, Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edgewise Position.
      e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
      f. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 SUBMITTALS

A. Action Submittals:
   1. Physical and chemical properties for epoxy resin.
   2. Technical data for metering, mixing, and injection equipment.

3. Depth of penetration, length, material used, and procedures where epoxy is approved for use.
4. Marked up drawings of proposed epoxy injection repair crack locations, widths, and lengths and direction on structure.
5. Sample bottle.
6. Pot Life Test.
7. Slant Shear Test (Bond Strength).
8. Core Test Results.

B. Informational Submittals:
1. Manufacturer's recommended surface preparation procedures and application instructions for epoxy resins.
2. Manufacturer's Certificate of Compliance. Certified test results for each batch of epoxy resin.
3. Statements of Qualification for Epoxy Resin:
   a. Manufacturer's Site representative.
   b. Injection applicator.
   c. Injection pump operating technician.
4. Sample of epoxy resin two component ratio and injection pressure test records for concrete crack repair work.
5. Installation instructions for repairing core holes with repair mortar.
6. Health and Safety Plans for confined space entry. Test results of epoxy resin bond tests.
7. Epoxy resin two component ratio and injection pressure test records for concrete crack repair work.

1.04 QUALITY ASSURANCE

A. Qualifications for Injection Staffs:
1. Manufacturer's Site Representative:
   a. Capable of instructing successful methods of epoxy injection process for concrete structure.
   b. Understands and is capable of explaining technical aspects of correct material selection and use.
   c. Experienced in operation, maintenance, and troubleshooting of application equipment.
2. Injection Crew and Job Foreman:
   a. Provide written and verifiable evidence showing compliance with the following requirements:
      1) Injection Crew and Job Foreman are certified to install by epoxy resin material manufacturer.

B. Injected Epoxy Resin:
1. Fill cracks and joints with minimum resin depth penetration no less than 90 percent of:
   a. Full thickness of concrete section for cracks or joints.
   b. Depth between waterstop and inside face of structure for joints with an embedded waterstop.

C. Injected cracks and joints which leak shall be considered deficient work irrespective of depth of penetration. Reinjection of deficient work or, with approval of Design Engineer, provide other repairs to eliminate leakage.

D. Bond Strength Test for Epoxy Resin:
1. Concrete failure before resin failure.

2. 1,500 psi minimum bond strength per ASTM C882 test requirements with no failure of either concrete or epoxy resin.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:
   1. Package resin material in new sealed containers and label with following information:
      a. Manufacturer's name.
      b. Product name and lot number.
      c. ANSI Hazard Classification.
      d. ANSI recommended precautions for handling.
      e. Mix ratio by volume for components
      f. Storage and Protection: Store epoxy resin material containers in accordance with manufacturer's printed instructions and at ambient temperatures below 110 degrees F and above 45 degrees F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Materials and accessories specified in this section shall be products of:
   1. BASF Construction Chemicals, LLC-Building Systems, Shakopee, MN; SCB Concresive Series products that meet properties indicated in Article Epoxy Injection Resin.
   2. Sika Corp., Lyndhurst, NJ; Sikadur Series products that meet properties below.
   3. Euclid Chemical Co., Cleveland, OH; Euco Series (#452) products that meet properties below.

2.02 EPOXY INJECTION RESIN

A. Two-component A and B structural epoxy resin for injection into cracks or joints or other voids in concrete structures for bonding or grouting.

B. Uncured Resin Properties:
   1. When mixed in ratio specified on resin container label:

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Pot Life (60-gram mass) @ 77, plus or minus 4 degrees F	As specified in Article Source Quality Control	13 to 25 minutes	15 to 30 minutes
Pot Life (60-gram mass) @ 100, plus or minus 4 degrees F	As specified in Article Source Quality Control	3 to 10 minutes	10 to 20 minutes
Viscosity @ 40, plus or minus 3 degrees F	Brookfield RVT Spindle No. 4 @ 20 rpm	4,400 cps	600 cps

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Viscosity @ 75 to 77 degrees F	Brookfield RVT Spindle No. 2 @ 20 rpm	375 to 350 cps	175 to 140 cps

C. Epoxy Resin Properties: When cured for 7 days at 77 degrees F, plus or minus 3 degrees F and conditioned at test temperature 12 hours prior to test, unless otherwise specified.

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Ultimate Tensile Strength, psi	ASTM D638	8,000 min.	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	4.2 max.	3.0 max.
Flexural Strength, psi	ASTM D790	10,000 min.	10,000 min.
Flexural Modulus, psi	ASTM D790	5.5×10^5 min.	4.5×10^5 min.
Compressive Yield Strength, psi	ASTM D695*	15,000 min.	12,000 min.
Compressive Modulus, psi	ASTM D695*	4.0×10^5 min.	4.0×10^5 min.
Heat Deflection Temperature	ASTM D648*	130 degrees F min.	140 degrees F min.
Cured 3 days @ 40 deg F – Wet Concrete		3,500 psi min.	3,500 psi min.
Cured 1 day @ 77 deg F – Dry Concrete		5,000 psi min.	5,000 psi min.
Cured 3 days @ 77 deg F plus or minus 3 deg F		5,000 psi min.	5,000 psi min.

*Cure test specimens so that peak exothermic temperature of resin does not exceed 100 degrees F.

Note: See referenced specifications for preparation method of test specimens.

2.03 SURFACE SEAL

A. Sufficient strength and adhesion for holding injection fittings firmly in place and to resist pressures preventing leakage during injection.

B. Capable of removal after injection resin has cured.

2.04 ACID FLUSHING SOLUTION

A. Premixed solution of food grade phosphoric acid diluted to a 5 percent plus or minus 0.5 percent of the volume of the bottle.

2.05 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

2.06 SAMPLE BOTTLE

A. Five-inch natural wide mouth HDPE bottle or 4-ounce clear PVC cylinder bottle; supplied with caps.

2.07 SOURCE QUALITY CONTROL

A. Requirements: Perform tests for each batch of epoxy resin.

B. Pot Life Test:

C. Slant Shear Test:
   1. Condition Component A and Component B to required temperature.
   2. Measure components in ratio of Component B as stated on manufacturer's label into an 8-fluid ounce paper cup.
   3. Mix components for 60 seconds using nonmetallic stirring instrument. Scrape sides and bottom of cup periodically.
   4. Probe mixture once with nonmetallic stirring instrument every 30 seconds, starting 2 minutes prior to minimum specified pot life.
   5. Pot Life Definition: Time at which a soft stringy mass forms in center of cup.

D. Slant Shear Test: Prepare specimens and perform tests in accordance with ASTM C882.

PART 3 - EXECUTION

3.01 GENERAL

A. Unless permitted otherwise, structurally repair cracks or joints listed below:
   1. Cracks considered to be defective as defined in Section 03 30 00, Cast-in-Place Concrete.
   2. Vertical cracks or joints near corners or intersections.
   3. Horizontal cracks or joints at wall bases.
   4. Cracks or joints caused by voids or honeycombs.
   5. Horizontal joints with leaks and dampness.
   6. Cracks or joints caused by construction overloading.
   7. Vertical or diagonal cracks or joints caused by drying shrinkage within a distance equal to the height of wall from the face of corners or intersecting walls. Inject 90 days after placement, unless approved otherwise by the project Structural Design Engineer.
   8. Horizontal cracks or joints caused by drying shrinkage within a distance equal to one-quarter on the wall height above or below elevated slabs. Inject 90 days after placement, unless approved otherwise by the project Structural Design Engineer.
   9. Cracks or joints as a result of thermal shrinkage where the concrete member being injected has been allowed to dry after placement for a minimum of 90 days.

10. Other cracks or joints as a result of drying shrinkage to be repaired 90 days or more after placement.

B. Do not proceed with injection work until submittals have been reviewed and approved by Design Engineer.

C. Perform cracks or joints injection work after removing defective surface materials and after performing surface preparation, but prior to applying surface repair material unless otherwise noted. See Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces, and Section 03 01 33, Repair of Horizontal Concrete Surfaces, for concrete surface repair system.

D. Width of cracks may vary along length and through thickness of concrete section.

E. Remove excess, unused epoxy resin materials on concrete surfaces exposed to view prior to end of Work.

3.02 EQUIPMENT

A. Portable, positive displacement type pumps with in-line metering to meter and mix two epoxy resin components and inject mixture into cracks or joints.

B. Pumps:
1. Electric or air powered with interlocks providing positive ratio control of proportions for the two components at nozzle.
2. Primary injection pumps for each material of different mix ratio, including a standby backup pump of similar ratio.
3. Capable of immediate compensation for changes in resins.
4. Do not use batch mix pumps.

C. Discharge Pressure: Automatic pressure controls capable of discharging mixed epoxy resin at pressures in accordance with epoxy resin manufacturer's printed instruction and able to maintain pressure.

D. Automatic Shutoff Control: Provide sensors on both Component A and Component B reservoirs for stopping machine automatically when only one component is being pumped to mixing head.

E. Proportioning Ratio Tolerance: Maintain epoxy resin manufacturer's prescribed mix ratio within a tolerance of plus or minus 5 percent by volume at discharge pressure up to 160 psi.

F. Ratio/Pressure Check Device:
1. Two independent valve nozzles capable of controlling flow rate and pressure by opening or closing valve to restrict material flow.
2. Pressure gauge capable of sensing pressure behind each valve.

3.03 PREPARATION

A. Free cracks or joints from loose matter, dirt, laitance, oil, grease, efflorescence, salt, and other contaminants.

B. Clean cracks or joints in accordance with epoxy resin manufacturer's instructions.

C. Clean surfaces adjacent to cracks or joints from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system and to expose the full extent

of cracks and joints in accordance with manufacturer's printed instruction by low pressure water cleaning using a pressure of 1,000 psi to 3,000 psi.

D. Do not use acids and corrosives for cleaning, other than those specified herein unless neutralized prior to injecting epoxy resin.

E. During installation and curing of materials, if ambient temperature is expected to drop below manufacturer's recommended minimum temperature, provide enclosures and heat as required.

F. Provide work platforms as required.

G. Dry out cracks or joints if required by manufacturer's instructions.

3.04 APPLICATION

A. Liquid is to be removed from hydraulic structure prior to commencing with epoxy injection, unless approved otherwise.

B. Entry Ports:
   1. Establish openings for epoxy resin entry in surface seal along crack.
   2. Determine space between entry ports equal to thickness of concrete member to allow epoxy resin to penetrate to the full thickness of the member.
   3. Drill injection holes at an angle between 45 degrees and 60 degrees from surface of concrete and perpendicular to alignment of cracks or joints, to intersect crack or joint at midpoint of concrete section, and intersect joints at midpoint between waterstop and interior concrete surface, except as noted otherwise.
   4. Locate drill holes on alternate sides of crack or joint where possible, unless orientation of crack or joint is known or has been verified by non-destructive testing techniques or core drilling.
   5. Drill Hole Spacing: Do not to exceed concrete thicknesses or 12 inches maximum, except as noted otherwise.
   6. Adjust location and angle of drill holes to suit orientation of crack or joint and at commencement of drilling holes for injection and at beginning of each subsequent shift.
   7. Take measures to prevent drilling holes for injection too shallow or too deep or damaging existing waterstop in joints.
   8. Remove dust and debris in drill holes and on surface of structure resulting from drilling operation, by flushing with water prior to installing the injection packers or ports.
   9. Space entry ports closer together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
      a. Cracks or joints extend entirely through concrete element.
      b. Backfill of walls on one side.
      c. Slab-on-grade.
      d. Difficult to excavate behind wall to seal both surfaces of crack.
   10. Install injection packers or ports in drill holes in accordance with manufacturer's printed instructions with zerk coupling or other one-way ball or check valve, to permit testing for watertightness and acid flushing of cracks and joints.

C. Acid Flushing of Cracks and Joints:
   1. Flush cracks and joints with acid flushing solution in accordance with manufacturer's printed instructions at high pressure or resin injection pressure. Apply acid flushing solution for a sufficient duration to permit solution to penetrate full depth and length of cracks and joints or to waterstop in joints.

2. Following acid flushing, flush cracks and joints with copious quantities of potable water in accordance with manufacturer's printed instructions at a pressure of 1,000 psi, or resin injection pressure, whichever is greater, until no evidence of acid flushing solution is visible in flush water.
3. Submit in-field health and safety plan for acid flushing operation. As a minimum, identify worker conducting acid flushing by wearing a reflective safety vest and signs indicating "Acid Flushing". Also, clearly identify Work area where acid flushing is underway by signs and isolate by placing orange pylons or other temporary barrier, and signs indicating "Acid Flushing". As work progresses, move pylons or barriers and signs to maintain a safe zone.

D. Application of Surface Seal along Cracks and Joints:
1. Apply surface seal in accordance with manufacturer's instructions to designated cracks and joints face prior to injection. Seal surface of cracks or joints to contain and prevent escape of injection epoxy.
2. Cure surface seal in accordance with manufacturer's printed instructions before commencing inject work.

E. Epoxy Injection:
1. Ensure zerk coupling is not installed in ports or packers next to the one being injected.
2. Start injection into each crack or joint at lowest elevation entry port or packer along vertical or diagonal crack or joint, and at one end of horizontal crack or joint.
3. Where injection entry ports or packers are used, continue injection at first port or packer until resin begins to flow out of port or packer at next highest elevation. Plug first port or packer and start injection at second port or packer until resin flows from next port or packer.
4. Inject entire crack or joint with same sequence.
5. At no time inject more than 6 feet length of first vertical crack or joint before verifying resin in sample bottle has start to set and cure.
6. Prior to commencing injection work along a horizontal crack or joint in structure when processed using ports or packers with zerk couplings are used, remove zerk couplings from injection ports or packers except for two ports or packers located where injection work will commence. Commence injection work in first two ports or packers. Once clean resin is vented from third injection port or packer, cease injection at first port or packer, and install zerk coupling and commence injection at third port or packer. Repeat process for fourth and subsequent ports or packers until full length of crack or joint has been injected.

F. Finishing:
1. Allow epoxy resin to cure in accordance with manufacturer's instruction after cracks or joints have been completely injected to allow surface seal removal without draining or runback of uncured epoxy resin material from cracks or joints.
2. Remove surface seal and injection packers or ports from cured injection resin along crack.
3. Finish crack or joint faces flush with adjacent concrete.
4. Indentations or protrusions caused by placement of entry ports, packers, drill holes, or damage from removal of surface seal is not acceptable.
5. Grind off protrusions and patch indentations and holes from injection packers and entry ports with a suitable patch material to satisfaction of Design Engineer.
6. Remove surplus surface seal material splatters and injection resin material runs and spills from concrete surfaces

3.05 FIELD QUALITY CONTROL

A. Epoxy Resin Two Component Ratio Tests:
   1. Disconnect mixing head and pump two resin components simultaneously through ratio check device.
   2. Adjust discharge pressure to 160 psi for both resin components.
   3. Simultaneously discharge both resin components into separate calibrated containers.
   4. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.
   5. Complete test at 160 psi discharge pressure and repeat procedure for 0 psi discharge pressure.
   6. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work has stopped for more than 1 hour.
   7. Document and maintain complete accurate records of ratios and pressure checks.

B. Injection Pressure Test:
   1. Disconnect mixing head of injection equipment and connect two resin component delivery lines to pressure check device.
   2. Pressure Check Device:
      a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
      b. Pressure gauge capable of sensing pressure buildup behind each valve.
   3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 psi.
   4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 psi within 3 minutes.
   5. Run pressure test for each injection equipment unit:
      a. Beginning and end of each injection work day.
      b. When injection work stop for more than 45 minutes.
   6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

C. Bottled Sample Tests:
   1. During injection operation, provide at least one sample of mixed epoxy resin for each injection pump per shift per injection work day in a sample bottle.
   2. Provide sufficient sample to demonstrate sample material epoxy resin will set and cure correctly.
   3. Label each bottled sample with Contractor’s name, date, and time sample was taken, and location in structure where sample was taken. Record details of bottle sample tests.
   4. Place filled sample bottle upright in a container and allow sample to cure.
   5. After sample has been allowed to cure, cut bottled sample open and visually inspect contents to verify that epoxy resin material has completely reacted and cured.
   6. Evaluation and Assessment of Test:
      a. Should bottled sample(s) indicate a problem, such as epoxy resin not cured or foreign liquid in sample bottle, take verifying core sample immediately from cracks or joints, where material was used.
      b. Should above-referenced bottle sample(s) and core sample(s) indicate a problem with epoxy resin, arrange to have a Technical Representative of the epoxy resin manufacturer come to Site to review bottled sample(s) and core drilled sample(s) with Design Engineer and provide technical advice on corrective measures.
      c. Carry out further investigation work or corrective measures recommended by Technical Representative of epoxy resin manufacturer.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
   2. American Galvanizers Association (AGA):
      a. Inspection of Hot-Dip Galvanized Steel Products.
      b. Quality Assurance Manual.
   3. American Iron and Steel Institute (AISI): Stainless Steel Types.
   4. American Ladder Institute (ALI): A14.3, Ladders - Fixed - Safety Requirements.
   5. American National Standards Institute (ANSI).
   6. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
   7. American Welding Society (AWS):
      a. D1.1/D1.1M, Structural Welding Code - Steel.
      b. D1.2/D1.2M, Structural Welding Code - Aluminum.
      c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
   8. ASTM International (ASTM):
      a. A36/A36M, Standard Specification for Carbon Structural Steel.
      b. A48/A48M, Specification for Gray Iron Castings.
      c. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      d. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
      e. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      f. A143/A143M, Standard for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
      g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      h. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
      i. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
      j. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
      k. A276, Standard Specification for Stainless Steel Bars and Shapes.
      l. A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
      m. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      n. A325, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
      o. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

p. A384/A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
q. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
r. A489, Standard Specification for Carbon Steel Lifting Eyes.
s. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
t. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
u. A563, Standard Specification for Carbon and Alloy Steel Nuts.
v. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
w. A780/A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
x. A786/A786M, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
y. A793, Standard Specification for Rolled Floor Plate, Stainless Steel.
z. A967, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
aa. A992/A992M, Standard Specification for Structural Steel Shapes.
bb. A1085, Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
cc. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
dd. B308/B308M, Standard Specification for Aluminum-Alloy 6061 T6 Standard Structural Profiles.
ee. B429/B429M, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ff. B632/B632M, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
gg. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
hh. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
ii. F436, Standard Specification for Hardened Steel Washers.
jj. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
kk. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ll. F594, Standard Specification for Stainless Steel Nuts.
mm. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
nn. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.

9. NSF International (NSF): 61, Drinking Water System Components—Health Effects.
10. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910.27, Fixed Ladders.
    b. 29 CFR 1926.105, Safety Nets.
    c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.
11. Specialty Steel Industry of North America (SSINA):
    a. Specifications for Stainless Steel.
    b. Design Guidelines for the Selection and Use of Stainless Steel.
    c. Stainless Steel Fabrication.
    d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Anchor Bolt: Cast-in-place anchor; concrete or masonry.

B. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

C. Exterior Area: Location not protected from weather by building or other enclosed structure.

D. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.

E. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

F. Submerged: Location at or below top of wall of open water-holding structure, such as basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior below-grade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Metal fabrications, including welding and fastener information.
   2. Samples: Color samples of abrasive stair nosings.

B. Informational Submittals:
   1. Pre-engineered Ladders: Letter of certification that ladder meets OSHA 29 CFR 1910.27 requirements.
   2. Passivation method for stainless steel members.
   3. Galvanized coating applicator qualifications.
   4. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer, with description of material processed and ASTM standard used for coating.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Insofar as practical, factory assemble specified items. Package assemblies, which have to be shipped unassembled to protect materials from damage and tag to facilitate identification and field assembly.

B. Package stainless steel items to provide protection from carbon impregnation.

C. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling. Use padded slings and straps.

D. Store fabricated items in dry area, not in direct contact with ground.

1.06 SPECIAL GUARANTEE

A. Manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of hatches found defective during a period of 5 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

1.07 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following extra materials:

Item	Quantity
Neoprene Gasket	Two for each location requiring neoprene gaskets.
4-inches wide by 50 feet long Neoprene Gasket Material	One roll for each location requiring neoprene gaskets.
Neoprene Gasket Adhesive	One (manufacturer's recommended) for each location requiring neoprene gaskets.

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5-inches thick for ASTM A36/A36M steel), limit maximum silicon content to 0.21 percent and phosphorous content to 0.03 percent.

B. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Steel Wide Flange Shapes	A992/992M
Other Steel Shapes and Plates	A36/A36M or A572/A572M, Grade 50 or A992/A992M for other steel shapes
Steel Pipe	A500, Grade B
Hollow Structural Sections (HSS)	A500/A500M, Grade C
Aluminum:	
Aluminum Plates	B209, Alloy y6061-T6
Aluminum Structural Shapes	B308/B308M, Alloy 6061-T6
Stainless Steel:	
Bars and Angles	A276, AISI Type 316 (316L for welded connections)

Shapes	A276, AISI Type 304 (304L for welded connections)
Steel Plate, Sheet, and Strip	A240/A240M, AISI Type 316 (316L for welded connections)
Bolts, Threaded Rods, Anchor Bolts, and Anchor Studs	F593, AISI Type 316, Group 2, Condition SH
Nuts	F594, AISI Type 316, Condition CW
Steel Bolts and Nuts:	
Carbon Steel	A307 bolts, with A563 nuts
High-Strength	A325, Type 1 bolts, with A563 nuts
Anchor Bolts and Rods	F1554, Grade **36**, with weldability supplement S1.
Eyebolts	A489
Threaded Rods	A36/A36M
Flat Washers (Unhardened)	F844
Flat and Beveled Washers (Hardened)	F436
Thrust Ties for Steel Pipe:	
Threaded Rods	A193/A193M, Grade B7
Nuts	A194/A194M, Grade 2H
Plate	A283/A283M, Grade D
Welded Anchor Studs	A108, Grades C-1010 through C-1020
Aluminum Bolts and Nuts	F468, Alloy 2024-T4
Cast Iron	A48/A48M, Class 35

C. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

2.02 ANCHOR BOLTS

A. Cast-In-Place Anchor Bolts:
   1. Headed type, unless otherwise shown on Drawings.
   2. Material type and protective coating as shown in Fastener Schedule at end of this section.

2.03 POST-INSTALLED CONCRETE ANCHORS

A. See Section 01 88 15, Anchoring and Bracing.

2.04 STUD SHEAR CONNECTORS

A. Headed anchor studs (HAS), or threaded anchor studs (TAS), or stud shear connectors, as indicated on Drawings.

1. Carbon Steel: ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semikilled or killed aluminum or silicon dioxidation, unless indicated otherwise.
2. Stainless Steel: ASTM F593, AISI Type 316, Condition CW, where indicated.

B. Manufacturers:
1. Nelson Stud Welding, FabriSteel Co., Elyria, OH.
2. Stud Welding Associates, Inc., Elyria, OH.

2.05 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Welded anchors for stainless steel support frames shall also be stainless steel.

2.06 SIDEWALK DOORS – NOT USED

2.07 HATCHES

A. Load Capacity: 300 psf with maximum deflection of 1/150th of span.

B. Component Fabrication:
1. Access Door Leaf(s): 1/4-inch thick aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.
2. Angle Frame: 1/4-inch thick extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip.

C. Door Hardware:
1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins, through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.
2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.
3. Hold-Open Arm:
   a. Locks automatically in open position.
   b. Disengages with slight pull on vinyl grip with one hand.
   c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.
4. Snap Lock:
   a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
   b. Threaded plug for flush outside surface with key wrench removed.

D. Aluminum: Mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09 90 00, Painting and Coating.

E. Manufacturers and Products:
1. Bilco Co., New Haven, CT; K Series.
2. Nystrom Products Co., Minneapolis, MN; FH Series.
3. U.S.F. Fabrication, Hialeah, FL; A Series.
4. ITT Flygt Corporation, Trumbull, CT; FLE Series.
5. Thompson Fabricating Co., Birmingham, AL; TI Series.
6. Halliday Products, Orlando, FL; SS Series.

2.08 HATCH SAFETY NET

A. General:
   1. Conforms to ASSE A10.11 and OSHA CFR Part 1926.105.
   2. Size to fit hatch opening where indicated.

B. Components and Accessories:
   1. Rails and Slide Rings: Aluminum 6061 T6 extruded rails and aluminum-alloy 713.0 slide rings.
   2. Corner Hooks and Eyebolts: AISI Type 316 stainless steel.
   3. Netting: Polyester, 5-inch by 5-inch net openings; 5,000 pounds minimum breaking strength.
   4. Bolts, Nuts, and Concrete Anchors: AISI Type 316 stainless steel.

C. Manufacturer and Product: Safe Approach Inc., Auburn, ME; Hatch Net 121.

2.09 HINGED MANHOLE COVERS – NOT USED

2.10 LADDERS

A. Fabricate ladders with rails, rungs, landings, and cages to meet applicable requirements of OSHA, CFR Part 1910.27, and ALI A14.3.
   1. Design ladder for concentrated load of 200 pounds imposed by user concentrated at points that will cause maximum stress in structural member being considered.
   2. Include weight of ladder and attached appurtenances together with live load in design of rails and fastenings.
   3. Self-closing gates at landings.

B. Flat Bar Ladder:
   1. Punch rails, pass rungs through rails, and weld on outside.
   2. Weld brackets to ladder for fastening ladder to wall.
   3. Hot-dip galvanize steel after fabrication in accordance with ASTM A123/A123M and ASTM A385/A385M.

C. Ladder Safety Post:
   1. Telescoping tubular, spring balanced and automatically locking in raised position, with release lever for unlocking.
   2. Post: Hot-dip galvanized steel in accordance with ASTM A123/A123M.
   3. Hardware: Stainless steel, AISI Type 316.
   4. Furnish dissimilar metal protective coatings at connections.
   5. Manufacturer and Product: Bilco Co., New Haven, CT; “Ladder Up” to fit ladder rungs.

2.11 SAFETY CLIMB DEVICE

A. General:
   1. Conforms to ALI A14.3 and OSHA CFR Part 1910.27.
   2. Belt and harness shall withstand minimum drop test of 250 pounds in 6-foot free fall.
   3. Fall Prevention System Material: Hot-dip galvanized steel in accordance with ASTM A123/A123M.

B. Components and Accessories:
   1. Main Components: Sleeve or trolley, safety harness, and carrier or climbing rail.
   2. Ladder rung clamps with hot-dip galvanized steel mounting brackets and hardware.

3. Removable extension kit with tiedown rod or trolley gate, mandrel, and carrier rail for ladders under manholes and hatches.

C. Manufacturers and Products:
   1. Miller by Honeywell, Franklin, PA; Miller Saf T Climb.
   2. TS Products, Cambridge, Ontario, Canada; TS Safety Rail System.

2.12 FALL ARREST ANCHORS

A. General:
   1. Conforms to OSHA CFR Part 1926.502.
   2. Minimum Breaking Strength: 5,000 pounds.
   3. Material: Stainless steel, AISI Type 304.

B. Components and Accessories:
   1. Forged combination eye and base assembly with headed anchor bolt, backer plate, lock washer, and nut.
   2. Suitable for embedment in concrete wall.

C. Manufacturers and Products:
   1. Thaler Metal Industries, Buffalo, NY; FARA Wall Anchor.
   2. Rose Manufacturing Company, Pittsburgh, PA; Anchorage Connector.

2.13 ACCESSORIES

A. Antiseizing Lubricant for Stainless Steel Threaded Connections:
   1. Suitable for potable water supply.
   2. Resists washout.
   3. Manufacturers and Products:
      a. Bostik, Middleton, MA; Neverseez.
      b. Saf T Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:
   1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
   2. Thickness: Minimum 1/4-inch.
   3. Furnish without skin coat.
   4. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK1111LD.

2.14 FABRICATION

A. General:
   1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
   2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
   3. Conceal fastenings where practical; where exposed, flush countersink.
   4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
   5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
   6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 percent and 0.25 percent.
3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures–Allowable Stress Design.

C. Welding:
1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1/D1.1M, Section 5.
4. Aluminum: Meet requirements of AWS D1.2/D1.2M.
5. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1/D1.1M, Section 7, and manufacturer's instructions.
7. Complete welding before applying finish.

D. Painting:
1. Shop prime with rust-inhibitive primer as specified in Section 09 90 00, Painting and Coating, unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

E. Galvanizing:
1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653/A653M.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Electrolytic Protection: Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.

G. Watertight Seal: Where required or shown, furnish neoprene gasket of a type that is satisfactory for use in exterior conditions. Cover full bearing surfaces.

H. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

I. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.15 SOURCE QUALITY CONTROL

A. Visually inspect fabrication welds and correct deficiencies.
   1. Steel: AWS D1.1/D1.1M, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
   2. Aluminum: AWS D1.2/D1.2M.
   3. Stainless Steel: AWS D1.6/D1.6M.

PART 3 - EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:
   1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
   2. Install rigid, substantial, and neat in appearance.
   3. Install manufactured products in accordance with manufacturer's recommendations.
   4. Obtain Engineer approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:
   1. Do not remove mill markings from concealed surfaces.
   2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
   3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

C. Pipe Sleeves:
   1. Provide where pipes pass through concrete.
   2. Provide center flange for water stoppage on sleeves in exterior or water-bearing walls.
   3. Provide rubber caulking sealant or a modular mechanical unit to form watertight seal in annular space between pipes and sleeves.

D. Steel Lintels and Shelf Angles: Provide as required for support of construction not attached to structural steel framing, unless otherwise shown on Drawings.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Locate and hold anchor bolts in place with templates at time concrete is placed.

B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.

C. Minimum Bolt Size: 1/2-inch diameter by 12-inches long, unless otherwise shown.

3.03 ACCESS COVERS

A. Install access covers, including floor hatches, in accordance with manufacturer's instructions.

B. Accurately position prior to placing concrete, such that covers are flush with floor surface.

C. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.

D. Route drainpipe to exterior face of concrete or as shown on Drawings.

E. Position cover so that hinge is on side opposite ladder.

3.04 SAFETY CLIMB DEVICE SYSTEM

A. Provide for each ladder where unbroken height between levels exceeds 20 feet, or at lesser height where indicated on Drawings.

B. Install in accordance with manufacturer's instructions.

C. Furnish additional accessories required to complete system for each ladder.

D. Furnish one harness for each ladder equipped with safety climb device.

E. Furnish pivot section at platforms, landings, and roofs.

F. When installed to required height, fall prevention system shall be rigid and an integral part of the structure.

3.05 ELECTROLYTIC PROTECTION

A. Aluminum and Galvanized Steel:
   1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
   2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.
   3. Allow coating to dry before installation of the material.
   4. Protect coated surfaces during installation.
   5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

B. Titanium: Where titanium equipment is in contact with concrete or dissimilar metal, provide full-face neoprene insulation gasket, 3/32-inch minimum thickness and 70 durometer hardness.

C. Stainless Steel:
   1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
   2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
   3. Remove contamination using cleaning and passivation methods in accordance with requirements of ASTM A380 and ASTM A967.
   4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
   5. After treatment, visually inspect surfaces for compliance.

3.06 PAINTING

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 00, Painting and Coating.

B. Repair of Damaged Hot-Dip Galvanized Coating:
   1. Conform to ASTM A780/A780M.
   2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780/A780M.
   3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780/A780M.
   4. Use magnetic gauge to determine thickness is equal to or greater than base galvanized coating.

C. Field Painting of Shop Primed Surfaces: Prepare surfaces and field finish in accordance with Section 09 90 00, Painting and Coating.

3.07 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance:
   1. In accordance with CBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings.
   2. Contractor responsibilities and related information on special inspection, observation, and testing are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control:
   1. Inspection and testing required in Section 01 45 16.13, Contractor Quality Control.
   2. Manufacturer's Certificate of Compliance per Section 01 61 00, Common Product Requirements, for test results, or calculations, or drawings that ensure material and equipment design and design criteria meet requirements of Section 01 61 00, Common Product Requirements.

3.08 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

Service Use and Location	**Product**	**Remarks**
1. Anchor Bolts Cast into Concrete for Structural Steel, Metal Fabrications and Castings		
Interior Dry Areas	**Hot-dip galvanized** steel headed anchor bolts, unless indicated otherwise	
Exterior and Interior Wet Areas	**Stainless** steel (Type 316) headed anchor bolts	
Submerged and Corrosive Areas	Stainless steel (Type 316) headed anchor bolts with fusion bonded coating	See Section 09 90 00, Painting and Coating
2. Anchor Bolts Cast into Concrete for Equipment Bases		
Interior Dry Areas	**Hot-dip galvanized** steel headed anchor bolts, unless otherwise specified with equipment	

Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel (Type 316) headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment	See Section 09 90 00, Painting and Coating
3. Post-Installed Anchors: See Section 01 88 15, Anchoring & Bracing		
4. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members.
5. Connections for Steel Fabrications and Wood Components		
Exterior and Interior Wet and Dry Areas	**Stainless** steel (Type 316) bolted connections	
6. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel (Type 316) bolted connections, unless otherwise specified with equipment	
7. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel (Type 316) fasteners	

B. Anti-seizing Lubricant: Use on stainless steel threads.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. C661, Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
      b. C834, Standard Specification for Latex Sealants.
      c. C920, Standard Specification for Elastomeric Joint Sealants.
      d. C1193, Standard Guide for Use of Joint Sealants.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Surface preparation instructions. Indicate where each product is proposed to be used.
   2. Samples: Material proposed for use showing color range available.

B. Informational Submittals:
   1. Installation instructions.
   2. Documentation showing applicator qualifications.
   3. Manufacturer's Certificate of Compliance, in accordance with Section A: 01 61 00, Common Product Requirements.
   4. Special guarantee.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator must be able to perform activities consistent with the standards and requirements listed herein.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Ambient Temperature: Between 40 degrees F and 80 degrees F (4 degrees C and 27 degrees C) when sealant is applied. Consult manufacturer when sealant cannot be applied within these temperature ranges.

1.05 SPECIAL GUARANTEE

A. Product: Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction or, at the option of the Owner, removal and replacement of Work specified in this section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

B. Conditions: No adhesive or cohesive failure of sealant.

C. Sealed Joints: Watertight and weathertight with normal usage.

PART 2 - PRODUCTS

2.01 SEALANT MATERIALS

A. Characteristics:
   1. Uniform, homogeneous.
   2. Free from lumps, skins, and coarse particles when mixed.
   3. Non-staining, nonbleeding.
   4. Hardness of 15 minimum and 50 maximum, measured by ASTM C661 method.
   5. Immersible may be substituted for non-immersible.

B. Color: As selected by Architect from manufacturer's full range.

C. Type 1—Silicone, Non-sag, Non-immersible:
   1. Silicone base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
   2. Capable of withstanding movement up to 50 percent of joint width.
   3. 3Manufacturers and Products:
      a. Dow Corning Corp.; No. 790.
      b. General Electric; Silpruf.
      c. BASF; Sonneborn, Omniseal 50.

D. Type 2—Multipart Polyurethane, Self-leveling, Immersible:
   1. Polyurethane base, multicomponent, chemical curing; ASTM C920, Type M, Grade P, Class 25.
   2. Capable of being continuously immersed in water.
   3. Manufacturers and Products:
      a. BASF; Sonneborn, SL 2.
      b. Pecora Corp.; Urexspan NR 200.
      c. Tremco; THC-900/901.
      d. Sika Chemical Corp.; Sikaflex 2c SL.

E. Type 3—Multipart Polyurethane, Non-sag, Immersible:
   1. Polyurethane base, multicomponent, chemical curing; ASTM C920, Type M, Grade NS, Class 25.
   2. Capable of being continuously immersed in water.
   3. Manufacturers and Products:
      a. Pecora; DynaTrol II.
      b. Tremco; Dymeric 240.
      c. BASF; Sonneborn NP 2.
      d. Sika Chemical Corp.; Sikaflex 2c NS.

F. Type 4—Multipart Polyurethane, Non-sag, Non-immersible:
   1. Polyurethane base, multicomponent, chemical curing; ASTM C920, Type M, Grade NS, Class 25.
   2. Manufacturers and Products:
      a. BASF; Sonneborn NP 2.
      b. Pecora Corp.; Dynatrol II.
      c. Tremco; Dymeric 240.
      d. Sika Chemical Corp.; Sikaflex 2c NS.

G. Type 5—One-part Polyurethane, Immersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturers and Products for Non-sag:
    a. Sika Chemical Corp.; Sikaflex 1a.
    b. Tremco; Vulkem 116.
4. Manufacturers and Products for Self-leveling:
    a. BASF; Sonneborn, SL 1.
    b. Tremco; Vulkem 45.
    c. Sika Chemical Corp.; Sikaflex 1c SL.

H. Type 6—One-Part Polyurethane, Non-immersible:
1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Manufacturers and Products:
    a. Pecora Corp.; Dynatrol 1 XL.
    b. Tremco; Dymonic.
    c. BASF; Sonneborn, NP I.

I. Type 7—Multipart Polysulfide, Immersible:
1. Polysulfide base, two-component, chemical curing; ASTM C920, Type M, Grade P or NS, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturers and Products:
    a. W. R. Meadows; Deck O Seal Gun Grade, two-part.
    b. BASF; Sonolastic, two-part Polysulfde.

J. Type 8—One-Part Polysulfide, Nonsag, Non-immersible:
1. Polysulfide base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 12 1/2.
2. Capable of withstanding movement up to 20 percent of joint width.
3. Manufacturer and Product: W. R. Meadows; Deck O Seal, one-part.

K. Type 9—One-Part Acrylic Terpolymer, Non-sag, Non-immersible:
1. Acrylic base, single-component, solvent curing; ASTM C834 non-sag.
2. Capable of withstanding movement up to 7.5 percent of joint width; Shore “A” hardness of 55 maximum.
3. Manufacturer and Product: Tremco; Mono 555.

L. Type 10—Sanitary Sealant:
1. Silicone sealant similar to Type 1, above, formulated to resist mold growth and repeated exposure to high humidity while retaining adhesion, flexibility, and color.
2. Manufacturers and Products:
    a. Dow Corning; 786.
    b. General Electric; Sanitary Sealant SCS1700.

M. Type 11—Fire Penetration Seal:
1. Manufacturers and Products:
    a. 3M Corp.; Fire Barrier Caulk CP25 and Putty 303.
    b. General Electric; Pensil Sealant or Foam.
    c. Unifrax Corporation; Fyre Putty.
    d. Hilti USA; CP 604.

N. Type 12—One-Part Polycarbonate, Immersible:

1. Polycarbonate base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturer and Product: Pro Seal Products, Inc.; Pro Seal 34.

O. Type 13—Tape Sealant:
1. Compressible polyurethane foam impregnated with polybutylene or polymer-modified asphalt.
2. Color: Black.
3. Size: 3/4-inch wide by length required by expanded thickness recommended by manufacturer for particular application.
4. Manufacturers and Products:
   a. Emseal Joint Systems, Ltd.; AST—High Acrylic.
   b. Dayton Superior; Polytite Standard.
   c. PARR Technologies; PARR Sealant EP 7212 T.

2.02 BACKUP MATERIAL

A. Non-gassing, extruded, closed-cell round polyurethane foam or polyethylene foam rod, compatible with sealant used, and as recommended by sealant manufacturer.

B. Size: As shown or as recommended by sealant material manufacturer. Provide for joints greater than 3/16-inch wide.

C. Manufacturers and Products:
1. Sonneborn; Sonolastic Closed-cell Backing Rod.
2. Tremco; Closed-cell Backing Rod.
3. Pecora Corporation; Green Rod.

2.03 ANCILLARY MATERIALS

A. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Noncorrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Primer: Non-staining type recommended by sealant manufacturer to suit application.

2.04 PREFORMED SEALS

A. Preformed Compressible Joint Seals:
1. Widths Up to 5 Inches:
   a. BASF, Watson Bowman Acme Div.; Wabo Weatherseal II.
   b. Emseal Joint Systems Limited; Colorseal.
   c. LymTal International; Iso-flex Joint System.
2. Other Widths: Series or model recommended by seal manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

A. Use of more than one material for the same joint is not allowed unless approved by sealant manufacturer.

B. Install joint sealants in accordance with ASTM C1193.

C. Horizontal and Sloping Joints up to 1 Percent Maximum Slope: Use self-leveling (Grade P) joint sealant.

D. Steeper Sloped Joints, Vertical Joints, and Overhead Joints: Use non-sag (Grade NS) joint sealant.

E. Use joint sealant as required for the applicable application and as follows:

Joint Size	Sealant Type
Less than 1"	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or 12
Less than 2"	1, 2, 3, 4, or 7
Over 2"	Follow manufacturer’s recommendation

3.02 PREPARATION

A. Verify that joint dimensions, and physical and environmental conditions, are acceptable to receive sealant.

B. Surfaces to be sealed shall be clean, dry, sound, and free of dust, loose mortar, oil, and other foreign materials.
   1. Mask adjacent surfaces where necessary to maintain neat edge.
   2. Starting of work will be construed as acceptance of subsurfaces.
   3. Apply primer to dry surfaces as recommended by sealant manufacturer.

C. Verify joint shaping materials and release tapes are compatible with sealant.

D. Examine joint dimensions and size materials to achieve required width/depth ratios.

E. Follow manufacturer’s instructions for mixing multi-component products.

3.03 INSTALLATION

A. Use joint filler to achieve required joint depths, to allow sealants to perform intended function.
   1. Install backup material as recommended by sealant manufacturer.
   2. Where possible, provide full length sections without splices; minimize number of splices.
   3. Tape sealant may be used as joint filler if approved by sealant manufacturer.

B. Use bond breaker where recommended by sealant manufacturer.

C. Seal joints around window, door and louver frames, expansion joints, control joints, and elsewhere as indicated.

D. Joint Sealant Materials: Follow manufacturer's recommendation and instructions, filling joint completely from back to top, without voids.

E. Joints: Tool slightly concave after sealant is installed.
   1. When tooling white or light color sealant, use a water wet tool.
   2. Finish joints free of air pockets, foreign embedded matter, ridges, and sags.

F. Tape Sealant: Compress to 50 percent of expanded thickness and install in accordance with manufacturer's instructions.

3.04 PREFORMED SEALS

A. Prepare joint surfaces clean and dry, free from oil, rust, laitance, and other foreign material.

B. Construct joints straight and parallel to each other and at proper width and depth.

C. Apply joint sealant manufacturer's approved primer and adhesive in accordance with manufacturer's instructions.

D. Install seal in accordance with manufacturer's instructions.

3.05 CLEANING

A. Clean surfaces next to the sealed joints of smears or other soiling resultant of sealing application.

B. Replace damaged surfaces resulting from joint sealing or cleaning activities.

3.06 JOINT SEALANT SCHEDULE

A. This schedule lists the sealant types acceptable for each joint location. Use as few different sealant types as possible to meet the requirements of Project.

Joint Locations	**Sealant Type(s)**
Expansion/Contraction and Control Joints At:	
Concrete Walls (except water-holding and below grade portions of structures)	1, 3, 4, 5, 6, 7, 12
Concrete Floor Slabs (except for water-holding Structures)	2, 5
Slabs Subject to Vehicle and Pedestrian Traffic	2, 5
Masonry Walls	1, 3, 4, 5, 6, 7, 12, 13
Exterior Insulation and Finish System	4
Material Joints At:	
Metal Door, Window, and Louver Frames (Exterior)	1, 5, 6, 8, 12
Metal Door, Window, and Louver Frames (Interior)	1, 5, 6, 8, 9
Wall Penetrations (Exterior)	1, 5, 6, 8, 12
Wall Penetrations (Interior)	1, 5, 6, 8
Floor Penetrations	5, 6, 7

Ceiling Penetrations	1, 3, 4, 5, 6, 7
Roof Penetrations	5
Sheet Metal Flashings	5, 13
Other Joints:	
Threshold Sealant Bed	5
Around Plumbing Fixtures	10
Openings Around Pipes, Conduits, and Ducts Through Fire-Rated Construction	11
Concrete Form Snap-Tie Holes	1, 4, 5

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Water Works Association (AWWA):
      a. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
      b. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
      c. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
   2. Environmental Protection Agency (EPA).
   3. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
   4. NSF International (NSF): 61, Drinking Water System Components - Health Effects.
   5. Occupational Safety and Health Act (OSHA).
   6. Research Council on Structural Connections (RCSC): Specification for Structural Joints using High-Strength Bolts.
   7. The Society for Protective Coatings (SPC):
      a. PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements.
      b. PA 10, Guide to Safety and Health Requirements for Industrial Painting Projects.
      c. SP 1, Solvent Cleaning.
      d. SP 2, Hand Tool Cleaning.
      e. SP 3, Power Tool Cleaning.
      f. SP 5, White Metal Blast Cleaning.
      g. SP 6, Commercial Blast Cleaning.
      h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
      i. SP 10, Near-White Blast Cleaning.
      j. SP 11, Power Tool Cleaning to Bare Metal.
      k. SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
      l. SP 13, Surface Preparation of Concrete.
      m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02 DEFINITIONS

A. Terms used in this section:
   1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
   2. FRP: Fiberglass Reinforced Plastic.
   3. HCl: Hydrochloric Acid.
   4. MDFT: Minimum Dry Film Thickness, mils.
   5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
   6. Mil: Thousandth of an inch.
   7. PDS: Product Data Sheet.
   8. PSDS: Paint System Data Sheet.

9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Data Sheets:
         1) For each product, furnish a Product Data Sheet (PDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PDS form is appended to the end of this section.
         2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
         3) Technical and performance information that demonstrates compliance with specification.
         4) Furnish copies of paint system submittals to the coating applicator.
         5) Indiscriminate submittal of only manufacturer's literature is not acceptable.
      b. Detailed chemical and gradation analysis for each proposed abrasive material.

B. Informational Submittals:
   1. Applicator's Qualification: List of references substantiating experience.
   2. Coating manufacturer's Certificate of Compliance
   3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
   4. Manufacturer's written verification that submitted material is suitable for the intended use.
   5. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.
   6. Manufacturer's written instructions and special details for applying each type of paint.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator must be able to perform activities consistent with the standards and requirements herein.

B. Regulatory Requirements:
   1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
   2. Perform surface preparation and painting in accordance with recommendations of the following:
      a. Paint manufacturer's instructions.
      b. SSPC PA 10.
      c. Federal, state, and local agencies having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:
   1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
   2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:
   1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.
   2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
   2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. List of previous applicable previous applications shall be provided to the engineer upon request.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:
   1. Frazee Paint Company
   2. ICI Dulux Paints
   3. Sherwin Williams Co. (Sherwin Williams)
   4. Vista Paint Corporation (Vista Paints)
   5. Tnemic

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:
   1. Manufacturer's highest quality products suitable for intended service.
   2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats and to existing paint and existing coatings.
   3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Epoxy Primer - Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments

Epoxy Primer - Other	Epoxy primer, high build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
Fusion Bonded Epoxy Coating	100% solids, thermosetting, fusion bonded, dry powder epoxy, suitable for the intended service
High Build Epoxy	Polyamidoamine epoxy, minimum 69% volume solids, capability of 4 to 8 MDFT per coat
NSF Epoxy	Polyamidoamine epoxy, approved for potable water contact and conforming to NSF 61
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish

2.04 MIXING

A. Multiple-Component Coatings:
   1. Prepare using each component as packaged by paint manufacturer.
   2. No partial batches will be permitted.
   3. Do not use multiple-component coatings that have been mixed beyond their pot life.
   4. Furnish small quantity kits for touchup painting and for painting other small areas.
   5. Mix only components specified and furnished by paint manufacturer.
   6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph, Shop Coating Requirements.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:
   1. When required by equipment specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.
   2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:
   1. Steel Pipe:
      a. Surface preparation and application of primer shall be performed by pipe manufacturer.
      b. For pipe with epoxy lining, do not place end cap seals until pipe lining material has sufficiently dried.

E. Pumps:
   1. Sump Pumps:
      a. Surface preparation, application of primer, finish paint and epoxy shall be performed in accordance with System 29.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide Engineer minimum 7 days' advance notice to start of field surface preparation work and coating application work.

B. Perform the Work only in presence of Engineer, unless Engineer grants prior approval to perform the Work in Engineer's absence.

C. Schedule inspection of cleaned surfaces and coats prior to succeeding coat in advance with Engineer.

3.02 EXAMINATION

A. Factory Finished Items:
   1. Schedule inspection with Engineer before repairing damaged factory-finished items delivered to Site.
   2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. Field Abrasive Blasting:
   1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
   2. Refer to coating systems for degree of abrasive blasting required.
   3. Where the specified degree of surface preparation differs from manufacturer's recommendations, the more stringent shall apply.

B. Surface Contamination Testing:
   1. A surface contamination analysis test shall be performed every 500 square feet by means of a Chlor Test CSN Salts or approved equivalent.
   2. Surface with chloride levels exceeding 3 µg/square centimeter for submerged surfaces and 5 µg/square centimeter for exposed surfaces shall be treated with a liquid soluble salt remover equivalent to CHLOR*RID (CHLOR*RID International, Chandler, AZ).
   3. Follow manufacturer's recommendations and procedures for the use of this product to remove the surface contamination.

C. Metal Surface Preparation:
   1. Where indicated, meet requirements of SSPC Specifications summarized below:
      a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
      b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
      c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
      d. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
      e. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
      f. SP 7, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.
      g. SP 10, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
      h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.
      i. SP-16, Brush Blasting of Non-Ferrous Metals: A brush-off blast cleaned non-ferrous metal surface, when viewed without magnification, shall be free of visible oil, grease, dirt, dust, metal oxides (corrosion products), and other foreign matter. Intact, tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife. Bare metal substrates shall have a minimum profile of 19 micrometers (0.75 mil).
   2. The words "solvent cleaning", "hand tool cleaning", "wire brushing", and "blast cleaning", or similar words of equal intent in these Specifications or in paint manufacturer's specification refer to the applicable SSPC Specification.
   3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers' recommendations for wet blast additives and first coat application shall apply.
   4. Hand tool clean areas that cannot be cleaned by power tool cleaning.
   5. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
   6. Welds and Adjacent Areas:

a. Prepare such that there is:
    1) No undercutting or reverse ridges on weld bead.
    2) No weld spatter on or adjacent to weld or any area to be painted.
    3) No sharp peaks or ridges along weld bead.
b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

7. Preblast Cleaning Requirements:
    a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
    b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
    c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
8. Blast Cleaning Requirements:
    a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.
    b. Select type and size of abrasive to produce surface profile that meets coating manufacturer's recommendations for particular primer to be used.
    c. Use only dry blast cleaning methods.
    d. Do not reuse abrasive, except for designed recyclable systems.
    e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.
9. Post-Blast Cleaning and Other Cleaning Requirements:
    a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
    b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.

D. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:
1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.
2. Brush blast in accordance with SSPC SP 16.
3. Obtain and follow coating manufacturer's recommendations for additional preparation that may be required.

E. Plastic and FRP Surface Preparation:
1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

F. Existing Painted Surfaces to be Repainted Surface Preparation:
1. Test and verify compatibility of existing paint with manufacturer recommended paint.
2. Detergent wash and freshwater rinse.
3. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
4. Feather surrounding intact coating.
5. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
6. Apply one full finish coat of specified primer to entire surface.

7. If an aged, plural-component material is to be topcoated, contact coating manufacturer for additional surface preparation requirements.
8. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:
   1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.
   2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.
   3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.
   4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
   5. Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.
   6. Repair or replace surface damaged by blast cleaning.

B. Acid Etching:
   1. After precleaning, spread the following solution by brush or plastic sprinkling can: One part commercial muriatic acid reduced by two parts water by volume. Adding acid to water in these proportions gives an approximate 10 percent solution of HCl.
   2. Application:
      a. Rate: Approximately 2 gallons per 100 square feet.
      b. Work acid solution into surface by hard-bristled brushes or brooms until complete wetting and coverage is obtained.
      c. Acid will react vigorously for a few minutes, during which time brushing shall be continued.
      d. After bubbling subsides (10 minutes), hose down remaining slurry with high pressure clean water.
      e. Rinse immediately to avoid formation on the surface of salts that are difficult to remove.
      f. Thoroughly rinse to remove any residual acid surface condition that may impair adhesion.
   3. Ensure surface is completely dry before application of coating.
   4. Apply acid etching to obtain a “grit sandpaper” surface profile. If not, repeat treatment.

C. Solvent Cleaning:
   1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
   2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:
   1. The intention of these Specifications is for new, interior and exterior masonry, concrete, and metal, and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint exterior concrete surfaces, unless specifically indicated.
   2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.
4. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
5. Sand wood lightly between coats to achieve required finish.
6. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
7. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
8. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
9. On pipelines, terminate coatings along pipe runs to 1-inch inside pipe penetrations.
10. Keep paint materials sealed when not in use.
11. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Film Thickness and Coverage:
1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with specification.
   c. Coats are subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedules. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

B. System No. 5 Exposed Metal—Mildly Corrosive:

Surface Prep	Paint Material	Min. Coats, Cover
SP 2 or SP 3, Hand Tool Cleaning or Power Tool Cleaning	Epoxy Primer—Ferrous Metal	Spot prime - 1 coat, 2.5 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, located inside or outside of structures and exposed to weather or in a highly humid atmosphere and the following specific surfaces:
      1) Exterior of Exposed Metal Piping and Valves
      2) Pump Discharge Header
      3) Exterior exposed electrical conduits
      4) Exterior pump head
      5) Exterior pump motor

C. System No. 6 Exposed Metal—Atmospheric:

Surface Prep	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	Rust-Inhibitive Primer	1 coat, 2 MDFT
	Alkyd Enamel	2 coats, 4 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, located inside or outside of structures or exposed to weather, including metal doors and frames, vents, louvers, exterior metal ductwork, flashing, sheet metalwork and miscellaneous architectural metal trim, and the following specific surfaces:
      1) Electrical and instrumentation and control systems enclosures and cabinets for process.
   b. Apply surface preparation and primer to surfaces prior to installation. Finish coats need only be applied to surfaces exposed after completion of construction.

D. System No. 10 Galvanized Metal, Copper, and Nonferrous Metal Alloy Conditioning:

Surface Prep.	Print Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Epoxy Primer—Other	As recommended by coating manufacturer Remaining coats as required for exposure

1. Use on the following items or areas:
   a. Galvanized surfaces requiring painting, and the following specific surfaces:
      1) Pipe supports
      2) As noted on the drawings
   b. After application of System No. 10, apply finish coats as required for exposure.

E. System No. 25 Exposed FRP, PVC:

Surface Prep.	Print Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex Semigloss	2 coats, 320 SFPGPC

1. Use on the following items or areas:
   a. Exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV-resistant gel coat.

F. System No. 29 Fusion Bonded Coating:

Surface Prep.	Print Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100% Solids Epoxy	1 or 2 coats, 7 MDFT

1. For steel pipe and fittings, meet requirements of AWWA C213.
2. Use on the following items:
   a. Pump Barrel, interior, exterior submerged, and interior pump head

3.08 COLORS

A. Colors shall match existing colors found on pumps, pipes, appurtenances and supports.

3.09 FIELD QUALITY CONTROL

A. Testing Equipment:
   1. Provide calibrated electronic type dry film thickness gauge to test coating thickness specified in mils.
   2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA, Model M 1.
   3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:
   1. Thickness and Continuity Testing:
      a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
      b. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE SP0188.
      c. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE SP0188.
      d. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

C. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

D. Unsatisfactory Application:
   1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
   2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
   3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:
   1. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
   2. Remove rust and contaminants from metal surface. Provide surface cleanliness and profile in accordance with surface preparation requirements for specified paint system.
   3. Feather edges and repair in accordance with recommendations of paint manufacturer.
   4. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.10 MANUFACTURER'S SERVICES

A. Coating manufacturer's representative shall be present at Site as follows:
   1. To field test and verify the compatibility between existing paint and coatings with the recommended new paint and coating system.
   2. On first day of application of any coating system.
   3. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
   4. As required to resolve field problems attributable to or associated with manufacturer's product.
   5. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.11 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

PAINT SYSTEM DATA SHEET

Complete this PSDS for each coating system, include components of the system (surface preparation, primer, intermediate coats, and finish coats). Include components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	**Product Name/Number (Proprietary)**	**Min. Coats, Coverage**

PAINT PRODUCT DATA SHEET

Complete and attach manufacturer's Technical Data Sheet to this PDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning:_____

Ambient Temperature Limitations: min.:_____ max.:_____

Surface Temperature Limitations: min.:_____ max.:_____

Surface Profile Requirements: min.:_____ max.:_____

END OF SECTION

SECTION 26 05 02

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes basic electrical requirements.

1.02 REFERENCES

A. Related Specifications:
   1. 01 61 00 – Common Product Requirements

B. Reference Standards:
   1. National Electrical Contractors Association (NECA): National Electrical Installation Standards.
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. Z535.4, Product Safety Signs and Labels.
   3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
   4. Underwriters Laboratories, Inc. (UL).

1.03 QUALITY ASSURANCE

A. Provide the Work in accordance with NFPA 70. Where required by Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark or label.

C. Provide materials and equipment acceptable to AHJ for Class, Division, and Group of hazardous area indicated.

1.04 ENVIRONMENTAL CONDITIONS

A. The following areas are classified wet. Refer to drawings for hazardous area classification. Use materials and methods required for such areas.
   1. Outdoor above grade areas not covered above.
   2. Below grade vaults.

B. The following areas are classified as indoor and dry:
   Electrical Room.

PART 2 - PRODUCTS

2.01 GENERAL

A. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

B. Material and equipment installed in heated and ventilated areas shall be capable of continuous operation at their specified ratings within an ambient temperature range of 40 degrees F to 104 degrees F.

C. Materials and equipment installed outdoors shall be capable of continuous operation at their specified rating within the ambient temperature range.

2.02 EQUIPMENT FINISH

A. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with light gray color finish as approved by Engineer.

2.03 NAMEPLATES

A. Material: Laminated plastic.

B. Attachment Screws: Stainless steel.

C. Color: Black, engraved to a white core.

D. Letter Height:
   1. Pushbuttons/Selector Switches: 1/8-inch.
   2. Other electrical equipment: 1/4-inch.

2.04 SIGNS AND LABELS

A. Sign size, lettering, and color shall be in accordance with NEMA Z535.4.

PART 3 - EXECUTION

3.01 GENERAL

A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.

B. Check approximate locations of light fixtures, switches, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing.

C. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Keep openings in boxes and equipment closed during construction.

E. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform cutting, channeling, chasing,

or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces to original condition.

3.02 ANCHORING AND MOUNTING

A. Equipment anchoring and mounting shall be in accordance with manufacturer's requirements for seismic zone criteria given in Section 01 61 00, Common Product Requirements.

3.03 COMBINING CIRCUITS INTO COMMON RACEWAY

A. Drawings show each homerun circuit to be provided. Do not combine power or control circuits into common raceways without authorization of Engineer.

B. Homerun circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits may be combined into common raceways in accordance with the following requirements:
   1. Analog control circuits from devices in same general area to same destination.
      a. No power or AC discrete control circuits shall be combined in same conduit with analog circuits.
      b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
      c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into a multi-pair cable without authorization of Engineer.
      d. Raceways shall be sized per General Circuit and Raceway Schedule and do not exceed 40 percent fill.
         1) Changes shall be documented on record drawings.
      e. Discrete control circuits from devices in the same general area to the same destination.
         1) No power or analog control circuits shall be combined in same conduit with discrete circuits.
         2) No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
      f. Raceways shall be sized per the General Circuit and Raceway Schedule and do not exceed 40 percent fill.
         1) Changes shall be documented on record drawings.
      g. Power circuits from loads in same general area to same source location (such as: panelboard, switchboard, low voltage motor control center).
      h. Lighting Circuits: Combine no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
      i. Receptacle Circuits, 120-Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
         1) Other Power Circuits: Do not combine power circuits without authorization of Engineer.

3.04 NAMEPLATES, SIGNS, AND LABELS

A. Arc Flash Protection Warning Signs:

1. Field mark pump control panel to warn qualified persons of potential arc-flash hazards. Locate marking so to be clearly visible to persons before working on energized equipment.

B. Equipment Nameplates:
   1. Provide a nameplate to label electrical equipment including switchgear, switchboards, motor control centers, panelboards, control panels, motor starters, transformers, terminal junction boxes, disconnect switches, switches and control stations.
   2. Switchgear, motor control center, transformer, and terminal junction box nameplates shall include equipment designation.
   3. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.
   4. Switchboard and panelboard nameplates shall include equipment designation, service voltage, and phases.

3.05 LOAD BALANCE

A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.

B. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.

C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.06 CLEANING AND TOUCHUP PAINTING

A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.

B. Touchup Paint:
   1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.
   2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

3.07 PROTECTION FOLLOWING INSTALLATION

A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation and contact surfaces.

B. When equipment intended for indoor installation is installed at Contractor’s convenience in areas where subject to dampness, moisture, dirt or other adverse atmosphere until completion of construction, ensure adequate protection from these atmospheres is provided and acceptable to Engineer.

END OF SECTION

SECTION 26 05 05

CONDUCTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Conductors.

1.02 REFERENCES

A. Abbreviations and Acronyms

B. Definitions

C. Related Specifications:
   1. 26 05 33 – Raceway and Boxes
   2. 40 91 00 – Instrumentation and Control Components

D. Reference Standards:
   1. Association of Edison Illuminating Companies (AEIC): CS 8, Specification for Extruded Dielectric Shielded Power Cables Rated 5 kV through 46 kV.
   2. ASTM International (ASTM):
      a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
      b. B3, Standard Specification for Soft or Annealed Copper Wire.
      c. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
      d. B496, Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV Through 500 kV.
      b. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
      c. 404, Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500000 V.
   4. Insulated Cable Engineer's Association, Inc. (ICEA):
      a. S-58-679, Standard for Control Cable Conductor Identification.
      b. S-73-532, Standard for Control Thermocouple Extensions and Instrumentation Cables.
      c. T-29-520, Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input of 210,000 Btu/hour.
   5. National Electrical Manufacturers' Association (NEMA):
      a. CC 1, Electric Power Connectors for Substations.
      b. WC 57, Standard for Control, Thermocouple Extension, and Instrumentation Cables.
      c. WC 70, Standard for Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

d. WC 71, Standard for Nonshielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy.
e. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.

6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
7. Telecommunications Industry Association (TIA): TIA-568-C, Commercial Building Telecommunications Cabling Standard.
8. Underwriters Laboratories Inc. (UL):
   a. 13, Standard for Safety for Power-Limited Circuit Cables.
   b. 44, Standard for Safety for Thermoset-Insulated Wires and Cables.
   c. 62, Standard for Safety for Flexible Cord and Cables.
   d. 486A-486B, Standard for Safety for Wire Connectors.
   e. 486C, Standard for Safety for Splicing Wire Connectors.
   f. 510, Standard for Safety for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
   g. 854, Standard for Safety for Service-Entrance Cables.
   h. 1072, Standard for Safety for Medium-Voltage Power Cables.
   i. 1277, Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
   j. 1569, Standard for Safety for Metal-Clad Cables.
   k. 1581, Standard for Safety for Reference Standard for Electrical Wires, Cables, and Flexible Cords.

1.03 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Wire and cable.
      b. Wire and cable accessories.
   2. Manufactured Wire Systems:
      a. Product data.
      b. Rating information.
      c. Dimensional drawings.
      d. Special fittings.
   3. Cable Pulling Calculations:
      a. Ensure submitted and reviewed before cable installation.
      b. Provide for the following cable installations:
         1) Medium voltage cable runs that cannot be hand pulled.
         2) Multiconductor 600-volt cable sizes larger than 2 AWG that cannot be hand pulled.
         3) Power and control conductor, and control and instrumentation cable installations in ductbanks.
         4) Feeder circuits; single conductors #4/0 and larger.

B. Informational Submittals:
   1. Journeyman lineman or electrician splicing credentials.
   2. Certified Factory Test Report for conductors 600 volts and below.

1.04 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):
   1. Provide the Work in accordance with NFPA 70. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
   2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark.

PART 2 - PRODUCTS

2.01 CONDUCTORS 600 VOLTS AND BELOW

A. Conform to applicable requirements of NEMA WC 70.

B. Conductor Type:
   1. 120-Volt and 277-Volt Lighting, 10 AWG and Smaller: Solid copper.
   2. 120-Volt Receptacle Circuits, 10 AWG and Smaller: Solid copper.
   3. Other Circuits: Stranded copper.

C. Insulation: Type XHHW-2.

D. Flexible Cords and Cables:
   1. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
   2. Conform to physical and minimum thickness requirements of NEMA WC 70.

2.02 600-VOLT RATED CABLE

A. General:
   1. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 70,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
   2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
   3. Suitable for installation in open air, in cable trays, or conduit.
   4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
   5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

B. Type 1, Multiconductor Control Cable:
   1. Conductors:
      a. 14 AWG, seven-strand copper.
      b. Insulation: 15-mil PVC with 4-mil nylon.
      c. UL 1581 listed as Type THHN/THWN rated VW-1.
      d. Conductor group bound with spiral wrap of barrier tape.
      e. Color Code: In accordance with ICEA S-58-679, Method 1, Table 2.
   2. Cable: Passes the ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.

3. Cable Sizes:

No. of Conductors	Max. Outside Diameter (Inches)	Jacket Thickness (Mils)
3	0.41	45
5	0.48	45
7	0.52	45
12	0.72	60
19	0.83	60
25	1.00	60
37	1.15	80

4. Manufacturers:
   a. Okonite Co.
   b. Southwire.

C. Type 2, Multiconductor Power Cable:
1. General:
   a. Meet or exceed UL 1581 for cable tray use.
   b. Meet or exceed UL 1277 for direct burial and sunlight-resistance.
   c. Overall Jacket: PVC.
2. Conductors:
   a. Class B stranded, coated copper.
   b. Insulation: Chemically cross-linked ethylene-propylene or cross-linked polyethylene.
   c. UL rated VW-1 or listed Type XHHW-2.
   d. Color Code:
      1) Conductors, size 8 AWG and smaller, colored conductors, ICEA S-58679, Method 1, Table 1.
      2) Conductors, size 6 AWG and larger, ICEA S-73-532, Method 4.
3. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
4. Cable Sizes:

Conductor Size	Minimum Ground Wire Size	No. of Current Carrying Conductors	Max. Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
12	12	2 3 4	0.42 0.45 0.49	45
10	10	2 3 4	0.54 0.58 0.63	60
8	10	3 4	0.66 0.75	60

Conductor Size	Minimum Ground Wire Size	No. of Current Carrying Conductors	Max. Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
6	8	3 4	0.74 0.88	60
4	6	3 4	0.88 1.04	60 80
2	6	3 4	1.01 1.16	80
1	6	3 4	1.10 1.25	80
1/0	6	3 4	1.22 1.35	80
2/0	4	3 4	1.32 1.53	80
3/0	4	3 4	1.40 1.60	80
4/0	4	3 4	1.56 1.78	80 110

5. Manufacturers:
   a. Okonite Co.
   b. Southwire.

D. Type 3, 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.
   1. Outer Jacket: 45-mil nominal thickness.
   2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
   3. Dimension: 0.31-inch nominal OD.
   4. Conductors:
      a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
      b. 20 AWG, seven-strand tinned copper drain wire.
      c. Insulation: 15-mil nominal PVC.
      d. Jacket: 4-mil nominal nylon.
      e. Color Code: Pair conductors, black and red.
   5. Manufacturers:
      a. Okonite Co.
      b. Alpha Wire Corp.
      c. Belden.

E. Type 4, 16 AWG, Twisted, Shielded Triad Instrumentation Cable: Single triad, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.
   1. Outer Jacket: 45-mil nominal.

2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
3. Dimension: 0.32-inch nominal OD.
4. Conductors:
   a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
   b. 20 AWG, seven-strand, tinned copper drain wire.
   c. Insulation: 15-mil nominal PVC.
   d. Jacket: 4-mil nylon.
   e. Color Code: Triad conductors black, red, and blue.
5. Manufacturers:
   a. Okonite Co.
   b. Alpha Wire Corp.
   c. Belden.

F. Type 5, 18 AWG, Multitwisted Shielded Pairs, with a Common Overall Shield, Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable, meeting NEMA WC 57 requirements.
1. Conductors:
   a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
   b. Tinned copper drain wires.
   c. Pair drain wire size AWG 20, group drain wire size AWG 18.
   d. Insulation: 15-mil PVC.
   e. Jacket: 4-mil nylon.
   f. Color Code: Pair conductors, black and red with red conductor numerically printed for group identification.
   g. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer.
2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.
3. Cable Sizes:

Number of Pairs	Maximum Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
4	0.50	45
8	0.68	60
12	0.82	60
16	0.95	80
24	1.16	80
36	1.33	80
50	1.56	80

4. Manufacturers:
   a. Okonite Co.
   b. Alpha Wire Corp.
   c. Belden.

G. Type 6, 18 AWG, Multitwisted Pairs with Common Overall Shield Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable meeting NEMA WC 57.

1. Conductors:
   a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
   b. Tinned copper drain wire size AWG 18.
   c. Insulation: 15-mil nominal PVC.
   d. Jacket: 4-mil nylon.
   e. Color Code: Pair conductors, black and red with red conductor numerically printed for group identification.
2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.

Cable Sizes: Number of Pairs	Maximum Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
4	0.48	45
8	0.63	60
12	0.75	60
16	0.83	60
24	1.10	80
36	1.21	80
50	1.50	80

3. Manufacturers:
   a. Okonite Co.
   b. Alpha Wire Corp.
   c. Belden.

2.03 SPECIAL CABLES

A. Type 30, Unshielded Twisted Pair (UTP) Telephone and Data Cable, 300V:
   1. Category 6 UTP, UL listed, and third party verified to comply with TIA/EIA 568-C Category 6 requirements.
   2. Suitable for high speed network applications including gigabit ethernet and video. Cable shall be interoperable with other standards compliant products and shall be backward compatible with Category 5 and Category 5e.
   3. Provide four each individually twisted pair, 23 AWG conductors, with FEP insulation and blue PVC jacket.
   4. NFPA 70 Plenum (CMP) rated; comply with flammability plenum requirements of NFPA 70 and NFPA 262.
   5. Cable shall withstand a bend radius of 1-inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.
   6. Manufacturer and Product: Belden; 7852A.

2.04 GROUNDING CONDUCTORS

A. Equipment: Stranded copper with green, Type XHHW-2 inslulation.

B. Direct Buried: Bare stranded copper.

2.05 ACCESSORIES FOR CONDUCTORS 600 VOLTS AND BELOW

A. Tape:
   1. General Purpose, Flame Retardant: 7-mil, vinyl plastic, Scotch Brand 33+, rated for 90 degrees C minimum, meeting requirements of UL 510.
   2. Flame Retardant, Cold and Weather Resistant: 8.5-mil, vinyl plastic, Scotch Brand 88.
   3. Arc and Fireproofing:
      a. 30-mil, elastomer.
      b. Manufacturers and Products:
         1) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
         2) Plymouth; 53 Plyarc, with 77 Plyglas glass cloth tapebinder.

B. Identification Devices:
   1. Sleeve:
      a. Permanent, PVC, yellow or white, with legible machine-printed black markings.
      b. Manufacturers and Products:
         1) Raychem; Type D-SCE or ZH-SCE.
         2) Brady, Type 3PS.
   2. Heat Bond Marker:
      a. Transparent thermoplastic heat bonding film with acrylic pressure sensitive adhesive.
      b. Self-laminating protective shield over text.
      c. Machine printed black text.
      d. Manufacturer and Product: 3M Co.; Type SCS-HB.
   3. Marker Plate: Nylon, with legible designations permanently hot stamped on plate.
   4. Tie-On Cable Marker Tags:
      a. Chemical-resistant white tag.
      b. Size: 1/2-inch by 2-inches.
      c. Manufacturer and Product: Raychem; Type CM-SCE.
   5. Grounding Conductor: Permanent green heat-shrink sleeve, 2-inch minimum.

C. Connectors and Terminations:
   1. Nylon, Self-Insulated Crimp Connectors:
      a. Manufacturers and Products:
         1) Thomas & Betts; Sta-Kon.
         2) Burndy; Insulug.
         3) ILSCO.
   2. Nylon, Self-Insulated, Crimp Locking-Fork, Torque-Type Terminator:
      a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
      b. Seamless.
      c. Manufacturers and Products:
         1) Thomas & Betts; Sta-Kon.
         2) Burndy; Insulink.
         3) ILSCO; ILSCONS.
   3. Self-Insulated, Freespring Wire Connector (Wire Nuts):
      a. UL 486C.
      b. Plated steel, square wire springs.
      c. Manufacturers and Products:
         1) Thomas & Betts.
         2) Ideal; Twister.
   4. Self-Insulated, Set Screw Wire Connector:
      a. Two piece compression type with set screw in brass barrel.
      b. Insulated by insulator cap screwed over brass barrel.

c. Manufacturers:
1) 3M Co.
2) Thomas & Betts.
3) Marrette.

D. Cable Lugs:
1. In accordance with NEMA CC 1.
2. Rated 600 volts of same material as conductor metal.
3. Uninsulated Crimp Connectors and Terminators:
a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
b. Manufacturers and Products:
1) Thomas & Betts; Color-Keyed.
2) Burndy; Hydent.
3) ILSCO.
4. Uninsulated, Bolted, Two-Way Connectors and Terminators:
a. Manufacturers and Products:
1) Thomas & Betts; Locktite.
2) Burndy; Quiklug.
3) ILSCO.

E. Cable Ties:
1. Nylon, adjustable, self-locking, and reusable.
2. Manufacturer and Product: Thomas & Betts; TY-RAP.

F. Heat Shrinkable Insulation:
1. Thermally stabilized cross-linked polyolefin.
2. Single wall for insulation and strain relief.
3. Dual Wall, adhesive sealant lined, for sealing and corrosion resistance.
4. Manufacturers and Products:
a. Thomas & Betts; SHRINK-KON.
b. Raychem; RNF-100 and ES-2000.

2.06 PULLING COMPOUND

A. Nontoxic, noncorrosive, noncombustible, nonflammable, water-based lubricant; UL listed.

B. Suitable for rubber, neoprene, PVC, polyethylene, hypalon, CPE, and lead-covered wire and cable.

C. Approved for intended use by cable manufacturer.

D. Suitable for zinc-coated steel, aluminum, PVC, bituminized fiber, and fiberglass raceways.

E. Manufacturers:
1. Ideal Co.
2. Polywater, Inc.
3. Cable Grip Co.

2.07 MANUFACTURED WIRING SYSTEMS

A. System Rating:
1. 20 amperes load-carrying capacity each phase with final assemblies consisting of maximum of three-phase conductors.

2. Composition: Type MC cable with 90 degrees C insulation and stranded copper conductors.

B. Cable Configuration: Three, single-phase, five-wire circuit with standard color wire coding:
   1. 208/120 Volt: Black, red, blue, white, green.
   2. 480/277 Volt: Brown, orange, yellow, white, green.

C. Locking Mechanism: Latch/strike with voltage clearly marked on latch.

D. NFPA 262 listed for use in air handling plenums, listed to connect or disconnect under load, and manufactured in accordance with NFPA 70, Article No. 604.

2.08 WARNING TAPE

A. As specified in Section 26 05 33, Raceway and Boxes.

2.09 SOURCE QUALITY CONTROL

Conductors 600 Volts and Below: Test in accordance with UL 44 and UL 854.

PART 3 - EXECUTION

3.01 GENERAL

A. Conductor installation shall be in accordance with manufacturer's recommendations.

B. Conductor and cable sizing shown is based on copper conductors, unless noted otherwise.

C. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

D. Terminate conductors and cables, unless otherwise indicated.

E. Tighten screws and terminal bolts in accordance with UL 486A-486B for copper conductors and aluminum conductors.

F. Cable Lugs: Provide with correct number of holes, bolt size, and center-to-center spacing as required by equipment terminals.

G. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 12 inches on center.

H. Ream, remove burrs, and clear interior of installed conduit before pulling wires or cables.

I. Concrete-Encased Raceway Installation: Prior to installation of conductors, pull through each raceway a mandrel approximately 1/4-inch smaller than raceway inside diameter.

3.02 POWER CONDUCTOR COLOR CODING

A. Conductors 600 Volts and Below:
   1. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering area 1-1/2 inches to 2-inches wide.

2. 8 AWG and Smaller: Provide colored conductors.
3. Colors:

System	Conductor	Color
Systems	Equipment Grounding	Green
240/120 Volts, Single-Phase, Three- Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts, Three-Phase, Four- Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts, Three-Phase, Four-Wire, Delta, Center Tap, Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts, Three-Phase, Four- Wire	Grounded Neutral Phase A Phase B Phase C	White Brown Orange Yellow
Note: Phase A, B, C implies direction of positive phase rotation.		

4. Tracer: Outer covering of white with identifiable colored strip, other than green, in accordance with NFPA 70.

3.03 CIRCUIT IDENTIFICATION

A. Identify power, instrumentation, and control conductor circuits at each termination, and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.

B. Circuits Appearing in Circuit Schedules: Identify using circuit schedule designations.

C. Circuits Not Appearing in Circuit Schedules:
   1. Assign circuit name based on device or equipment at load end of circuit.
   2. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.

D. Method:
   1. Conductors 3 AWG and Smaller: Identify with sleeves or heat bond markers.
   2. Cables and Conductors 2 AWG and Larger:
      a. Identify with marker plates or tie-on cable marker tags.
      b. Attach with nylon tie cord.
   3. Taped-on markers or tags relying on adhesives not permitted.

3.04 CONDUCTORS 600 VOLTS AND BELOW

A. Install 10 AWG or 12 AWG conductors for branch circuit power wiring in lighting and receptacle circuits.

B. Do not splice incoming service conductors and branch power distribution conductors 6 AWG and larger, unless specifically indicated or approved by Engineer.

C. Connections and Terminations:
   1. Install wire nuts only on solid conductors. Wire nuts are not allowed on stranded conductors.
   2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control, circuit conductors.
   3. Install self-insulated, set screw wire connectors for two-way connection of power circuit conductors 12 AWG and smaller.
   4. Install uninsulated crimp connectors and terminators for instrumentation, control, and power circuit conductors 4 AWG through 2/0 AWG.
   5. Install uninsulated, bolted, two-way connectors and terminators for power circuit conductors 3/0 AWG and larger.
   6. Install uninsulated terminators bolted together on motor circuit conductors 10 AWG and larger.
   7. Place no more than one conductor in any single-barrel pressure connection.
   8. Install crimp connectors with tools approved by connector manufacturer.
   9. Install terminals and connectors acceptable for type of material used.
   10. Compression Lugs:
      a. Attach with a tool specifically designed for purpose. Tool shall provide complete, controlled crimp and shall not release until crimp is complete.
      b. Do not use plier type crimpers.

D. Do not use soldered mechanical joints.

E. Splices and Terminations:
   1. Insulate uninsulated connections.
   2. Indoors: Use general purpose, flame retardant tape or single wall heat shrink.
   3. Outdoors, Dry Locations: Use flame retardant, cold- and weather-resistant tape or single wall heat shrink.
   4. Below Grade and Wet or Damp Locations: Use dual wall heat shrink.

F. Cap spare conductors with UL listed end caps.

G. Cabinets, Panels, and Motor Control Centers:
   1. Remove surplus wire, bridle and secure.
   2. Where conductors pass through openings or over edges in sheet metal, remove burrs, chamfer edges, and install bushings and protective strips of insulating material to protect the conductors.

H. Control and Instrumentation Wiring:
   1. Where terminals provided will accept such lugs, terminate control and instrumentation wiring, except solid thermocouple leads, with insulated, locking-fork compression lugs.
   2. Terminate with methods consistent with terminals provided, and in accordance with terminal manufacturer’s instructions.
   3. Locate splices in readily accessible cabinets or junction boxes using terminal strips.

4. Where connections of cables installed under this section are to be made under Section 40 90 00, Instrumentation and Control for Process Systems, leave pigtails of adequate length for bundled connections.
5. Cable Protection:
    a. Maintain integrity of shielding of instrumentation cables.
    b. Ensure grounds do not occur because of damage to jacket over shield.
    c. Maintain integrity of shielding of instrumentation cables.

I. Extra Conductor Length: For conductors to be connected by others, install minimum 6 feet of extra conductor in freestanding panels and minimum 2 feet in other assemblies.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Labels.
   2. Bands and tubes.
   3. Tapes and stencils.
   4. Tags.
   5. Signs.
   6. Cable ties.
   7. Miscellaneous identification products.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

   Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Retain option in first paragraph below for projects with electrical utility work, including underground and overhead distribution and medium-voltage cabling. By reference, IEEE C2 requires compliance with ANSI Z531.1 through ANSI Z531.5.

B. Comply with ASME A13.1 and IEEE C2.

C. Comply with NFPA 70.

D. Retain first paragraph below if danger, caution, or safety instruction signs (including arc-flash warning labels) are to be specified.

E. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

F. Comply with ANSI Z535.4 for safety signs and labels.

G. Retain first paragraph and at least one option below if arc-flash warning labels are to be specified.

H. Retain first paragraph below if retaining self-adhesive products.

I. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

J. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
   1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   3. Colors for 480/277-V Circuits:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow.
   4. Color for Neutral: White.
   5. Color for Equipment Grounds: Green.

C. Warning Label Colors:
   1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:
   1. "Workspace Clearance Warning" Subparagraph below applies to OSHA requirements for building operations and does not reflect the clear working space required by NFPA 70.
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

E. Equipment Identification Labels:
   1. Black letters on a white field.

2.03 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Brady Corporation.
    b. Grafoplast Wire Markers.
    c. HellermannTyton.
    d. LEM Products Inc.
    e. Marking Services, Inc.
    f. Panduit Corp.

B. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
    1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        a. Brady Corporation.
        b. Brother International Corporation.
        c. Ideal Industries, Inc.
        d. LEM Products Inc.
        e. Marking Services, Inc.
        f. Panduit Corp.
    2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
    3. Marker for Labels:
        a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

C. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
    1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        a. Brady Corporation.
        b. Brother International Corporation.
        c. HellermannTyton.
        d. Ideal Industries, Inc.
        e. LEM Products Inc.
        f. Marking Services, Inc.
        g. Panduit Corp.
    2. Minimum Nominal Size:
        a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
        b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
        c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.
    1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
        a. Brady Corporation.

b. HellermannTyton.
c. Marking Services, Inc.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Brady Corporation.

2.05 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Champion America.
b. HellermannTyton.
c. Ideal Industries, Inc.
d. Marking Services, Inc.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.

C. Underground-Line Warning Tape:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Brady Corporation.
b. Ideal Industries, Inc.
c. Reef Industries, Inc.
2. Tape:
a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE."
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE."
4. Tape Type IID:

a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
b. Width: 3 inches (75 mm).
c. Overall Thickness: 8 mils (0.2 mm).
d. Foil Core Thickness: 0.35 mil (0.00889 mm).
e. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
f. Tensile according to ASTM D882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

2.06 SIGNS

A. Baked-Enamel Signs:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Carlton Industries, LP.
b. Champion America.
c. emedco.
2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Laminated Acrylic or Melamine Plastic Signs:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
2. Engraved legend.
3. Thickness:
a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16-inch (1.6 mm) thick.
b. For signs larger than 20 sq. in. (129 sq. cm), 1/8-inch (3.2 mm) thick.
c. Retain first option in first subparagraph below for instruction signs; retain second option for identification signs.
d. Engraved legend with black letters on white face.
e. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
f. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.07 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. HellermannTyton.
2. Ideal Industries, Inc.
3. Marking Services, Inc.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16-inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
   1. "EMERGENCY POWER."
   2. "POWER."
   3. "UPS."

K. Vinyl Wraparound Labels:
   1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
   2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

L. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

M. Self-Adhesive Labels:
   1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

N. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
   1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

P. Underground Line Warning Tape:
   1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16-inches (400 mm) overall.
   2. Install underground-line warning tape for direct-buried cables and cables in raceways.

Q. Baked-Enamel Signs:
   1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

R. Laminated Acrylic or Melamine Plastic Signs:
   1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

S. Cable Ties: General purpose, for attaching tags, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

A. Retain this article to describe label and sign legends.

B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

C. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
   1. "EMERGENCY POWER."
   2. "POWER."
   3. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

H. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

J. Arc Flash Warning Labeling: Self-adhesive labels.

K. Equipment Identification Labels:
   1. Indoor Equipment: Baked-enamel signs.
   2. Outdoor Equipment: Laminated acrylic or melamine sign.
   3. Equipment to Be Labeled:
      a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
      b. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.
      c. Enclosures and electrical cabinets.
      d. Access doors and panels for concealed electrical items.
      e. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
      f. Enclosed switches.
      g. Meter Pedestal
      h. Push-button stations.
      i. Contactors.

j. Battery-inverter units.
k. Power-generating units.
l. Monitoring and control equipment.

END OF SECTION

SECTION 26 26 50

ELECTRICAL MOTORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. This section applies only when referenced by a motor-driven equipment specification. Application, horsepower, enclosure type, mounting, shaft type, synchronous speed, and deviations from this section will be listed in the equipment specification. Where such deviations occur, they shall take precedence over this section.

1.02 REFERENCES

A. Reference standards:
   1. American Bearing Manufacturers Association (ABMA):
      a. 9, Load Ratings and Fatigue Life for Ball Bearings.
      b. 11, Load Ratings and Fatigue Life for Roller Bearings. Steel slotted support systems.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
      a. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
      b. 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Machines.
      c. 841, Standard for Petroleum and Chemical Industry – Premium Efficiency Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors – Up to and Including 370 kW (500 HP).
   3. National Electrical Manufacturers Association (NEMA):
      a. 250 Enclosure for Electrical Equipment (1,000 Volts Maximum).
      b. C50.41, Polyphase Induction Motors for Power Generating Stations.
      c. MG 1, Motors and Generators.
   4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC)
   5. UL:
      a. 83, Standard for Safety for Thermoplastic-Insulated Wire and Cables.
      b. 674, Standard for Safety for Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
      c. 2111, Standard for Safety for Overheating Protection for Motors.

B. Definitions:
   1. CISD-TEFC: Chemical industry, severe-duty enclosure
   2. DIP: Dust-ignition-proof enclosure
   3. EXP: Explosion-proof enclosure
   4. Inverter Duty Motor: Motor meeting applicable requirements of NEMA MG 1, Section, IV, Parts 30 and 31
   5. Motor Nameplate Horsepower: That rating after any derating required to allow for extra hearting caused by the harmonic content in the voltage applied to the motor by its controller.
   6. ODP: Open drip-proof enclosure
   7. TEFC: Totally enclosed, fan-cooled enclosure
   8. TENV: Totally enclosed, nonventilated enclosure
   9. WIP: Open weather protected enclosure, Type I
   10. WPII: Open weather protected enclosure, Type II

C. Related Specifications:
   1. 01 45 33 – Special Inspection, Observation, and Testing
   2. 01 78 23 – Operations and Maintenance Data

1.03 SUBMITTALS

A. Action Submittals:
   1. Descriptive information
   2. Nameplate date in accordance with NEMA MG 1
   3. Additional rating information:
      a. Service factor
      b. Locked rotor current
      c. Multispeed load classification (for example, variable torque)
      d. Adjustable frequency drive motor load classification (for example, variable torque) and minimum allowable motor speed for that load classification.
      e. Enclosure type and mounting (such as, horizontal, vertical)
      f. Dimensions and total weight
      g. Conduit box dimensions and usable volume as defined in NEMA MG 1 and NFPA 70
      h. Bearing type
      i. Bearing lubrication
      j. Bearing life
      k. Space heater voltage and watts
      l. Description, ratings, and wiring diagram of motor thermal protection
      m. Motor sound power level in accordance with NEMA MG 1
      n. Maximum brake horsepower required by the equipment driven by the motor
      o. Description and rating of submersible motor moisture sensing system

B. Informational Submittals
   1. Factory test reports
   2. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing
   3. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:
   1. General Electric
   2. Reliance Electric
   3. MagneTek
   4. Siemens
   5. Baldor
   6. U.S. Electrical Motors
   7. TECO-Westinghouse Motor Co.
   8. Toshiba International Corp. Industrial Division
   9. WEG Electrical Motors Corp.

2.02 GENERAL

A. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

B. To obtain single source responsibility, use a single supplier to provide drive motor, its driven equipment, and specified motor accessories.

C. Meet requirements of NEMA MG 1

D. For motors used in hazardous (classified) locations, Class I, Division 1, Groups B, C, and D and Class II, Division 1, Groups E, F, and G provide motors that conform to UL 674 and have an applied UL listing mark.

E. Motors shall be specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.

F. Lifting lugs on motors weighing 100 pounds or more.

G. Operating Conditions:
   1. Maximum ambient temperature not greater than 40 degrees C.
   2. Motors shall be suitable for operating conditions without reduction being required in nameplate rated horsepower or exceeding rated temperature rise.
   3. Overspeed in either direction in accordance with NEMA MG 1.

2.03 HORSEPOWER RATING

A. As designated in motor-driven equipment specification.

B. Constant speed applications: brake horsepower of driven equipment at any operating condition not to exceed motor nameplate horsepower rating, excluding service factor.

C. Adjustable Frequency and Adjustable Speed Applications (Inverter Duty Motor): Driven equipment brake horsepower at any operating condition not to exceed motor nameplate horsepower rating, excluding service factor.

2.04 SERVICE FACTOR

A. Inverter-duty Motors: 1.0 at rated ambient temperature, unless otherwise noted.

B. Other Motors: 1.15 minimum at rated ambient temperature, unless otherwise noted.

2.05 VOLTAGE AND FREQUENCY RATING

A. System Frequency: 60 Hz

B. Voltage Rating: Unless otherwise indicated in motor-driven equipment specification

C. Size: ½ HP and smaller shall be 115 Volts, single-phase

D. Size: ¾ HP through 400 HP shall be 460 Volts, three-phase

E. Suitable for full-voltage starting

F. 100 HP and larger also suitable for reduced voltage starting with 65 percent or 80 percent voltage tap settings on reduced inrush motor starters

G. Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 90 percent of motor rated voltage.

2.06 EFFICIENCY AND POWER FACTOR

A. For motors except single-phase, under 1 HP, multispeed, short-time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:
   1. Efficiency:
      a. Tested in accordance with NEMA MG 1, Paragraph 12.59,
      b. Guaranteed minimum at full load in accordance with NEMA MG 1 Table 12-12, Full-load Efficiencies for NEMA Premium Efficiency Motors Rated 600 Volts or Less (Random Wound), or as indicated in motor-driven equipment specification.

B. Power Factor: Guaranteed minimum at full load shall be manufacturer's standard or as indicated in motor-driven equipment specification.

2.07 LOCKED ROTOR RATINGS

A. Locked rotor kVA Code F or lower, if motor not covered by NEMA MG 1 tables.

B. Safe stall time: 12 seconds or greater.

2.08 INSULATION SYSTEMS

A. Single-phase, fractional horsepower motors: Manufacturer's standard winding insulation system.

B. Motors rated over 600 Volts: Sealed winding in accordance with NEMA MG 1.

C. Three-phase and Integral Horsepower Motors: Unless otherwise indicated in motor-driven equipment specification, Class F with Class B rise at nameplate horsepower and designated operating conditions, except EXP motors which must be Class B with Class B rise.

2.09 ENCLOSURES

A. Enclosures to conform to NEMA MG 1

B. TEFC and TENV: Furnish with drain hole with porous drain/weather plug.

C. Explosion-proof (EXP):
   1. TEFC listed to meet UL and NFPA 70 requirements for Class I Division 1 Group D hazardous locations
   2. Drain holes with drain and breather fittings
   3. Integral thermostat opening and excessive motor temperate in accordance with UL 2111 and NFPA 70
   4. Terminate thermostat leads in terminal box separate from main terminal box.

D. Submersible: In accordance with Article Special Motors.

E. Chemical Industry, Severe-Duty (CISD-TEFC): In accordance with Article Special Motors.

2.10 TERMINAL (CONDUIT) BOXES

A. Oversize main terminal boxes for motors.

B. Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.

C. Except ODP, furnish gaskets between box halves and between box and motor frame.

D. Minimum usable volume in percentage of that specified NEMA MG 1, Section 1, Paragraph 4.19 and NFPA 70, Article 430.

E. Terminal for connection of equipment grounding wire in each terminal box.

F. Coordinate motor terminal box conduit entries versus size and quantity of conduits shown on Drawings.

2.11 BEARINGS AND LUBRICATION

A. Horizontal Motors:
   1. ¾ HP and smaller: permanently lubricated and sealed ball bearings or regreaseable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
   2. 1 hp through 400 hp: regreaseable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
   3. Above 400 hp: split sleeve, oil insulated bearings.
   4. Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in ABMA 9 and ABMA 11.

B. Vertical Motors:
   1. Thrust Bearings:
      a. Antifriction bearing.
      b. Manufacturer's standard lubrication 200 HP and smaller.
      c. Oil-lubricated 125 HP and larger.
      d. Minimum 50,000 hours L-10 bearing life.
   2. Guide Bearings:
      a. Manufacturer's standard bearing type.
      b. Manufacturer's standard lubrication 200 hp and smaller.
      c. Oil-lubricated 250 HP and larger.
      d. Minimum 100,000 hours L-10 bearing life.
   3. Regreaseable Antifriction Bearings:
      a. Readily accessible, grease injection fittings.
      b. Readily accessible, removable grease relief plugs.
   4. Oil Lubrication Systems:
      a. Oil reservoirs with sight level gauge.
      b. Oil fill and drain openings with opening plugs.
      c. Provisions for necessary oil circulation and cooling.
   5. Inverter Duty Rated Motors, Bearing Isolation: Motors larger than 50 HP shall have electrically isolated bearings to prevent stray current damage.

2.12 NOISE

A. Measured in accordance with NEMA MG 1.

B. Motors controlled by adjustable frequency drive systems shall not exceed sound levels of 3 dBA higher than NEMA MG 1.

2.13 BALANCE AND VIBRATION CONTROL

A. In accordance with NEMA MG 1, Part 7.

2.14 EQUIPMENT FINISH

A. External Finish: Prime and finish coat manufacturer's standard. Finish color manufacturer's standard.

B. Internal Finish: Bore and end turns coated with clear polyester or epoxy varnish.

2.15 SPECIAL FEATURES AND ACCESSORIES

A. Screen Over Air Openings: Stainless steel on motors with ODP, WPI, and WPII enclosures meeting requirements for guarded machine in NEMA MG 1, and attached with stainless steel screes.

B. Winding Thermal Protection:
   1. Thermostats:
      a. Motors for constant speed application 10 hp to 90 hp. Motors for adjustable speed application 20 hp to 25 hp.
      b. Bi-metal disk or rod type thermostats embedded in stator windings.
      c. Automatic reset contacts rated 120 Volts AC, 5 amps minimum, opening on excessive temperature (provide manual reset at motor controller).
      d. Leads extending to separate terminal box for motors 100 hp and larger.
   2. Thermistors:
      a. Motors for constant speed application 100 hp and larger. Motors for adjustable speed application 40 hp and larger.
      b. Thermistor embedded in each stator phase winding before winding dip and bake process.
      c. In intimate contact with winding conductors.
      d. Epoxy-potted, solid-state thermistor control module mounted in NEMA 250 Type 4X box on motor, by motor manufacturer, individual thermistor circuits factory-wired to control module.
      e. Control module rated for 120 Volts AC power supply.
      f. Control module automatically reset contact for external use rated 120 VAC, 5 amps minimum, opening on abnormally high winding temperature. Provide manual reset at motor controller.

C. Bearing Temperature Protection:
   1. On each bearing of horizontal motors 100 HP and larger.
   2. On the thrust bearing of each vertical motor 100 HP and larger.
   3. Bearing temperature sensor/relay, Mercoid, with contact closing on bearing overtemperature mounted in NEMA 250, Type 4X enclosure.

D. Vibration detection relay mounted in NEMA 250, Type 4X enclosure on side of motors 200 HP and larger.

E. Nameplates:
   1. Raised or stamped letters on stainless steel or aluminum.
   2. Display motor data required by NEMA MG 1, Paragraph 10.39 and Paragraph 10.40 in addition to bearing numbers for both bearings.

3. Premium efficiency motor nameplates to display NEMA nominal efficiency, guaranteed minimum efficiency, full load power factor, and maximum allowable kVAR for power factor correction capacitors.

F. Anchor Bolts: Provide meeting manufacturer's recommendations and of sufficient size and number for specified seismic condition.

2.16 SPECIAL MOTORS

A. Requirements in this article take precedence over conflicting features specified elsewhere in this section.

B. Chemical Industry, Sever-Duty (CISD-TEFC):
1. In accordance with IEEE 841.
2. TEFC in accordance with NEMA MG 1.
3. Suitable for indoor or outdoor installation in sever-duty applications including high humidity, chemical (corrosive), dirty, or salty atmospheres.
4. Motor Frame, End Shields, Terminal Box, and Fan Cover: Cast iron.
5. Ventilating Fan: Corrosion-resistant, non-sparking, external.
6. Drain and Breather Fittings: Stainless steel.
7. Nameplate: Stainless steel.
8. Gaskets between terminal box halves and terminal box and motor frame.
9. Extra slinger on rotor shaft to prevent moisture seepage along shaft into motor.
10. Double shielded bearings.
11. 125,000 hours minimum L-10 bearing life for direct-connected loads.
12. External Finish: Double-coated epoxy enamel.
13. Coated rotor and stator air gap surfaces.
14. Insulation System, Windings, and Connections:
15. Class F insulation, Class B rise or better at 1.0 service factor.
16. Multiple dips and bakes of non-hygroscopic polyester varnish.
17. Service Factor:
18. At 40 degrees C Ambient: 1.15.
19. At 65 degrees C Ambient: 1.00.
20. Safe Stall Time: 20 seconds minimum.

C. Severe-duty Explosion-proof: Meet requirements for EXP enclosures and CISD-TEFC motors.

D. Severe-duty Dust-Ignition-proof: Meet requirements for DIP enclosures and CISD-TEFC motors.

E. Multispeed: Meet requirements for speeds, number of windings, and load torque classification indicated in motor-driven equipment specification.

F. Inverter Duty motor:
1. Motor supplied power by adjustable voltage and adjustable frequency drives shall be inverter duty rated.
2. Suitable for operation over entire speed range indicated.
3. Provide forced ventilation where speed ration is greater than published range for motor provided.
4. When installed in Division 1 hazardous (classified) location shall be identified as acceptable for variable speed when used in Division 1 location.

G. Submersible Pump Motor:

1. Manufacturers:
   a. Reliance Electric
   b. ITT Flygt Corp.
2. At 100 percent load:

Horsepower	Guaranteed Minimum Efficiency	Guaranteed Minimum Power Factor
5 through 10	80	0.82
10.1 through 50	85	0.82
50.1 through 100	87	0.82
Over 100	89	0.82

3. Insulation System: Manufacturer's standard Class B or Class F.
4. Motor capable of running dry continuously.
5. Enclosure:
   a. Hermetically sealed, watertight, for continuous submergence up to 65-foot depth.
   b. Listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Groups C and D hazardous atmosphere.
   c. Seals: Tandem mechanical.
6. Bearing and Lubrication:
   a. Permanently sealed and lubricated, replaceable antifriction guide and thrust bearings.
   b. Minimum 15,000 hours L-10 bearing life.
7. Inrush KVA/horsepower no greater than NEMA MG 1 and NFPA 70, Code F.
8. Winding Thermal Protection:
   a. Thermal sensor and switch wired assembly, one each phase, embedded in stator windings and wired in series.
   b. Switches normally closed, open upon excessive winding temperature and automatically reclose when temperature has cooled to safe operating level.
   c. Switch contacts rated at 5 amps, 120 VAC.
9. Motor Seal Failure Moisture Detection:
   a. Probes or sensors to detect moisture beyond seals.
   b. Probe or sensor monitoring module for mounting in motor controller, suitable for operation from 120 VAC supply.
   c. Monitoring module with control power transformer, probe test switch and test light, and two independent 120 VAC contacts, one opening and one closing when flux of moisture is detected.
10. Bearing Overtemperature Protection for Motors Larger than 100 HP:
    a. Sensor on lower bearing housing monitoring bearing temperature.
    b. Any monitoring relay necessary to provide 120 VAC contact opening on bearing overtemperature.
11. Winding thermal protection, moisture detection, and bearing overtemperature specified above may be monitored by single device providing two independent 120 VAC contacts, one closing and one opening on malfunction.
12. Connecting Cables:
    a. One cable containing power, control, and grounding conductors.
    b. Each cable suitable for hard service, submersible duty with watertight seal where cable enters motor.
    c. Length: 50 feet minimum.
    d. UL 83 listed and sized in accordance with NFPA 70.

H. Inclined Motors;
   1. Motors suitable for operation only in horizontal position not acceptable.
   2. Bearings designed for thrust imposed by driven equipment and by motor rotor when motor is in inclined position.
   3. Lubrication system designed to provide adequate bearing lubrication when motor is in inclined position.

2.17 FACTORY TESTING

A. Tests:
   1. In accordance with IEEE 112 for polyphase motors.
   2. Routine (production) tests in accordance with NEMA MG 1. Test multispeed motors at all speeds.
   3. For energy efficient motors, test efficiency and power factor at 50 percent, 75 percent, and 100 percent of rated horsepower:
      a. In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraph 12.59, and Paragraph 12.60.
      b. For motors 500 HP and larger where facilities are not available to test by dynamometer (Test Method B), determine efficiency by IEEE 112, Test Method F.
      c. On motors of 100 HP and smaller, furnish certified copy of motor efficiency test report on an identical motor.
   4. Provide test reports for polyphase motors 100 HP and larger.

B. Test Report Forms:
   1. Routine Tests: IEEE 112, Form A-1.

C. Screen Over Air Openings: Stainless steel on motors with ODP, WPI, and WPII enclosures meeting requirements for guarded machine in NEMA MG 1, and attached with stainless steel screes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. In accordance with manufacturer's instructions and recommendations.

B. Align motor carefully and properly with driven equipment.

C. Secure equipment to mounting surface with anchor bolts.

3.02 MANUFACTURER'S SERVICES

A. Furnish manufacturer's representative at Site for installation assistance, inspection, equipment testing, and startup assistance for motors larger than 150 HP.

B. Manufacturer's Certificate of Proper Installation.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 - GENERAL

1.01 DEFINITIONS

A. Common Excavation: Removal of material not classified as rock excavation.

B. Rock Excavation: Not Used

1.02 SUBMITTALS

A. Informational Submittals:
   1. Excavation Plan, Detailing:
      a. Methods and sequencing of excavation.
      b. Proposed locations of stockpiled excavated material.
      c. Proposed onsite and offsite spoil disposal sites.
      d. Numbers, types, and sizes of equipment proposed to perform excavations.
      e. Anticipated difficulties and proposed resolutions.
      f. Reclamation of onsite spoil disposal areas.

1.03 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized overexcavation.

1.04 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.05 SEQUENCING AND SCHEDULING

A. Demolition: Not Used.

B. Clearing, Grubbing, and Stripping: Not Used.

C. Dewatering: Not Used.

D. Excavation Support: Install and maintain shoring system as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed Work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.

B. Do not overexcavate without written authorization of Engineer.

C. Use of explosives is prohibited.

3.02 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete excavation regardless of the type, nature, or condition of the materials encountered.

3.03 CLASSIFIED EXCAVATION – NOT USED

3.04 TRENCH WIDTH

A. Minimum Width of Trenches:
   1. Single Pipes, Conduits, Direct-Buried Cables, and Duct Banks:
      a. Less than 4 inch Outside Diameter or Width: 3 inches.
      b. Greater than 4 inch Outside Diameter or Width: 6 inches minimum, 8 inches maximum greater than outside diameter or width of pipe, conduit, direct-buried cable, or duct bank.
   2. Multiple Pipes, Conduits, Cables, or Duct Banks in Single Trench: 3 inches greater than aggregate width of pipes, conduits, cables, duct banks, plus space between.
   3. Increase trench widths by thicknesses of sheeting.

B. Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.

3.05 PIPE BEDDING GROOVES FOR NONPERFORATED DRAIN LINES

A. Semicircular, trapezoidal, or 90 degree V.

B. Excavated or plowed into trench bottom. Forming groove by compaction will not be acceptable.

3.06 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

B. Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

3.07 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Post signs indicating proposed use of material stockpiled. Post signs that are readable from directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.

C. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.

D. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

E. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.08 DISPOSAL OF SPOIL

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite.

END OF SECTION

SECTION 31 23 23

FILL AND BACKFILL

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. This work includes installation of a new 66-Inch Pipe at Miramar Reservoir pump station in accordance with these specifications, and in reasonably close conformity with the lines and grades shown on the Plans.

1.02 REFERENCES

A. The following is a list of standards from the American Society for Testing and Materials (ASTM) which may be referenced in this section:
   1. C117, Standard Test Method for Materials Finer Than 75 Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   2. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   3. D75, Standard Practice for Sampling Aggregates.
   4. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   5. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   6. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft lbf/ft3 (2,700 kN m/m3)).
   7. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   8. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   9. D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
   10. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.03 DEFINITIONS

A. Relative Compaction: Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.

B. Maximum Dry Density: The maximum density that is determined in accordance with ASTM D1557. For oversize material apply a correction to the maximum dry density in accordance with ASTM D4718, as determined by Engineer.

C. Optimum Moisture Content: The water content at which the maximum dry density is determined in accordance with ASTM D1557.

D. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.

E. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

F. Completed Course: A course or layer that is ready for next layer or next phase of Work.

G. Lift: Loose (uncompacted) layer of material.

H. Earthwork: The excavation, hauling, and placing of soil, rock, gravel and material found below the ground.

I. Geosynthetics: Geotextiles, geogrids, or geomembranes.

J. Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
   1. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
   2. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.
   3. Influence Area: Area within planes sloped downward and outward at 60 degree angle from horizontal measured from
      a. 1 foot outside outermost edge at base of foundations or slabs.
      b. 1 foot outside outermost edge at surface of roadways or shoulder.
      c. 0.5 foot outside exterior at spring line of pipes or culverts.

K. Borrow Material: Material from excavations or from designated borrow areas on or near site.

L. Select Backfill Material: Materials available onsite that Engineer determines to be suitable for specific use.

M. Imported Material: Materials obtained from sources offsite, suitable for specified use.

N. Structural Fill: Fill materials as required under structures, pavements, and other facilities.

O. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

P. Plans: The Drawings, profiles, cross sections, Standard Plans, Working Drawings, and Shop Drawings, or reproductions thereof, approved by the Engineer, which shows the location, character, dimensions, or details of the Work.

Q. Standard Specifications: When referenced in this section, shall mean the “Whitebook”, Standard Specifications for Public Works Construction, 2021 Edition.

1.04 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Imported backfill mix design.
   2. Samples:
      a. Imported material taken at source.

B. Informational Submittals:
   1. Manufacturer’s data sheets for compaction equipment.
   2. Certified laboratory test results from independent testing agency for the material used in the backfill operations.

PART 2 - PRODUCTS

2.01 MATERIALS SHALL CONFORM TO THE REQUIREMENTS SHOWN ON THE PLANS AND SPECIFIED BELOW. DOCUMENT THE ORIGIN AND INTENDED USE OF ANY IMPORTED MATERIAL AT THE SITE.

A. Backfill
   1. Excavated material may be used as backfill provided they are free from rocks larger than 3 inches, organic materials, expansive clays and deleterious debris.
   2. Material containing more than 20 percent gravel, cobbles, or stones is unacceptable.
   3. Material containing expansion index higher than 50 is unacceptable.
   4. Provide imported material of equivalent quality, if required to accomplish Work.

B. Granular Fill
   1. 1-inch minus crushed gravel or crushed rock.
   2. Free from dirt, clay balls, and organic material and meet applicable Greenbook Standards.
   3. Well-graded from coarse to fine and containing sufficient fines to bind material when compacted, but with maximum 8 percent by weight passing No. 200 sieve.

C. Sand
   1. Free from clay, organic matter, or other deleterious material and meet applicable Greenbook Standards.
   2. Gradation as determined in accordance with ASTM C117 and ASTM C136:

Sieve Size	Percent Passing by Weight
1/4-inch	100
No. 4	95 - 100
No. 200	0 - 8

D. Slurry Fill
   1. Slurry mix shall be a mixture of clean washed sand and Type II/V cement, containing at least 3 sacks of cement per cubic yard.
   2. Slurry fill shall have a compressive strength of 100 to 200 psi when tested in general accordance with ASTM D3832.
   3. Contractor shall submit a slurry mix design for approval by the engineer prior to backfilling.

E. Water for Moisture Conditioning
   1. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction and meet applicable Greenbook Standards.

F. Base Course Rock
   1. The material must be free from organic matter and other deleterious substances and shall be of such nature that it can be compacted readily under watering and rolling to form a firm, stable base. Aggregate shall consist of any combination of the flowing materials: broken stone, crushed gravel, and natural rough surface gravel and meet applicable Greenbook Standards.

PART 3 - EXECUTION

3.01 EXCAVATION:

A. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 6 inches on each side.

B. For deeper trenches (>4-feet) or for unstable material, the trench walls shall be shored and braced in accordance with OSHA requirements, or as shown on the plans. No excavation shall be permitted to remain open, when the Contractor is not working within the exaction, without continuous barricading around the open trench walls.

C. Any trenches located in a vehicle service road and other areas subject to vehicular movements shall be fully plated at all times outside active construction periods. When open trenches are present, barricades and flagmen shall be used to protect the trenches from incursion by construction and non-construction traffic.

D. Contractor shall comply with current Federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, Contractor shall observe that requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail. The trench bottom shall be shaped to full and uniformly support the bottom quadrant of the pipe.

3.02 SUBGRADE STABILIZATION:

1. Where a firm foundation is not encountered at the subgrade established, due to moist, soft or other unstable soil, the unstable soil shall be removed and replaced with acceptable material. The Engineer shall determine the depth of removal of material to have a stable subgrade. The subgrade and bedding material shall be compacted to provide adequate support for the pipe.

3.03 BEDDING:

1. The pipe bedding shall conform to the class specified on the Plans. When no bedding class is specified or detailed on the Plans, the requirements for Class C bedding shall apply. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.04 BACKFILLING:

1. Pipes shall be inspected before any backfill is placed; pipes found to be out of alignment, unduly settled, or damaged shall be removed and re-laid or replaced at the Contractor's expense.
2. Material for backfill shall be fine, readily compatible soil, granular material selected from the excavation or approved source, and shall meet the backfill material specifications.
3. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.
4. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.
5. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.

6. Backfill shall be compacted to a minimum of 90% relative compaction and within 3 percent of the optimum moisture content per ASTM D1557however, for areas beneath slabs, pavements, curbs the upper 12 inches should be compacted to 95 percent relative compaction and within 3 percent of the optimum moisture content (ASTM D1557).
7. It shall be the Contractor's responsibility to protect existing foundations, other existing pipes and culverts from damage due to construction equipment operations. Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

3.05 TOLERANCES:

A. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.

B. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

3.06 SETTLEMENT:

A. Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.07 CONTRACTOR QUALITY CONTROL

A. Contractor shall develop a quality control program and shall perform quality control tests and inspections necessary to control the production and construction process applicable to this specification. The program shall address elements that affect the quality of the pipe installation.

3.08 QUALITY ASSURANCE AND ACCEPTANCE

A. Quality assurance and acceptance shall be the responsibility of the owner. For products or workmanship specified by association, trade or Federal Standards comply with requirements of the standards, except when more rigid requirements are specified or are required by applicable codes. Laboratory testing will be performed by the owner representative to verify materials meet specifications.
   1. Notify Engineer when:
      a. Start of earthwork operations for project.
      b. Excavation trenches are ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
      c. Site conditions differ from the anticipated ground conditions during excavation activities.
      d. Soft or loose subgrade materials are encountered during earthwork operations for embankment or site fill placement at the site.
      e. Fill material appears to be deviating from Specifications.

3.09 SITE TESTING

A. Gradation:
   1. One sample from each finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications.
   2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
   3. Remove material placed in Work that does not meet Specification requirements.

4. In-place density tests: In place density tests shall be conducted on backfill materials in accordance with ASTM D6938. During placement of materials, one test shall be conducted per lift.

END OF SECTION

SECTION 33 44 13

PRECAST PUMP STATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provide site assembled precast wastewater utility pumping station, including specified controls, pumps, valves, internal piping, and precast concrete well and valve vault

B. Provide and test pumps, electric motors, instrumentation, guiderail system, anchor bolts, and appurtenances as indicated and specified for the Sanitary Sewer Pump Station.

1.02 REFERENCES

A. Related Specifications:

1. 40 61 96 – Process Control Descriptions
2. 40 91 00 – Instrumentation and Control Components
3. 40 92 01 – Control Panels

B. Reference Standards

1. American Society for Testing and Materials International (ASTM)

1.03 ADMINISTRATIVE REQUIREMENTS

A. Manufacturer's Service

1. Provide on-site services of a factory trained Service Engineer, specifically trained on the type of equipment specified. Submit qualifications of Service Engineer for approval. One person-day is an 8-hour day on-site. The minimum person-day requirements specified are exclusive of travel time and do not relieve Contractor of the obligation to provide enough service to place equipment in satisfactory operation and in accordance with the Manufacturer's instructions and warranty requirements. Person-days not used during the project will be credited back to the City.
2. Minimum Person-Day Requirements:
    a. Installation, start-up, and testing of pumps: 1 person-days
3. Time and materials used to correct defective equipment at no additional cost to the City and in addition to time periods specified above.

1.04 SUBMITTALS

A. Product Data:

1. Data regarding pump and motor characteristics and performance:
    a. Provide guaranteed performance curves showing they meet specified requirements for head, capacity, and horsepower efficiency.
        (1) For units of same size and type, provide curves for a single unit only.

B. Shop Drawings:

a. Dimensional drawings and data for pumps and accessory items including guiderail, guiderail brackets, discharge elbow and other system components.

C. Manufacturer Instructions:

a. Operating and Maintenance Manuals: Submit materials for inclusion in Operating and Maintenance Manuals. Include manufacturer's instructions for equipment installation, start-up, operation, preventative maintenance, servicing, and troubleshooting procedures. Include parts list for maintenance and servicing.

D. Site Quality Control Submittals:

1. Field inspection reports.
2. Field Reports: Provide quality-control test reports documenting station operation performance.
3. Warranty: Copy of manufacturer's warranty.

E. Operation and Maintenance Manual:

1. Include component manufacturer’s O&M manuals, approved station design, completed start-up report, and component manufacturer’s schedule for maintenance requirements

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Unit Responsibility:

a. The pump, mechanical seals, motor units, guiderails, guiderail brackets, pump discharge elbow, anchor bolts, float switches, and control and monitoring unit will be supplied by the same manufacturer or supplier in order to achieve standardization of operation, maintenance, spare parts, manufacturer's service and warranty.

b. Manufacturer will assume full responsibility for the completeness of the pumping system. The pump manufacturer will be the source of information on respective pumping equipment furnished per this section.

2. Pumps to be of the same type and the product of one manufacturer.
3. Pumps to be manufacturer's standard cataloged product.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Manufacturer Qualifications:

1. NPCA-certified plant with experience and demonstrated capability to produce work specified in this Section
2. The manufacturer will be qualified to manufacture solids handling pumping equipment like those indicated for this Project and that have a record of successful in-service performance. Manufacturer must be able to meet the standards and requirements listed herein.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Packaging will be as required to prevent damage during shipment and unloading.

B. Storage and Handling Requirements

1. Handle equipment and materials very carefully. Damaged equipment and materials will not be acceptable. Protect bolt threads, etc. from damage and corrosion. Protect factory applied coatings from damage during shipment, unloading, storage and installation.
2. Material and equipment will be covered or stored in a manner which will prevent entry of deleterious matter. Power cables will be covered or stored in a manner which will protect them from dirt and abrasion.

1.07 WARRANTY

A. Manufacturer Warranty:

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of pumping stations that fail in materials or workmanship within specified warranty period.
   a. Failures include, but are not limited to, the following:
      (1) Structural failures including precast concrete structures, hatches, and other accessories.
      (2) Faulty operation of pumps, controls, or pumping and piping system accessories.
      (3) Deterioration of metals, metal finishes, and other materials beyond normal use.
   b. Warranty Period for Complete Packaged Pump Station provided by a Single Source Supplier (Including Concrete, Pumps, and Control Panel): One year from date of delivery.
2. This warranty will not deprive the City of other rights the City may have under other provisions of the Contract Documents and is in addition to and runs concurrent with the warranties made under the requirements of Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pump Station

1. Jensen
2. Old Castle
3. Or Equal

B. Submersible pump:

1. Myers
2. Sulzer
3. Grundfos
4. HOMA
5. Or Approved Equal

2.02 DESIGN CRITERIA

A. Pumps:

1. General:
    a. As this pump will be utilized for solids handling, it must be capable of either repeatedly passing spherical solids up to 3 inch in diameter OR have the ability to macerate all solids prior to the solid entering the volute by using a rotating cutter mounted on the shaft immediately adjacent to the impeller.
    b. Designed to handle raw, unscreened sewage, stormwater, sludge, or similar contaminated liquid, with induction type electric motor assembled in a single body, watertight NEMA Type B chamber.
    c. Capable of maintaining their watertight integrity submerged under 50 feet of water.
    d. Capable of being removed without entry into wet well.
    e. Comply with NEC Class 1, Division 1, Group C & D hazardous locations. C.
2. Materials of Construction:
    a. Major castings: ASTM A48 Class 40B Cast Iron.
    b. Wear Ring: ASTM Bl44 Bronze.
    c. Shaft: AISI 430F Stainless Steel.
    d. Fasteners: AISI 304 Stainless Steel
    e. O-Rings: Nitrile Rubber
    f. Shaft Seals: Silicon Carbide/Silicon Carbide (impeller and motor side)
    g. Cable Jacket: Neoprene.
    h. Cable Entry: elastomer grommet, stainless steel washers.
    i. Protective Coating: High Solids Epoxy
3. Pump System Characteristics:
    a. Number of Pumps: 3
    b. Arrangement: Parallel, 2 Active +1 Swing/Standby
    c. Flow Rate (System): 1000 gpm
    d. Flow Rate (per pump): 692 gpm
    e. Motor Size: 12-16 hp
    f. Total Dynamic Head: 62 feet
    g. Static Head: 36 feet
    h. Motor Speed: As Needed
4. Electrical Characteristics:
    a. Volts: 480 V
    b. Phases: 3
    c. See Section 26 26 50 “Electrical Motors” for additional a requirements.

B. Connecting Cable:

1. Cable suitable for hard service, submersible duty with watertight seal where cable enters motor. Cable to contain power, control, and grounding conductors, be UL 83 listed and sized in accordance with NFPA 70. Cable will withstand a pull of 100 pounds.

C. Precast Concrete Structures:

1. Dimensions and sizing per Plans
2. See Section 03 48 00 “Recast Concrete Specialties”.
3. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.

D. Well Protective Liner:

1. Liner shall be Dura Plate 100 as manufactured by A-LOK® Products or equal.
2. Liner Composition: The liner, channel joints, H-joints and corner joints shall be manufactured from an Acrylic PVC Alloy.

E. Ventilation: FRP piping per Plans, with internal insect screening.

2.03 ACCESS DOORS AND FRAMES

A. Access Door:

1. Double-leaf opening as shown on Plans
2. Aluminum angle frame access hatch
3. Include: lift assist, flush lifting handle, 316 stainless steel nuts & bolts, hinges, and hold-open arm.

B. Fabricated access hatches, doors, grates or covers required for equipment or maintenance access into Utility Structure shall be designed and fabricated in accordance with ASTM C1802 for the applicable Load Level.

C. Fabricated access covers shall be manufactured using aluminum, or steel with slip-resistant material and torsion-assisted assemblies.

2.04 PIPING, VALVES, AND FITTINGS:

A. Ductile-Iron, Mechanical-Joint Pipe and Fittings:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless flanged ends are indicated.
   a. Provide flanged ends within well and vault.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
4. Application: Buried service between well and vault.

2.05 ACCESSORIES

A. Discharge Elbow: Ductile iron with a fusion bonded epoxy coating.

B. Guide Rails, brackets and components: 316 stainless steel.

2.06 CONTROLS

A. Control Strategy

1. The detailed control strategy is given in Section 40 61 96, Process Control Descriptions.

B. Instrumentation:

1. See Section 40 91 00, Instrumentation and Control Components.

C. Control Panel:

1. The control panel will be per the drawings, Section 40 92 01, Control Panels, and Section 40 91 00 Instrumentation and Control Components.

2.07 FABRICATION

A. ASTM C 478 for precast wells.

B. ASTM C 890 for precast vaults.

C. Fabricate structures with continuous joints to provide watertight construction.

D. Prepare valve and meter vaults with factory installed piping, valves, sleeves and other devices required.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Support piping independent of pump.

B. Check and align unit components in accordance with the manufacturer’s written recommendations.

C. Make electrical connections in conformance with requirements with the Electrical Plans and Specifications.

D. Install precast concrete structure sections with sealants per ASTM C 891 and ASTM C 1821.

3.02 FIELD TESTS AND INSPECTIONS

A. Retain factory trained pump and motor manufacturer's representatives with demonstrated ability and experience in the installation and operation of the pumps, and motors and accessories to perform the services listed below:

1. Provide written recommendations for technical assistance to Contractor during installation of pumping units.

2. Assist in initial start-up, adjustments and field testing.

3. Instruct City's personnel in the operation and user.

4. Provide written recommendations for the correction of any defective or faulty Work before and after acceptance by City. The Contractor is responsible for completing the work.

B. The manufacturer will test operate the pumps in the presence of the City and will verify the equipment conforms to the specified requirements. The manufacturer representative will re-visit the jobsite as often as necessary until deficiencies related to the pump and motors specified in this specification are corrected and the installation and operation is satisfactory to the City.

C. Perform tests in the presence of the City and the pump manufacturer's representative.

D. Submit report on pump performance from the pump manufacturer's representative.

3.03 SYSTEM STARTUP

A. Verify that structures, pipes and equipment are compatible.

B. Perform initial pump prime and ensure that pump operates as described above.

C. Adjust as required to achieve optimum operation.

D. Field test using job supplied flow meters and pressure gauges to demonstrate mechanical integrity and compliance with hydraulic performance criteria in this spec and with shop performance tests and vibration limitations. The tests will demonstrate that the equipment operates in the manner intended. The Contractor is responsible for completing the work.

E. Demonstrate that the completed installation meets specified requirements and that controls and safety shutdowns are operational. Adjust as required to place equipment in proper operating condition.

END OF SECTION

SECTION 40 05 71.13

FLEXIBLE CHECK VALVE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes flexible check valve with a stainless steel expandable clamp to secure in place.

1.02 DEFINITION

A. Mating Surface: Inner surface of existing host pipe.

B. Cracking Pressure: Pressure at which “duckbill” lips open and allow the passage of water from upstream of the check valve.

1.03 REFERENCES

A. Reference Standards
   1. American Society for Testing and Materials International (ASTM)
      a. ASTM – A1418-85 Rubber and Rubber Latices-Nomenclature Gray Iron Castings for Valves, Flanges and Pipe
      b. ASTM – A126-84 Fittings

1.04 SUBMITTALS

A. Product Data

B. Shop Drawings

C. Manufacturer Instructions

D. Factory Test Results

E. Operating and Maintenance Manual

1.05 QUALITY ASSURANCE

A. Test valves or provide confirmation from manufacturer that valves shall not leak with a back pressure of 3 psig and will open at 6 inches of head.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Care should be taken when handling valves, to reduce the possibility of damaging check valve during installation. Special care should be taken in loading, hoisting, and lowering.

B. If possible, store valve in warehouse setting in a relatively dry and cool location. Valve shall be stored in a vertical position on a pallet or wooden platform.

1. If rubber check valve is stored outside, keep valve in a waterproof crate until ready for installation. Keep the check valve protected from any external elements such as direct UV exposure. Do not lay other boxes on top of the check valve or check valve box.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Cla-Val: Series RF-DBI-LH Low Headloss In-line Rubber-Flex

B. Proco: Proflex Style 790

C. Flexicraft: WaStop Backflow Valve

D. Or Approved Equal

2.02 DESIGN CRITERIA

A. One piece sleeve that opens when upstream pressure forces the sleeve apart to permit flow.

B. In-Line style, valve must be able to be installed inside smooth pipe.

C. Valves shall not require outside sources of power or manual assistance to operate.

D. Materials of construction:

Component	Material
Valve Expansion Clamp	316 Stainless Steel
Valve Body	Compatible with sewer gases

E. Backpressure: 3 psi

F. Cracking Pressure/Opening Pressure: 6 inches of water.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with Manufacturer's Instructions.

3.02 SITE QUALITY CONTROL

A. Inspect check valve for any damage that may have occurred during transportation

B. Check packing slip to ensure items have been received

C. Inspect the mating surface to ensure it is undamaged, clean, and free of foreign matter before installation of the check valve.

3.03 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage mating surface or surrounding construction.

END OF SECTION

SECTION 40 61 96

PROCESS CONTROL DESCRIPTIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section describes the general operation of the South Bay Water Reclamation Plant (SBWRP) Sanitary Sewer Pump Station (SSPS).

B. The following control descriptions complement the Process and Instrumentation Diagrams (P&IDs).

1.02 REFERENCES

A. Abbreviations and Acronyms:
   1. DCS: Distributed Control System.
   2. FIT: Low indicating transmitter
   3. HMI: Human Machine Interface.
   4. LE: Level element
   5. LI: Level indicator
   6. LIT: Level indicating transmitter
   7. LSH: Level switch, high
   8. LSHH: Level switch, high-high
   9. LSL: Level switch, low
   10. LSLL: Level switch, low-low
   11. P&ID: Process and Instrument Diagram.
   12. PLC: Programmable Logic Controller.
   13. PVC: Poly Vinyl Chloride.
   14. SCADA: Supervisory Control and Data Acquisition.
   15. SSPS: Sanitary Sewer Pump Station.
   16. ZSL: Flow switch, low

B. Definitions

C. Drawings, general conditions, and special conditions of the contract and Division 1 specifications apply to this section.

D. Related Specifications: The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.

1.03 CONTROL STRATEGY

A. Overview:
   1. The SSPS wet well receives sanitary sewer flow from an 18-inch line, storm water from the West basin through a 30-inch line, storm water from the east through a 24-inch line and two, 2-inch drain lines and pumps through an 8-inch PVC line directly to the headworks. Three submersible pumps (00P101, 00P102, and 00P103) are available and are automatically controlled using a lead-lag, N+1 control philosophy. Local panel

00PNL101 PLC monitors and controls the SSPS. Remote control and monitoring are made available to the plant DCS HMI via Ethernet communications.

B. Monitoring and Control:
   1. Wet well level is monitored by redundant ultrasonic level sensors 00LE101A and 00LE101B connected to ultrasonic level transmitter 00LIT101, which provides wet well level and level sensor fail signal to panel 00PNL101 PLC. Four float level switches (00LSHH101, 00LSH101, 00LSL101, and 00LSLL101) provide backup point level alarms to panel 00PNL101 PLC. The PLC in panel 00PNL101 monitors the wet well level signals and starts/stops the submersible pumps accordingly.
   2. Panel 00PNL101 PLC controls individual pumps in the wet well by direct-on-line motor starters in panel 00PNL101. Each motor starter returns running and overload status to the PLC. Each pump motor moisture sensor returns seal leak status to the PLC.
   3. Panel 00PNL101 PLC monitors total flow out of the wet well by magnetic flow meter 00FIT101, as well as monitors for presence of flow from each pump via check valve limit switches 00ZSL1011, 00ZSL1021, and 00ZSL1031.
   4. Panel 00PNL101 PLC monitors foul air exhaust fan flow signal via flow switch and provides alarm to plant DCS HMI under no flow condition.
   5. PLC monitors the following from panel 00PNL101 internal operation and provides alarms to DCS HMI:
      a. Panel door open alarm
      b. Panel high temperature alarm
      c. Panel power supply fail
      d. Panel control power status

C. Local Display/Control (Recommended for testing only):
   1. Panel 00PNL101 has local HMI providing local monitoring and control of wet well process conditions.
   2. Personnel, with the correct password, can view the status as well as operate the system. Local HMI to have selector for LOCAL MANUAL mode. In LOCAL MANUAL mode, individual pumps can be manually controlled from the local HMI. Panel 00PNL101 PLC communicates an alarm to the plant DCS HMI when in LOCAL MANUAL mode.
   3. When control is placed in LOCAL MANUAL, automatic control from 00PNL101 PLC is disabled and automatically operated pumps need to be manually stopped prior to manual operation of a single pump. Only two pumps run at the same time; operation of the third pump is disabled if two pumps are running.

D. Remote Manual Control:
   1. Individual pumps can be manually controlled from the plant DCS HMI when the AUTO/MANUAL mode is selected MANUAL. When control is placed in MANUAL, automatic control from 00PNL101 PLC is disabled and automatically operated pumps need to be manually stopped prior to manual operation of a single pump. Only two pumps run at the same time; operation of the third pump is disabled if two pumps are running.

E. Remote Auto Control:
   1. SSPS can be placed into remote control from the plant DCS HMI when the AUTO/MANUAL mode is selected AUTO. Automatic control from 00PNL101 PLC is then enabled.
   2. Operator at DCS HMI can set lead and lag pump and can place any pump out of service. 00PNL101 PLC sequences lead and lag pumps for every new pump cycle. The third pump is reserved for pump fail substitution and is designated by the last pump in the sequence. Only two pumps run at the same time; operation of the third pump is disabled

if two pumps are running. Pumps placed out of service are excluded from pump sequence. 00PNL101 PLC tracks pump run time and provide information to DCS HMI.

3. One level transmitter, 00LIT101 monitors both sensors 00LE101A and 00LE101B to continuously monitor the water level in SSPS wet well and transmit these signals to 00PNL101 PLC. The water level is displayed at the local HMI and plant DCS HMI. 00PNL101 PLC generates a low-low level, low level, high level and high-high level setpoint. Alarms will automatically acknowledge and return to normal at a 5% dead-band level from their original setpoint. A Loss of Echo alarm is transmitted from each ultrasonic sensor that will indicate sensor failure when active.
4. Automatic level control is based on 00LI101A signal, with 00LI101B as backup. Operator at DCS HMI can select which level signal is used. Float switch signals override PLC control and alarms.
5. When the wet well level reaches the high level set point the lead pump starts. If the wet well level reaches the high-high level set point the lag pump starts. When the wet well level reaches the low or low-low level set point the pumps stops.
6. If a running pump fails (i.e., overload, seal leak, or running status is false), start the next available pump.
7. During pump operation, if the corresponding ZSL check valve limit switch indicates no flow, the operator has the option to stop the pump and start the next available pump from the plant DCS HMI.

F. Emergency Stop:
   1. Panel 00PNL101 to have door-mounted emergency stop button. When activated, pumps stop and Emergency Stop alarm sent to PLC and DCS HMI. Manual reset required.

G. Interlocks and I/O from Other Processes:
   1. N/A

H. Alarms and Indication
   1. 00YA101A: Loss of echo alarm
   2. 00YA101B: Loss of echo alarm
   3. 00LI101A: SSPS level indication
   4. 00LI101B: SSPS level indication
   5. 00LSHH1011: High-high level alarm
   6. 00LSH1011: High level alarm
   7. 00LSL1011: Low level alarm
   8. 00LSLL1011: Low-low level alarm
   9. 00ZSL1011: Pump 00P101 No flow alarm
   10. 00ZSL1021: Pump 00P102 No flow alarm
   11. 00ZSL1031: Pump 00P103 No flow alarm
   12. 00FSL901: Exhaust fan 00F901 No flow alarm
   13. 00YS101: Pump 00P101 running status
   14. 00US101: Pump 00P101 motor overload
   15. 00XSH101: Pump 00P101 seal leak fail
   16. 00YS102: Pump 00P102 running status
   17. 00US102: Pump 00P102 motor overload
   18. 00XSH102: Pump 00P102 seal leak fail
   19. 00YS103: Pump 00P103 running status
   20. 00US103: Pump 00P103 motor overload
   21. 00XSH103: Pump 00P103 seal leak fail
   22. 00FIT101: Pump station flow indicator
   23. 00FIT101: Alarms for under range and over range values.
   24. 00UA100A: Panel 00PNL101 control power status

25. 00UA100B: Panel 00PNL101 power supply failure alarm
26. 00UA100C: Panel 00PNL101 emergency stop alarm
27. 00ZA100: Panel 00PNL101 panel door open alarm
28. Lead pump indication
29. Pump available indication
30. Pump runtime hours indication
31. Out-of-service pump indication
32. Lead pump indication
33. LOCAL MANUAL/MANUAL/AUTO control mode indication

I. Input/Output Summary
   1. Instrument Index

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

INPUT/OUTPUT LIST

Loop Number	P&ID Sheet	Description	I/O Type	Terminating Panel	Comments
00 UA 100A	I-02	00PNL101 CONTROL POWER FAIL	DI	00PNL101	
00 UA 100B	I-02	00PNL101 POWER SUPPLY FAIL	DI	00PNL101	
00 UA 100C	I-02	00PNL100C PANEL EMERGENCY STOP	DI	00PNL101	
00 ZA 100	I-02	00PNL100C PANEL DOOR OPEN	DI	00PNL101	
00 LI 101A	I-02	SSPS WET WELL LEVEL INDICATION 1	AI	00PNL101	
00 YA 101A	I-02	SSPS WET WELL LEVEL INDICATION 1 LOSS OF ECHO	DI	00PNL101	
00 LI 101B	I-02	SSPS WET WELL LEVEL INDICATION 1	AI	00PNL101	
00 YA 101B	I-02	SSPS WET WELL LEVEL INDICATION 1 LOSS OF ECHO	DI	00PNL101	
00 LSH 101	I-02	SSPS WET WELL HIGH-LEVEL SWITCH	DI	00PNL101	
00 LSHH 101	I-02	SSPS WET WELL HIGH-HIGH LEVEL SWITCH	DI	00PNL101	
00 LSL 101	I-02	SSPS WET WELL LOW-LEVEL SWITCH	DI	00PNL101	
00 LSLL 101	I-02	SSPS WET WELL LOW-LOW LEVEL SWITCH	DI	00PNL101	
00 FIT 101	I-02	SSPS FLOW INDICATION	AI	00PNL101	
00 ZSL 1011	I-02	SSPS PUMP 101 NO FLOW ALARM	DI	00PNL101	
00 ZSL 1012	I-02	SSPS PUMP 102 NO FLOW ALARM	DI	00PNL101	
00 ZSL 1013	I-02	SSPS PUMP 103 NO FLOW ALARM	DI	00PNL101	
00 YA 101	I-02	SSPS PUMP 101 MOTOR OVERLOAD	DI	00PNL101	
00 YL 101	I-02	SSPS PUMP 101 RUN STATUS	DI	00PNL101	
00 HS 101A	I-02	SSPS PUMP 101 START COMMAND	DO	00PNL101	
00 HS 101B	I-02	SSPS PUMP 101 STOP COMMAND	DO	00PNL101	
00 UA 101	I-02	SSPS PUMP 101 FAIL	DI	00PNL101	
00 YA 102	I-02	SSPS PUMP 102 MOTOR OVERLOAD	DI	00PNL101	
00 YL 102	I-02	SSPS PUMP 102 RUN STATUS	DI	00PNL101	
00 HS 102A	I-02	SSPS PUMP 102 START COMMAND	DO	00PNL101	
00 HS 102B	I-02	SSPS PUMP 102 STOP COMMAND	DO	00PNL101	
00 UA 102	I-02	SSPS PUMP 102 FAIL	DI	00PNL101	
00 YA 103	I-02	SSPS PUMP 103 MOTOR OVERLOAD	DI	00PNL101	
00 YL 103	I-02	SSPS PUMP 103 RUN STATUS	DI	00PNL101	
00 HS 103A	I-02	SSPS PUMP 103 START COMMAND	DO	00PNL101	
00 HS 103B	I-02	SSPS PUMP 103 STOP COMMAND	DO	00PNL101	
00 UA 103	I-02	SSPS PUMP 103 FAIL	DI	00PNL101	
00 FAL 901	I-02	SSPS FOUL AIR EXHAUST FAN NO FLOW SWITCH	DI	00PNL101	

SECTION 40 92 01

CONTROL PANELS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section gives requirements for furnishing custom fabricated control panels.

1.02 REFERENCES

A. Abbreviations and Acronyms:
   1. FDT: Factory Demonstration Test.
   2. I&C: Instrumentation and Control.
   3. I/O: Input and Output.
   4. O&M: Operation and Maintenance.
   5. P&ID: Process and Instrument Diagram.
   6. PIC: Process Instrumentation and Control.
   7. PLC: Programmable Logic Controller.
   8. SCADA: Supervisory Control and Data Acquisition.

B. Related specifications:
   1. Division 1, General Requirements
   2. Section 01 78 23 – Operation, Maintenance and Asset Data
   3. Section 01 88 15 – Anchorage and Bracing
   4. Section 40 91 00 - Instrumentation and Control Components

C. Reference Standards:
   1. American National Standards Institute (ANSI).
   2. ASTM International (ASTM):
      a. A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
      b. A276, Standard Specification for Stainless Steel Bars and Shapes.
      c. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
      d. B32, Standard Specification for Solder Metal.
      e. B88, Standard Specification for Seamless Copper Water Tube.
   3. Deutsche Industrie-Norm (DIN): VDE 0611, Specification for modular terminal blocks for connection of copper conductors up to 1,000V ac and up to 1,200V dc.
   4. Institute of Electrical and Electronics Engineers, Inc. (IEEE): C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   5. The Instrument, Systems, and Automation Society (ISA):
      a. RP12.06.01, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation Part 1: Intrinsic Safety.
      b. S5.1, Instrumentation Symbols and Identification.
      c. S5.4, Instrument Loop Diagrams.
      d. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.

e. TR20.00.01, Specification Forms for Process Measurement and Control Instruments, Part 1: General.

6. International Conference on Energy Conversion and Application (ICECA).
7. National Electrical Code (NEC).
8. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. ICS 1, Industrial Control and Systems General Requirements.
9. National Fire Protection Association (NFPA):
   a. 79, Electrical Standard for Industrial Machinery.
   b. 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
10. Underwriters Laboratories, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.

1.03 SUBMITTALS

A. General:
   1. Identify proposed items, options, installed spares, and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).

B. Action Submittals:
   1. General: Manufacture of the control panels shall not commence until related submittals have been approved by the Engineer.
   2. Submittal Requirements:
      a. Catalog Cuts and Product Information: For I&C components, electrical devices, and mechanical devices:
         1) Catalog information, marked to identify proposed items and options.
         2) Descriptive literature.
         3) External power and signal connections.
         4) Scaled drawings showing exterior dimensions and locations of electrical and mechanical interfaces.
      b. Design calculations:
         1) Enclosure heating/cooling requirements and environmental controls.
         2) Panel load list and power supply sizing.
      c. Layout Drawings:
         3) Control panel layout drawings, including the following information, is to be provided by the PIC System Integrator:
            a) Front, rear, and internal panel views to scale.
            b) Dimensional information.
            c) Tag number and functional name of components mounted in and on the panel.
            d) Product information on panel components.
            e) Nameplate location and legend including text, letter size and colors to be used.
            f) Location of external wiring and/or piping connections.
            g) Mounting and installation details.
            h) Subpanel layouts and mounting details for items located inside control panels.
      d. Wiring and/or Piping Diagrams:
         1) Control panel wiring and/or piping diagrams, including the following information, is to be provided by the PIC System Integrator:
            a) Name of panel, console or cabinet.
            b) Wiring sizes and types.

c) Piping sizes and types.
d) Terminal strip numbers.
e) Color coding.
f) Functional name and manufacturer's designation for components to which wiring and piping are connected.
g) Wires: Wire number and color. Cable number if part of multiconductor cable.
h) Terminals: Location (enclosure number, terminal junction box number, or MCC number), terminal strip number, and terminal block number.
i) Components:
(i) Tag number, terminal numbers, and location ("FIELD," enclosure number, or MCC number).
(ii) Switching action (open or close on rising or falling process variable), set point value and units, and process variable description (for example, Sump Level High).
j) I/O Points: PLC unit number, I/O tag number, I/O address, terminal numbers, and terminal strip numbers.
k) Relay Coils:
(i) Tag number and its function.
(ii) On right side of run where coil is located, contact location by ladder number and sheet number. Underline normally closed contacts.
l) Relay Contacts: Coil tag number, function, and coil location (ladder rung number and sheet number).
m) Communications and Networks: Network type, address or node identification, port or channel number, and type of connector.
n) Ground wires, surge protectors, and connections.
o) Wire and Cable Names: Names, wire number, and wire color for circuits entering and leaving a panel.

e. Bill of Materials:
1) The PIC System Integrator will provide a Bill of Materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.
2) Submit updated Bill of Materials for components shown.

f. Submit electronic copies of drawings markups in pdf format.

C. Informational Submittals:
1. Manufacturer's O&M manuals for components, electrical devices, and mechanical devices:
a. In accordance with Section 01 78 23, Operation and Maintenance Data.
b. Content for Each O&M Manual:
1) Table of Contents.
2) Operations procedures.
3) Installation requirements and procedures.
4) Maintenance requirements and procedures.
5) Troubleshooting procedures.
6) Calibration procedures.
7) Internal schematic and wiring diagrams.
2. Testing Related Submittals:
a. Factory Demonstration Test:
1) Proposed test procedures, forms, and checklists.
2) Test Documentation: Copy of signed off test results.
3. Record Drawings and Documentation:

a. Submit final markups of the Engineer's panel drawings, wiring diagrams, and documentation to reflect any updates made to the panels during fabrication and testing.
b. Provide electronic copies of the markups in AutoCad Version 2015.

4. Submit anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.

1.04 QUALITY ASSURANCE

A. General: The PIC System Integrator shall supply its company's Quality Assurance Plan. The plans shall include but not necessarily be limited to method of testing, raw material criteria, methods of documentation, station control, "Burn-In," final tests and serialization coding and packaging.

B. Qualifications:
1. Manufacturer must be able to meet the standards and requirements listed herein
2. Have a UL approved panel shop.
3. Have a record of prompt shipments in accordance with contract obligations required for previous projects.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers protected against impact, abrasion, corrosion, discoloration and/or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment.

B. Notify the Engineer of the storage requirements and recommendations for the equipment prior to shipment.

C. Prior to shipment, include corrosive inhibitive vapor capsules in shipping containers, and related equipment as recommended by capsule manufacturer.

1.06 SEQUENCING AND SCHEDULING

A. Prerequisite Activities and Lead Times: Do not start following key Project activities until prerequisite activities and lead times listed below have been completed and satisfied:
1. Test Prerequisite: Associated test procedures Submittals completed.
2. Factory Demonstration Test Prerequisite:
a. Approval of Control Panel submittals.
b. Test procedures submittals completed.
3. Control Panels Shipment to Site:
a. Prerequisites:
1) Approval of Shop Drawings.
2) Factory Demonstration Test (FDT) completed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide control panels in accordance with the control panel layout drawings and wiring diagrams.

B. Like Equipment Items: Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.

2.02 CONTROL PANEL COMPONENTS

A. Provide components and hardware necessary to make each control panel fully operational and in conformance with requirements specified in this Section.

2.03 SERVICE CONDITIONS

A. Service Conditions for Panels:
   1. Freestanding Panel and Consoles:
      a. Outside: NEMA 4X.

2.04 NAMEPLATES AND TAGS

A. Panel Nameplates: For identification of panels and components mounted thereon.
   1. Nameplate Size and Material: 3/32-inch thick laminated phenolic type with black matte finish surface and white letter engraving.
   2. Panel Identification Nameplates: 1/2-inch high letter engravings.
   3. Panel Mounted Component (e.g., Control Devices, Indicating Lights, Selector Switches, etc.) Identification Nameplates: 1/4-inch high letter engravings.
   4. Attached to the panel face with two stainless steel self-tapping screws.
   5. Nameplate Engravings: Include the instrument or equipment tag number and descriptive title as shown and specified.

B. Internally Mounted Instruments Tags:
   1. Tag Numbers: As listed in the Contract Documents.
   2. Identifying Tag Number: Permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
   3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.
   4. Identification Tag: Installed so that the numbers are easily visible to service personnel.
   5. Front of Panel Mounted Instruments: Tag attached to rear of device.

C. Tagging of the following items shall be accomplished with the use of adhesive plastic Brady USA, Inc. labels, or equal.
   1. Tag electrical devices (e.g., relays, timers, power supplies) mounted within control panels and enclosures.
   2. Tag pneumatic lines.
   3. Numerically tag terminal blocks.
   4. Numerically tag wiring at each end.

D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.
   1. Inscription:

a. Refer to table under Paragraph Standard Pushbutton Colors and Inscriptions.
b. Refer to table under Paragraph Standard Light Colors and Inscriptions.
c. Refer to P&IDs and panel Drawings.

2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.
3. Letters: Black on gray or white background.

E. Service Legends: Component identification nameplate located on face of component.
1. Inscription: As shown on panel drawing.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch high, white on black background, unless otherwise noted.

F. Nametags: Component identification for field devices.
1. Inscription: Component tag number.
2. Materials: 16-gauge, Type 304 stainless steel.
3. Letters: 3/16-inch high, imposed.
4. Mounting: Affix to component with 16-gauge or 18-gauge stainless steel wire rope or stainless-steel screws.

2.05 ELECTRICAL REQUIREMENTS

A. I&C and electrical components, terminals, wires, and enclosures UL recognized or UL listed.

B. Wires within Enclosures:
1. ac Circuits:
a. Type: 600-volt, Type MTW stranded copper.
b. Size: For current to be carried, but not less than No. 18 AWG.
2. Analog Signal Circuits:
a. Type: 600-volt tinned stranded copper, twisted shielded pairs or triad with a 100 percent, aluminum-polyester shield, rated 60 degrees C.
b. Panels with Circuits Less than 600 volts: Rated at 600 volts. Belden No. 18 AWG Type 9341, Triad Beldon No. 1121A.
c. Size: No. 18 AWG, minimum.
3. Other dc Circuits:
a. Type: 600-volt, Type MTW tinned stranded copper.
b. Size: For current carried, but not less than No. 18 AWG.
4. Special Signal Circuits: Use manufacturer’s standard cables.
5. Wire Identification: Numbered and tagged at each termination.
a. Wire Tags: Machine printed, heat shrink.
b. Manufacturers:
1) Brady Perma Sleev.
2) Tyco Electronics.

C. Terminal Blocks for Enclosures:
1. Quantity:
a. Accommodate present and spare indicated needs.
b. One wire per terminal for field wires entering enclosures.
c. Maximum of two wires per terminal for No. 18 AWG wire for internal enclosure wiring.
d. Spare Terminals: 20 percent of connected terminals, but not less than 5 per terminal block, unless otherwise shown on Drawings.

2. Allen-Bradley Wiring Systems I/O cabling and termination units shall be used for Allen-Bradley I/O modules.

D. Grounding of Enclosures:
   1. Furnish isolated copper grounding bus for signal and shield ground connections.
   2. Ground this ground bus at a common signal ground point in accordance with National Electrical Code requirements.
   3. Single Point Ground for Each Analog Loop:
      a. Locate signal ground at dc power supply for loop.
      b. Use to ground wire shields for loop.
      c. Group and ground wire shields in PLC control panels or PLC remote I/O panels.
   4. Ground terminal block rails to ground bus.

E. Intrinsic Safety System Installation:
   1. Comply with NEC Article 504, Intrinsically Safe Systems.
   2. Install intrinsically safe circuits in a separate wire way that:
      a. Is separated from nonintrinsically safe circuits as specified by NEC.
      b. Is colored light blue and has message “Intrinsically Safe Circuits Only” on raceway cover every 6-inches.

F. Electrical Transient Protection:
   1. General:
      a. Function: Protect elements of PIC against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems.
      b. Provide and install surge suppressors at:
         1) At the control panel, connection of signal circuits that have portions of the circuit extending outside of a protective building.
   2. Surge Suppressor Types:
      a. General:
         1) Construction: First-stage high-energy metal oxide varistor and second-stage bipolar silicon avalanche device separated by series impedance; includes grounding wire, stud, or terminal.
         2) Response: 5 nanoseconds maximum.
         3) Recovery: Automatic.
         4) Temperature Range: Minus 20 degrees C to plus 85 degrees C.
      b. Suppressors on Analog Signal Lines:
         1) Test Waveform: Linear 8 microsecond rise in current form 0 amps to a peak current value followed by an exponential decay of current reaching one-half the peak value in 20 microseconds.
         2) Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.
            a) dc Clamping Voltage: 20 percent to 40 percent above operating voltage for circuit.
            b) dc Clamping Voltage Tolerance: Less than plus or minus 10 percent.
            c) Maximum Loop Resistance: 18 ohms per conductor.
      c. Physical Characteristics:
         1) Mounted in Enclosures: Encapsulated inflame retardant epoxy.
         2) Din rail mount.
         3) For 24-Volt Analog Signals Lines:
            a) Plug: Phoenix Contact, PT 2X2-24DC-ST.
            b) Base: Phoenix Contact, PT 2X2+F-BE.
         4) For 120V ac Lines:
            a) Plug: Phoenix Contact, PT 2-PE/S-120AC-ST.

b) Base: Phoenix Contact, PT-BE/FM.

2.06 PANEL FABRICATION

A. General:
1. Nominal Panel Dimensions: Refer to control panel layout drawings.
2. Panel Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), state and local codes, and applicable sections of NEMA, ANSI, UL, and ICECA.
3. Fabricate panels, install instruments and wire, and plumb at panel Supplier's facility. No fabrication other than correction of minor defects or minor transit damage permitted onsite.
4. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.
5. Electrical Work: In accordance with the applicable requirements of Division 26, Electrical.

B. Temperature Control:
1. Enclosures installed outdoors or indoors in spaces that are not conditioned:
   a. For enclosures with programmable logic controllers, microprocessors, or when noted:
      1) Provide NEMA 4/4X side-mounted or top-mounted closed-loop air conditioning unit. Size the unit to maintain temperatures inside the enclosure to no more than 45 degrees C with an ambient temperature of 50 degrees C in full sun and the equipment operating at full load.
      2) Air Conditioner Power: 120 volts, taken from internal control panel transformer, for loads not to exceed 5A. For loads greater than 5A at 120V, notify the Engineer and request direction.

C. Freestanding Panel Construction:
1. Materials:
   a. Outdoor Installations: Type 304 stainless steel with a white powder coat finish.
   b. Minimum Thickness: 12-gauge, unless otherwise noted.
2. Panel Rating:
   a. Outdoor: NEMA 4X.
3. Panel Front:
   a. Fabricated from a single piece of sheet steel, unless otherwise shown on Drawings.
   b. No seams or bolt heads visible when viewed from front.
   c. Panel Cutouts: Smoothly finished with rounded edges.
   d. Stiffeners: Steel angle or plate stiffeners or both on back of panel face to prevent panel deflection under instrument loading or operation.
4. Internal Framework:
   a. Structural steel for instrument support and panel bracing.
   b. Permit panel lifting without racking or distortion.
5. Sub-panels for installation of relays and other internally mounted components.
6. Lifting rings to allow simple, safe rigging and lifting of panel during installation.
7. Adjacent Panels: Securely bolted together so front faces are parallel.
8. Door:
   a. Full height, fully gasketed access door where shown on Drawings.
   b. Latch: Three-point, Southco Type 44.
   c. Handle: "L"-type.
   d. Hinges: Full-length, continuous, piano-type, steel hinges with stainless steel pins.

e. Rear Access: Extend no further than 24 inches beyond panel when opened to 90-degree position.
f. Front and Side Access Doors: As shown on Drawings.

9. Bottom 12 Inches: Free of devices, including terminal strips, to provide ease of installation and testing.

D. Breather and Drains: Furnish with NEMA 250, Type 4 and 4X panels:
1. Manufacturer and Product: Cooper Crouse-Hinds; ECD Type 4X Drain and Breather; Drain Model ECD1-N4D, Breather Model ECD1-N4B.

E. Control Panel Electrical:
1. Power Distribution within Panels:
a. Feeder Circuits:
1) One 480 Vac, 3Ph, 60-Hz feeder circuits as shown on Drawings.
2) Make provisions for feeder circuit conduit entry.
3) Furnish terminal block for termination of wires.
b. Control power transformer (CPT):
1) One 480 VAC to 120 VAC CPT for supplying control power to the control panel. Panel manufacturer to size CPT to power control panel loads.
c. Power Panel: Furnish main circuit breaker and circuit breaker on each individual branch circuit distributed from power panel.
1) Locate to provide clear view of and access to breakers when door is open.
2) Branch Circuit Breaker Sizes: Coordinate such that fault in branch circuit will trip only the branch breaker, but not trip the main breaker.
a) Branch Circuit Breakers: 15 amps at 250V ac.
b) Provide a minimum of two spare breakers.
3) Sub-branch Circuit Breakers:
a) Provide as required to distribute power to PLC I/O circuits and 120V ac field instruments.
b) Size circuit breakers as required to protect each sub-branch circuit without tripping the associated branch circuit.
c) Provide a minimum of two spare breakers.
4) Breaker Manufacturers and Products: Refer to Division 26, Electrical.
d. Circuit Wiring: P&IDs and Control Diagrams on Drawings show function only. Use following rules for actual circuit wiring:
1) Devices on Single Circuit: 20, maximum.
2) Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group units on same branch circuit.
3) Branch Circuit Loading: 12 amperes continuous, maximum.
4) Panel Lighting and Service Outlets: Put on separate 15 amp, 120V ac branch circuit.
5) Provide 120V ac plugmold for panel components with line cords.
2. Signal Distribution:
a. Signal Wiring: Separate analog signal cables from power and control within a panel and cross at right angles where necessary.
b. Within Panels: 4 to 20 mA dc signals may be distributed as 1V dc to 5V dc.
c. Outside Panels: Isolated 4 to 20 mA dc only.
d. Signal Wiring: Twisted shielded pairs.
e. RTD and Thermocouple Extension Cable:
1) Continuous field to panel with no intermediate junction boxes or terminations.

2) RTDs in motor windings are considered a 600-volt circuit.
3) Terminate thermocouple extension wire directly to loop instrument.

3. Push-to-Test Circuitry: For each push-to-test indicating light, provide a fused push-to-test circuit.
4. Internal Panel Lights and Switch for Freestanding Panels:
   a. Type: Door-switch activated LED back-of-panel lights.
   b. Quantity: One light for every 4 feet of panel width.
   c. Mounting: Inside and in the top of back-of-panel area.
   d. Protective metal shield for lights.
   e. One 120V ac, 20A, snap switch, to turn on the lights, mounted in an outlet box with a cover and located so that it is easily accessible from access door.
5. Service Outlets for Freestanding Panels:
   a. Type: Three-wire, 120-volt, 20-ampere, GFCI GFCI duplex receptacles.
   b. Quantity:
      1) Panels 4 Feet Wide and Smaller: One.
      2) Panels Larger than 4 Feet Wide: One for every 4 feet of panel width, two minimum per panel.
   c. Mounting: Evenly spaced along back-of-panel area.
6. Internal Panel Lights and Service Outlets for Smaller Panels:
   a. Internal Panel Light and Switch: Switched LED light. One 120V ac, 20A, snap switch, to turn on the light, mounted in an outlet box with a cover and located so that it is easily accessible from access door.
   b. Service Outlet: Breaker protected 120-volt, 20-amp, GFCI GFCI duplex receptacle:
   c. Required for panels. Refer to Control Panel Schedule in Article Supplements.

F. Electrical Components:
1. Terminal Blocks for Enclosures:
   a. General:
      1) Connection Type: Screw compression clamp.
      2) Compression Clamp:
         a) Complies with DIN-VDE 0611.
         b) Hardened steel clamp with transversal grooves that penetrate wire strands providing a vibration-proof connection.
         c) Guides strands of wire into terminal.
      3) Screws: Hardened steel, captive, and self-locking.
      4) Current Bar: Copper or treated brass.
      5) Insulation:
         a) Thermoplastic rated for minus 55 degrees C to plus 110 degrees C.
         b) Two funneled shaped inputs to facilitate wire entry.
      6) Mounting:
         a) Standard DIN rail.
         b) Terminal block can be extracted from an assembly without displacing adjacent blocks.
         c) End Stops: Minimum of one at each end of rail.
      7) Wire Preparation: Stripping only permitted.
      8) Jumpers: Allow jumper installation without loss of space on terminal or rail.
      9) Marking System:
         a) Terminal number shown on both sides of terminal block.
         b) Allow use of preprinted and field marked tags.
         c) Terminal strip numbers shown on end stops.
         d) Mark terminal block and terminal strip numbers as shown on panel control diagrams and loop diagrams.

e) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.

b. Manufacturers:
   1) Phoenix Contact.
   2) Weidmuller.
   3) Or equal.

2. Power Supplies:
   a. A 120 VAC uninterruptable power supply (UPS) shall be provided. sized the UPS for the connected load. The battery shall be sized for minimum 10 minutes of back up for the connected load to allow orderly shutdown of equipment.
   b. Furnish as required to power instruments requiring external dc power, including two-wire transmitters and dc relays. Provide dual power supplies with diode auctioneered outputs.
   c. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.
   d. Provide output over voltage and over current protective devices to:
      1) Protect instruments from damage due to power supply failure.
      2) Protect power supply from damage due to external failure.
   e. DC power supply and UPS failure contacts shall be wired in series to PLC for alarm purposes.
   f. Enclosures: NEMA 1.
   g. Mount such that dissipated heat does not adversely affect other components.
   h. Fuses: For each dc supply line to each individual two-wire transmitter.
      1) Type: Indicating.
      2) Mount so fuses can be easily seen and replaced.
   i. Manufacturer and Product: Phoenix Contact, Sola, or approved equal.

3. Intrinsic Safety Barriers:
   a. Intrinsically Safe Relays: Monitor discrete signals that originate in hazardous area and are used in a safe area.
      1) Manufacturer: Per field equipment manufacturer's recommendations.

G. Control Panel Internal Wiring:
   1. Restrain by plastic ties or ducts or metal raceways.
   2. Hinge Wiring: Secure at each end so bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
   3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
   4. Provide abrasion protection for wire bundles that pass-through holes or across edges of sheet metal.
   5. Connections to Screw Type Terminals:
      a. Locking-fork-tongue or ring-tongue lugs.
      b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.
      c. Wires terminated in a crimp lug, maximum of one.
      d. Lugs installed on a screw terminal, maximum of two.
   6. Connections to Compression Clamp Type Terminals:
      a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.
      b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.
   7. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.

8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.
9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
11. Plastic Wire Duct Fill: Do not exceed manufacturer's recommendations.
12. Conductors Carrying Foreign Voltages within a Panel:
    a. Route foreign voltage conductors into panel and land on a circuit blade disconnect type terminal block.
    b. Use wire with pink insulation to identify foreign voltage circuits within panel from terminal block on. Do not use wires with pink insulation for any other purpose.
13. Harness Wiring:
    a. 120V ac: No. 14 AWG, MTW.
    b. 24V dc: No. 16 AWG, MTW where individual conductors are used and Type TC shielded tray cable where shielded wire is used.
14. Panelwork:
    a. No exposed connections.
    b. Allow adjustments to equipment to be made without exposing these terminals.
    c. For power and control wiring operating above 80V ac or dc use covered channels or EMT raceways separate from low voltage signal circuits.
15. Plastic Wire Ducts Color:
    a. 120V ac: White.
    b. 24V dc: Gray.
    c. Communications Cables and Fiber Optic Jumpers:
        1) Multi-mode Fiber Jumpers: Orange.
        2) Single-Mode Fiber Jumpers: Yellow.
16. Provide a communications plastic wire duct for communications cables and fiber optic cables between the communications devices in control panel and communications raceways. Design plastic wire duct design to take into account the minimum bending radius of the communications cable.
17. Make plastic wire ducts the same depth.
18. Provide a minimum of 1-1/2 inches between plastic wire ducts and terminal blocks.

H. Factory Finishing:
1. Furnish materials and equipment with manufacturer's standard finish system
2. Use specific color if indicated. Otherwise use manufacturer's standard finish color, or light gray if manufacturer has no standard color.
3. Stainless Steel and Aluminum: Not painted.
4. Nonmetallic Panels: Not painted.
5. Steel Panels:
    a. Sand panel and remove mill scale, rust, grease, and oil.
    b. Fill imperfections and sand smooth.
    c. Paint panel interior and exterior with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel.
    d. Sand surfaces lightly between coats.
    e. Dry Film Thickness: 3 mils, minimum.
    f. Color: Manufacturer's standard.

2.07 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsules:

1. Use corrosion inhibiting vapor capsules in enclosures to protect components from corrosion.
2. Manufacturers and Products:
    a. Northern Instruments; Model Zerust VC.
    b. Hoffmann Engineering; Model A-HCI.

2.08 SOURCE QUALITY CONTROL

A. General:
1. The Engineer may actively participate in the tests.
2. The Engineer's decision will be final regarding acceptability and completeness of testing.
3. Procedures, Forms, and Checklists:
    a. Except for Unwitnessed Factory Test, conduct tests in accordance with, and documented on, reviewed and accepted procedures, forms, and checklists.
    b. Describe each test item to be performed.
    c. Have space after each test item description for sign off by appropriate party after satisfactory completion.
4. Required Test Documentation: Test procedures, forms, and checklists signed by the Engineer.
5. Conducting Tests:
    a. Provide special testing materials and equipment.
    b. Provide suitable means of simulation of test inputs and outputs.
    c. Define simulation techniques in test procedures.
    d. Test Format: Cause and effect.
        1) Person conducting test initiates an input (cause).
        2) Specific test requirement is satisfied if correct result (effect), occurs.
    e. Provide sufficient temporary software configuring to allow FAT testing.

B. Unwitnessed Factory Test:
1. Scope: Inspect and test panels to ensure it is operational, ready for FAT.
2. Location: Panel Supplier's facility.

C. Factory Acceptance Tests (FAT):
1. Notify the Engineer of test schedule 4 weeks prior to start of test.
2. Owner reserves the right to participate in FAT.
3. Scope: Test entire control panel to demonstrate it is operational.
4. Location: Panel Supplier's facility.
5. Temporary Application Software: Provide application software to allow PLC and network testing including communications and input/output tests.
6. Correctness of wiring from panel field terminals to PLC system input/output points and to panel components.
    a. Simulate each discrete signal at terminal strip.
    b. Simulate correctness of each analog signal using current source.
7. Operation of communications between PLCs and remote I/O and between PLCs and Ethernet devices including other PLCs, computers, and power monitors.
8. Correct deficiencies found and complete prior to shipment to Site.
9. Failed Tests: Repeat and witnessed by the Engineer.
10. Make following documentation available to the Engineer at test site both before and during FAT:
    a. Drawings, Specifications, Addenda, and Change Orders.
    b. Master copy of FAT procedures.
    c. List of equipment to be tested including make, model, and serial number.

d. Approved hardware Shop Drawings for equipment being tested.

11. Daily Schedule for FAT:
    a. Begin each day with meeting to review day's test schedule.
    b. End each day with each meeting to review day's test results and to review or revise next day's test schedule.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 40 92 07

NETWORK COMPONENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section gives the requirements for furnishing Ethernet network components and accessories including switches, routers, and firewalls.

1.02 RELATED SECTIONS

A. Related sections include the following: Division 1, General Requirements.

1.03 SUBMITTALS

A. Action Submittals:
   1. Purchase Quotation: Listing of network components and accessories to be provided. Include applicable tag numbers and functional names of components.
   2. Order Confirmation Summary: Final listing of network components and accessories to be provided.
   3. Network Components Data Sheets:
      a. Neat and legible markups of the Network Components Data Sheets provided in this Section.
      b. Markup the Network Components Data Sheets to include complete product information and corrections to reflect items in the purchase quotation.

B. Informational Submittals:
   1. Operation and Maintenance Information:
      a. Provide sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for Ethernet components.
      b. Name, address and telephone number of the Network Components supplier's local service representative.
      c. Complete list of supplied network components with full model numbers, including spare parts and test equipment provided.
   2. Manufacturer's Original Copies of Hardware, Software and Installation, Assembly and Operations Manuals for network components. Manuals shall include the following information:
      a. General descriptive information covering the basic features.
      b. Physical description covering layout and installation requirements and environmental constraints.
      c. Functional and operational descriptions covering the procedures for programming, operation, startup, shutdown, and of the Ethernet equipment and explaining how the various functions are performed.
      d. Maintenance procedures covering checkout and troubleshooting:
         1) Checkout procedures shall provide the means to verify the satisfactory operation of equipment.
         2) Troubleshooting procedures shall serve as a guide in determining faulty components.

e. Wiring and schematic diagrams.
f. Safety considerations relating to operation and maintenance procedures.

3. Content for each O&M Manual:
   a. Table of Contents.
   b. Operations procedures.
   c. Installation requirements and procedures.
   d. Maintenance requirements and procedures.
   e. Troubleshooting procedures.
   f. Internal schematic and wiring diagrams.
4. List of spares, expendables, test equipment and tools provided.
5. List of additional recommended spares, expendables, test equipment, and tools. Include quantities, unit prices, and total costs.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers protected against impact, abrasion, corrosion, discoloration and/or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment.

B. Prior to shipment, include corrosive inhibitive vapor capsules in shipping containers, and related equipment as recommended by capsule manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide components that are listed in the Ethernet Components List in Article Supplements at the end of this Section. Specific component requirements are defined in the Ethernet Components Data Sheets in Article Supplements at the end of this Section.

PART 3 - EXECUTION

3.01 ONSITE CONFIGURATION AND TESTING

A. IGMP Snooping functionality for switches and routers on the Ethernet/IP networks will be configured and tested as specified by Rockwell Automation.

3.02 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this Specification.
   1. Network Components List.

1. Network Components List.

ITEM	DESCRIPTION	MANUFACTURER	MODEL
1	Network switch (for Sanitary Pump Station Panel 00PNL101)	NTRON	105FX
2	Network switch (for Network Cabinet 29PCM01)	NTRON	105FX

END OF SECTION

SECTION 44 30 00

FOUL AIR BLOWER

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes positive displacement air blower. Air blower will transfer air from the sanitary sewer pump station to the water reclamation plant's existing odor control system.

1.02 REFERENCES

A. Related Specifications
   1. Section 40 92 01 - Control Panels

B. Reference Standards
   1. American Society for Testing and Materials International (ASTM)

1.03 SUBMITTALS

A. Product Data:
   1. Data regarding blower and motor characteristics and performance:
      a. Prior to fabrication and testing, provide guaranteed performance curves based on actual shop tests of mechanically duplicate blowers, showing they meet indicated and specified requirements for pressure rise, capacity, horsepower, efficiency and temperature rise.
      b. Provide catalog performance curves at maximum blower speed indicated and specified showing maximum and minimum speeds available.
      c. Submit curves for guaranteed performance, and shop performance tests on 8-1/2-in. by 11-in. sheets, one curve per sheet.
      d. Bearing temperature operating range for the service conditions specified.
      e. Manufacturer's product data and specifications for painting.
      f. Seismic anchorage and bracing calculations.

B. Test and Evaluation Reports
   1. Certified results of blower pressure testing.
   2. Blower shop test results.
   3. Motor shop test results.
   4. Resonant frequency analysis
   5. Shop and field testing procedures and equipment to be used.

C. Source Quality Control Submittals
   1. Shop and field inspection reports.

1.04 QUALITY ASSURANCE

A. Blowers shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

B. Welding: In accordance with latest applicable American Welding Society Code or equivalent.

C. Shop tests as specified.

D. The Contractor shall obtain the blowers, motors, silencers, enclosures, controls and appurtenances from a single blower manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:
   1. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
      a. Ship blower, package and sound enclosure assembly, in one piece.
   2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
   3. The Contractor shall obtain spare parts from the manufacturer at the same time as pertaining equipment. The Contractor shall maintain possession of spare parts until Substantial Completion at which time, spare parts shall be turned over to the Owner.

B. Receiving:
   1. Inspect and inventory items upon delivery to site.
   2. Store and safeguard equipment, material and spare parts in accordance with manufacturer's written recommendations and instructions.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. Materials for fan will be constructed of non-sparking corrosion resistant material
   1. Flow Rate: 1100 cfm
   2. Inlet Flow Rate (Minimum): 1000 cfm
   3. Brake Horsepower at design flow (Maximum): 5 hp
   4. Discharge pressure at discharge flange (Minimum): 9 in H2O
   5. Blower Speed (Maximum): 4,200 rpm

B. Motor: Perform without overload when the inlet conditions are 10 degrees F, 36 percent relative humidity, and 14.4 psia, at specified flow rates above.

C. Maximum Rotating Assembly Tip Speed: 530 feet per second, and first critical speed shall be at least 20 percent above its operating speed.

D. Noise Data:
   1. Maximum exhaust fan noise at the property line must be 45 dBA
   2. The Sound Pressure Level: Not to exceed unloaded sound power level of 85 dbA, reference 20 micro-newtons per square meter, at a distance of 3 feet-free field.
   3. Noise data need not be supplied if equipment manufacturer guarantees, in writing, that sound pressure level at 5 feet from any equipment or motor surface, with the equipment operating as specified, shall not exceed 95 dBA when measured with a sound level meter meeting the Type II requirements of ASA 47.
   4. If the sound pressure level of 95 dBA cannot be guaranteed, provide:
      a. Sound power levels in decibels (re. watts x 10 to the -12 power) in octave band center frequencies for the blower and motor combination when operating as specified.
      b. Frequency and sound power (or pressure) level of any audible discrete tones.

c. If the character of the source is such that the generated noise is directional, the directivity index and associated direction with respect to some reference shall be provided.
d. Information on any design restrictions such as, but not limited to, ventilation requirements for totally enclosed equipment and relocating local controls remotely.

5. Obtain acceptance of test reports from Engineer prior to shipment of equipment for use on Project.

2.02 BLOWER COMPONENTS:

A. Casing: 316 Stainless Steel or Cast Aluminum No. 443 Alloy

B. Impeller: 316 Stainless Steel or Cast Aluminum No. 443 Alloy

C. Shaft: Carbon Steel or 316 Stainless Steel

D. Bearings: Antifriction type designed for an ABMA B-10 rating life of 100,000 hours.

E. Coupling: Manufacturer's standard flexible coupling with OSHA coupling guard.

2.03 FLEXIBLE CONNECTIONS

A. Single arch, reinforced, flanged, rubber expansion joint with minimum 8-inch laying length for each blower inlet and outlet connection.

B. Design to mate with ANSI 125-pound flanges. Minimum working pressure range 10 psig to 15 inches Hg vacuum and minimum working temperature rating of at least 250 degrees F.

C. Stainless steel split retaining rings per connection.

D. Control unit at discharge flexible connection, suitable for mating to the blower outlet connection, to restrict axial pipe movement.

2.04 ACCESSORIES

A. Local Control Panel: Provide a local control panel is accordance with Section 40 92 01 - Control Panels with a Start/Stop button and status indicator lights for Running, Stopped and Fault.

B. Manometer: One, portable, mercury U-tube, calibrated in psi, range of 15 psi for troubleshooting, complete with necessary tubing and fittings.

C. Current Transformer:
1. One, window type, for each blower.
2. Locate each current transformer in blower motor starter to sense motor current in one phase and transmit signal to dual scale motor current indicator in blower panel.
3. Coordinate installation of current transformer with motor control center supplier.

D. Terminal Junction Boxes (TJB): Two, securely mounted to the blower assembly. Prewire blower mounted controls to the TJBs. One TJB shall be designated for analog control circuits and one for discrete control circuits.

E. Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 100 pounds.

F. Equipment Anchor Bolts: Type 316 stainless steel sized by equipment manufacturer, or at least 1/2 inch in diameter, or as shown.

G. Equipment Identification Plates: Provide 16-gauge Type stainless steel identification plate securely mounted on each separate equipment component and control panels in a readily visible location. Plate shall bear engraved equipment identification number and letters.

2.05 MANUFACTURERS

A. Manufacturer List:
   1. Hoffman Air and Filtration Division
   2. Clarkson Industries, Inc.
   3. Lamson Corp.
   4. Or Approved Equal

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install equipment in strict conformance with manufacturer's recommendations.

B. Defects and defective equipment shall be corrected promptly or replaced at expense of the manufacturer.

3.02 FIELD TESTS AND INSPECTIONS

A. Test piping connections to prove the blower nozzles are installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with blower nozzles.

B. After installation of equipment, and after inspection, operation, testing and adjustment have been completed by manufacturer's field service technician, conduct running test for each blower assembly to determine its ability to operate within the vibration and temperature limits specified, and to deliver its rated capacity under specified conditions. During tests, observe and record pressures, capacity, motor inputs, pump bearing housing temperature, noise and vibration. Immediately correct or replace defects or defective equipment revealed by or noted during tests, at no additional cost to the Owner, and repeat tests until specified results and results acceptable to the Engineer are obtained. Contractor to provide labor, piping, equipment, flowmeters, test gauges, vibration testing equipment and materials for conducting tests.

3.03 ADJUSTING

A. Adjust parts for smooth, uniform operation.

3.04 CLEANING

A. After installation and approved testing, Contractor will apply touch-up paint to scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting.

END OF SECTION

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: Storm Water Diversion at the South Bay Water Reclamation Plant

Project No. / WBS No.: B-20002.02.06

Project Location-Specific: The Project is located at the South Bay Water Reclamation Plant, located at 2411 Dairy Mart Road, within the Tijuana River Valley Community Planning Area (Council District 8).

Project Location-City/County: San Diego/San Diego

Description of nature and purpose of the Project: The Project involves demolition of the existing Sanitary Sewer Pump Station (SSPS) at the South Bay Water Reclamation Plant (SBWRP) facility, and construction of a new SSPS in its place. Additional improvements associated with the SSPS replacement include installation of a new cast-in-place reinforced concrete wet well and valve vault; installation of two 96-inch diameter diversion structures; installation of two new PVC storm drain pipe segments to connect storm water runoff from the diversion structures to the new SSPS; and installation of new electrical instrumentation and control systems for the new SSPS. The Project also includes landscaping and irrigation system restoration, and partial removal and replacement of existing paved sidewalk and driveway within the perimeter of the facility.

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 (new diversion structures are minor alterations to the existing SBWRP 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 SSPS, landscaping, irrigation, sidewalk, and driveway are replacements or reconstructions within the existing SBWRP 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 (new diversion structures and SSPS are new, small structures within the existing SBWRP 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

Carrie Purcell

Carrie Purcell, Interim Deputy Director

September 29, 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

Application for Fire Hydrant Meter (EXHIBIT A)

City of San Diego PUBLIC UTILITIES Water & Wastewater

(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

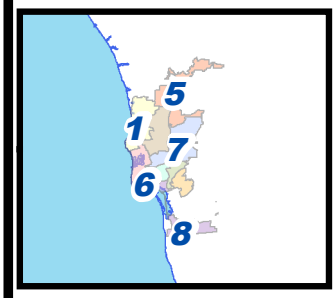
Construction Cash Flow Forecast

"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

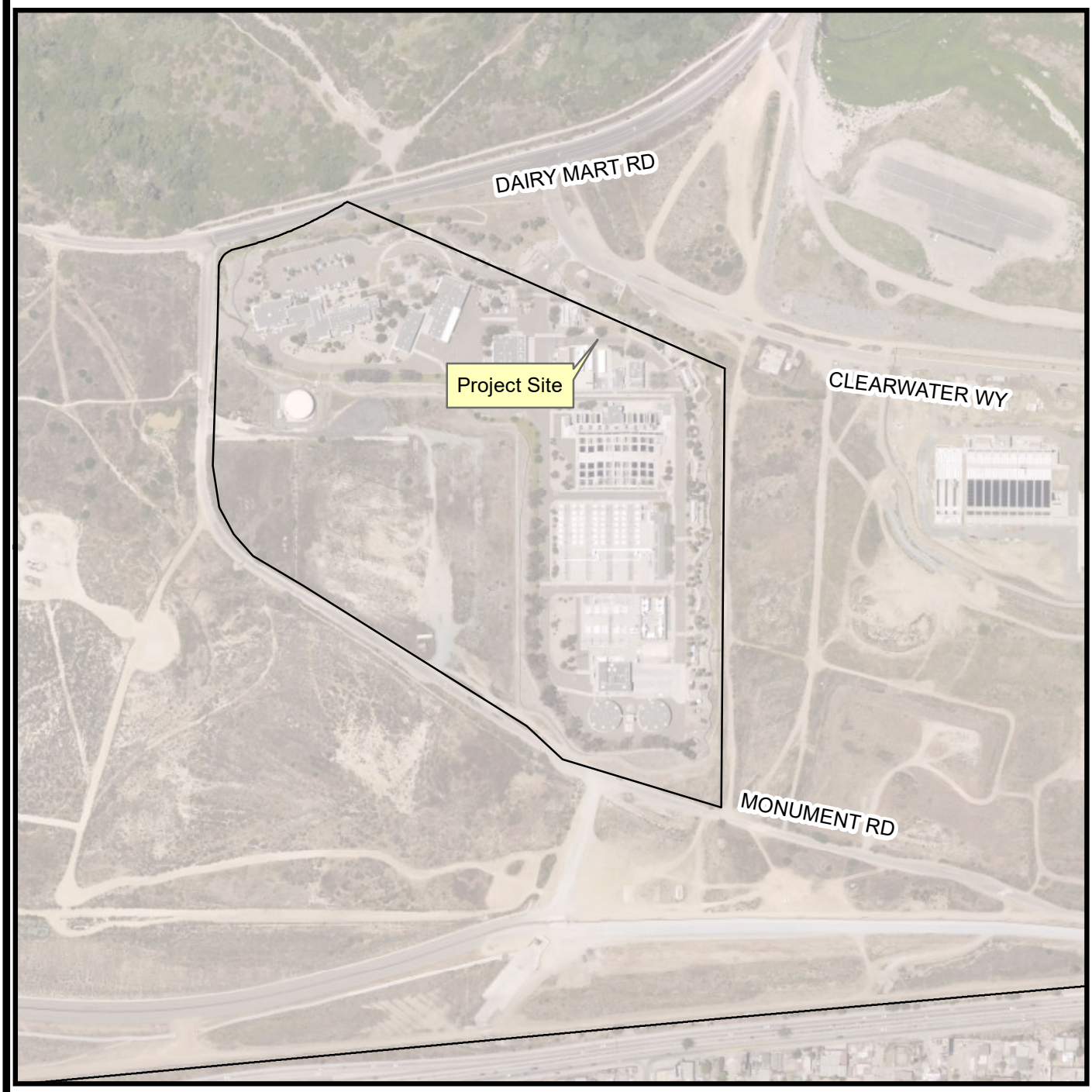
LOCATION MAP



Engineering & Capital Projects

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT

FOR QUESTIONS ABOUT THIS PROJECT
Call: 619-533-4207
Email: engineering@sandiego.gov



Legend

South Bay Water Reclamation Plant

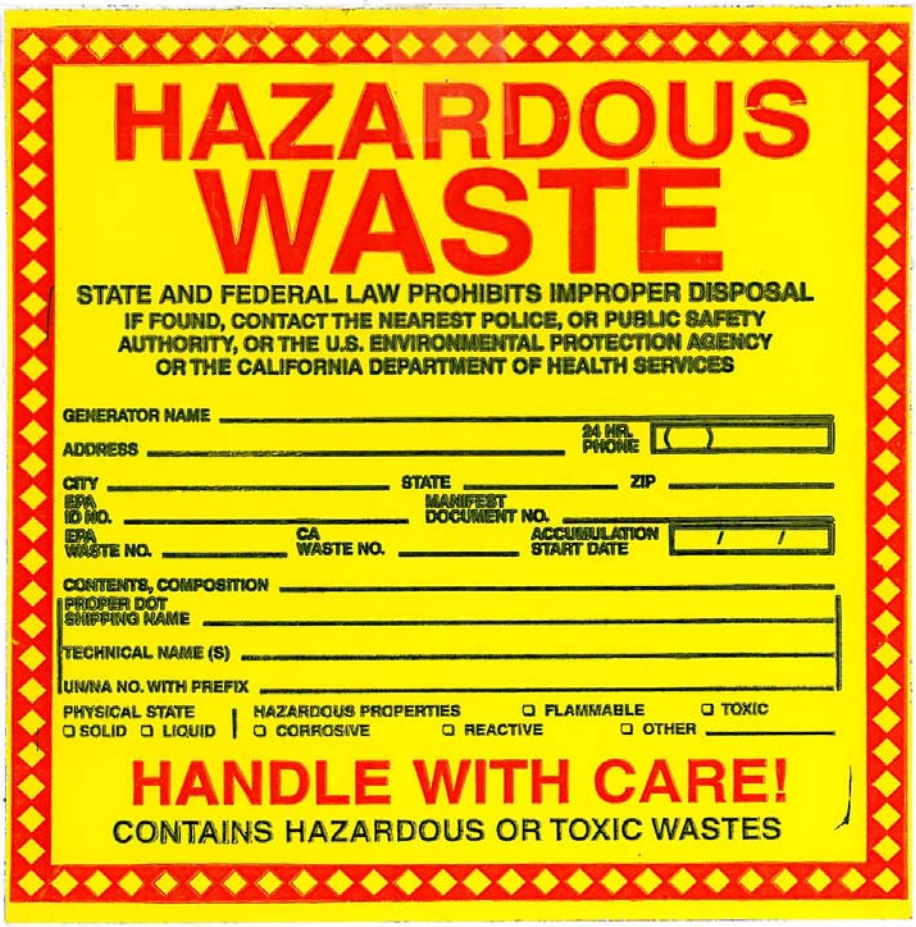
N
W
E
S

COMMUNITY NAME: Tijuana River Valley
COUNCIL DISTRICT: 8
WBS NO: B20002 (W)
Date: 10/19/2021

SanGIS

APPENDIX F

HAZARDOUS WASTE LABEL/FORMS


HAZARDOUS
WASTE
STATE AND FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY
AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY
OR THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES
GENERATOR NAME
ADDRESS
24 HR. PHONE
CITY
STATE
ZIP
EPA ID NO.
MANIFEST DOCUMENT NO.
EPA WASTE NO.
CA WASTE NO.
ACCUMULATION START DATE
CONTENTS, COMPOSITION
PROPER DOT SHIPPING NAME
TECHNICAL NAME (S)
UN/NA NO. WITH PREFIX
PHYSICAL STATE
SOLID LIQUID
HAZARDOUS PROPERTIES
CORROSIVE
REACTIVE
FLAMMABLE
TOXIC
OTHER
HANDLE WITH CARE!
CONTAINS HAZARDOUS OR TOXIC WASTES

INCIDENT/RELEASE ASSESSMENT FORM [1]

If you have an emergency, Call 911

Handlers of hazardous materials are required to report releases. The following is a tool to be used for assessing if a release is reportable. Additionally, a non-reportable release incident form is provided to document why a release is not reported (see back).

Questions for Incident Assessment:	YES	NO
1. Was anyone killed or injured, or did they require medical care or admitted to a hospital for observation?	❒	❒
2. Did anyone, other than employees in the immediate area of the release, evacuate?	❒	❒
3. Did the release cause off-site damage to public or private property?	❒	❒
4. Is the release greater than or equal to a reportable quantity (RQ)?	❒	❒
5. Was there an uncontrolled or unpermitted release to the air?	❒	❒
6. Did an uncontrolled or unpermitted release escape secondary containment, or extend into any sewers, storm water conveyance systems, utility vaults and conduits, wetlands, waterways, public roads, or off site?	❒	❒
7. Will control, containment, decontamination, and/or clean up require the assistance of federal, state, county, or municipal response elements?	❒	❒
8. Was the release or threatened release involving an unknown material or contains an unknown hazardous constituent?	❒	❒
9. Is the incident a threatened release (a condition creating a substantial probability of harm that requires immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment)?	❒	❒
10. Is there an increased potential for secondary effects including fire, explosion, line rupture, equipment failure, or other outcomes that may endanger or cause exposure to employees, the general public, or the environment?	❒	❒

If the answer is YES to any of the above questions – report the release to the California Office of Emergency Services at 800-852-7550 and the local CUPA daytime: (619) 338-2284, after hours: (858) 565-5255. Note: other state and federal agencies may require notification depending on the circumstances.

Call 911 in an emergency

If all answers are NO, complete a Non Reportable Release Incident Form (page 2 of 2) and keep readily available. Documenting why a "no" response was made to each question will serve useful in the event questions are asked in the future, and to justify not reporting to an outside regulatory agency.

If in doubt, report the release.

[1] This document is a guide for accessing when hazardous materials release reporting is required by Chapter 6.95 of the California Health and Safety Code. It does not replace good judgment, Chapter 6.95, or other state or federal release reporting requirements.

NON REPORTABLE RELEASE INCIDENT FORM

1. RELEASE AND RESPONSE DESCRIPTION Incident #_____

Date/Time Discovered	Date/Time Discharge	Discharge Stopped ☐ Yes ☐ No
Incident Date / Time:		
Incident Business / Site Name:		
Incident Address:		
Other Locators (Bldg, Room, Oil Field, Lease, Well #, GIS)		
Please describe the incident and indicate specific causes and area affected. Photos Attached?: ☐Yes ☐No		
Indicate actions to be taken to prevent similar releases from occurring in the future.		

2. ADMINISTRATIVE INFORMATION

Supervisor in charge at time of incident:	Phone:
Contact Person:	Phone:

3. CHEMICAL INFORMATION

Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Clean-Up Procedures & Timeline:	
Completed By:	Phone:
Print Name:	Title:

EMERGENCY RELEASE FOLLOW - UP NOTICE REPORTING FORM

A

BUSINESS NAME

FACILITY EMERGENCY CONTACT & PHONE NUMBER
( ) -

B

INCIDENT DATE MO DAY YR

TIME OES NOTIFIED (use 24 hr time)

OES CONTROL NO.

C

INCIDENT ADDRESS LOCATION

CITY / COMMUNITY

COUNTY ZIP

D

CHEMICAL OR TRADE NAME (print or type)

CAS Number

CHECK IF CHEMICAL IS LISTED IN 40 CFR 355, APPENDIX A ☐

CHECK IF RELEASE REQUIRES NOTIFI - CATION UNDER 42 U.S.C. Section 9603 (a) ☐

PHYSICAL STATE CONTAINED ☐ SOLID ☐ LIQUID ☐ GAS

PHYSICAL STATE RELEASED ☐ SOLID ☐ LIQUID ☐ GAS

QUANTITY RELEASED

ENVIRONMENTAL CONTAMINATION ☐ AIR ☐ WATER ☐ GROUND ☐ OTHER

TIME OF RELEASE

DURATION OF RELEASE
___DAYS ___HOURS ___MINUTES

E

ACTIONS TAKEN

F

KNOWN OR ANTICIPATED HEALTH EFFECTS (Use the comments section for addition information)

☐ ACUTE OR IMMEDIATE (explain) _____

☐ CHRONIC OR DELAYED (explain) _____

☐ NOTKNOWN (explain)

G

ADVICE REGARDING MEDICAL ATTENTION NECESSARY FOR EXPOSED INDIVIDUALS

H

COMMENTS (INDICATE SECTION (A - G) AND ITEM WITH COMMENTS OR ADDITIONAL INFORMATION)

I

CERTIFICATION: I certify under penalty of law that I have personally examined and I am familiar with the information submitted and believe the submitted information is true, accurate, and complete.

REPORTING FACILITY REPRESENTATIVE (print or type) _____

SIGNATURE OF REPORTING FACILITY REPRESENTATIVE _____ DATE: _____

EMERGENCY RELEASE FOLLOW-UP NOTICE
REPORTING FORM INSTRUCTIONS

GENERAL INFORMATION:

Chapter 6.95 of Division 20 of the California Health and Safety Code requires that written emergency release follow-up notices prepared pursuant to 42 U.S.C. § 11004, be submitted using this reporting form. Non-permitted releases of reportable quantities of Extremely Hazardous Substances (listed in 40 CFR 355, appendix A) or of chemicals that require release reporting under section 103(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [42 U.S.C. § 9603(a)] must be reported on the form, as soon as practicable, but no later than 30 days, following a release. The written follow-up report is required in addition to the verbal notification.

BASIC INSTRUCTIONS:

- The form, when filled out, reports follow-up information required by 42 U.S.C § 11004. Ensure that all information requested by the form is provided as completely as possible.
- If the incident involves reportable releases of more than one chemical, prepare one report form for each chemical released.
- If the incident involves a series of separate releases of chemical(s) at different times, the releases should be reported on separate reporting forms.

SPECIFIC INSTRUCTIONS:

Block A: Enter the name of the business and the name and phone number of a contact person who can provide detailed facility information concerning the release.

Block B: Enter the date of the incident and the time that verbal notification was made to OES. The OES control number is provided to the caller by OES at the time verbal notification is made. Enter this control number in the space provided.

Block C: Provide information pertaining to the location where the release occurred. Include the street address, the city or community, the county and the zip code.

Block D: Provide information concerning the specific chemical that was released. Include the chemical or trade name and the Chemical Abstract Service (CAS) number. Check all categories that apply. Provide best available information on quantity, time and duration of the release.

Block E: Indicate all actions taken to respond to and contain the release as specified in 42 U.S.C. § 11004(c).

Block F: Check the categories that apply to the health effects that occurred or could result from the release. Provide an explanation or description of the effects in the space provided. Use Block H for additional comments/information if necessary to meet requirements specified in 42 U.S.C. § 11004(c).

Block G: Include information on the type of medical attention required for exposure to the chemical released. Indicate when and how this information was made available to individuals exposed and to medical personnel, if appropriate for the incident, as specified in 42 U.S.C. § 11004(c).

Block H: List any additional pertinent information.

Block I: Print or type the name of the facility representative submitting the report. Include the official signature and the date that the form was prepared.

MAIL THE COMPLETED REPORT TO:

State Emergency Response Commission (SERC)
Attn: Section 304 Reports
Hazardous Materials Unit
3650 Schriever Avenue
Mather, CA 95655

NOTE: Authority cited: Sections 25503, 25503.1 and 25507.1, Health and Safety Code. Reference: Sections 25503(b)(4), 25503.1, 25507.1, 25518 and 25520, Health and Safety Code.

APPENDIX G

SAMPLE OF PUBLIC NOTICE

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

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Hours and Days of Operation:
Monday through Friday X:XX AM to X:XX PM.

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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

RESERVED

ATTACHMENT G

CONTRACT AGREEMENT

ATTACHMENT G

CONTRACT AGREEMENT

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and **Burtech Pipeline Incorporated**, herein called "Contractor" for construction of **STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT;** Bid No. **K-23-2064-DBB-3-A;** in the total amount **Two Million Eight Hundred Forty Thousand Six Hundred Fifty Dollars and Zero Cents ($2,840,650.00)**, which is comprised of the Base Bid.

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) That certain documents entitled **STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT**, on file in the Purchasing & Contracting Department as Document No. **B-20002**, as well as all matters referenced therein.

2. 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 **STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT**, Bid No. **K-23-2064-DBB-3-A**, San Diego, California.

3. 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.

4. 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.

5. 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 _____

Print Name: Stephen Samara
Principal Contract Specialist
Purchasing & Contracting Department

Date: 12/8/2022

APPROVED AS TO FORM

Mara W. Elliott, City Attorney

By _____

Print Name: Frank Ahn
Deputy City Attorney

Date: 12/27/2022

CONTRACTOR

By _____

Print Name: Dominic J. Burtech

Title: President & CEO

Date: 11/9/2022

City of San Diego License No.: B1996002066

State Contractor's License No.: 718202

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: 1000006324

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:

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT
(Project Title)

as particularly described in said contract and identified as Bid No. **K-23-2064-DBB-3-A**, SAP No. (WBS) **B-20002;** 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 BURTECH PIPELINE, INCORPORATED as Principal, and NATIONWIDE MUTUAL INSURANCE COMPANY 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

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT; BID NO.: K-23-2064-DBB-3-A

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 13TH day of SEPTEMBER, 20 22

BURTECH PIPELINE, INCORPORATED (SEAL)
(Principal)

By: ✓ _____
(Signature)
DOMINIC J. BURTECH, JR., PRESIDENT

NATIONWIDE
MUTUAL INSURANCE COMPANY (SEAL)
(Surety)

By: Mark D. Iatarola
(Signature)
MARK D. IATAROLA, ATTORNEY-IN-FACT

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

CALIFORNIA ALL-PURPOSE 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 10/4/2022 (Date) before me, Arthur Patrick Arquilla, Notary Public (Here Insert Name and Title of the Officer)

Personally appeared Dominic Burtech (Name(s) of Signer(s))

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 _____ (Signature of Notary Public)

ARTHUR PATRICK ARQUILLA
COMM. #2386204
NOTARY PUBLIC-CALIFORNIA
SAN DIEGO COUNTY
My Comm. Expires January 7 2026

Place Notary Seal Above

OPTIONAL

Though this section is optional, completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document _____ Document Date _____

Number of Pages _____ Signer(s) Other Than Named Above _____

Capacity(ies) Claimed by Signer(s)

Signer's Name _____
- ☐ Corporate Officer—Title(s) _____
- ☐ Partner ☐ Limited ☐ General
- ☐ Individual ☐ Attorney in Fact
- ☐ Trustee ☐ Guardian or Conservator
- ☐ Other _____

Signer Is Representing _____

Signer's Name _____
- ☐ Corporate Officer—Title(s) _____
- ☐ Partner ☐ Limited ☐ General
- ☐ Individual ☐ Attorney in Fact
- ☐ Trustee ☐ Guardian or Conservator
- ☐ Other _____

Signer Is Representing _____

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT CIVIL CODE § 1189

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 9/13/2022 (*Date*) before me, SANDRA FIGUEROA, NOTARY PUBLIC (*Here Insert Name and Title of the Officer*),

personally appeared MARK D. IATAROLA (*Name(s) of Signer(s)*),

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.

SANDRA FIGUEROA
COMM. # 2334108
SAN DIEGO COUNTY
NOTARY PUBLIC-CALIFORNIA
MY COMMISSION EXPIRES
SEPTEMBER 22, 2024

Place Notary Seal and/or Stamp Above

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 _____
Signature of Notary Public

OPTIONAL

Completing this information can deter alteration of the document or fraudulent reattachment of this form to an unintended document.

Description of Attached Document

Title or Type of Document: _____

Document Date: _____ Number of Pages: _____

Signer(s) Other Than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: MARK D. IATAROLA	Signer's Name: _____
☐ Corporate Officer – Title(s): _____	☐ Corporate Officer – Title(s): _____
☐ Partner – ☐ Limited ☐ General	☐ Partner – ☐ Limited ☐ General
☐ Individual ☒ Attorney in Fact	☐ Individual ☐ Attorney in Fact
☐ Trustee ☐ Guardian of Conservator	☐ Trustee ☐ Guardian of Conservator
☐ Other: _____	☐ Other: _____
Signer is Representing: _____	Signer is Representing: _____

Power of Attorney

KNOW ALL MEN BY THESE PRESENTS THAT:

Nationwide Mutual Insurance Company, an Ohio corporation

hereinafter referred to severally as the "Company" and collectively as "the Companies" does hereby make, constitute and appoint:
HELEN MALONEY; JOHN G MALONEY; MARK D IATAROLA; SANDRA FIGUEROA; TRACY LYNN RODRIGUEZ;

each in their individual capacity, its true and lawful attorney-in-fact, with full power and authority to sign, seal, and execute on its behalf any and all bonds and undertakings, and other obligatory instruments of similar nature, in penalties not exceeding the sum of

UNLIMITED

and to bind the Company thereby, as fully and to the same extent as if such instruments were signed by the duly authorized officers of the Company; and all acts of said Attorney pursuant to the authority given are hereby ratified and confirmed.

This power of attorney is made and executed pursuant to and by authority of the following resolution duly adopted by the board of directors of the Company:

"RESOLVED, that the president, or any vice president be, and each hereby is, authorized and empowered to appoint attorneys-in-fact of the Company, and to authorize them to execute and deliver on behalf of the Company any and all bonds, forms, applications, memorandums, undertakings, recognizances, transfers, contracts of indemnity, policies, contracts guaranteeing the fidelity of persons holding positions of public or private trust, and other writings obligatory in nature that the business of the Company may require; and to modify or revoke, with or without cause, any such appointment or authority; provided, however, that the authority granted hereby shall in no way limit the authority of other duly authorized agents to sign and countersign any of said documents on behalf of the Company."

"RESOLVED FURTHER, that such attorneys-in-fact shall have full power and authority to execute and deliver any and all such documents and to bind the Company subject to the terms and limitations of the power of attorney issued to them, and to affix the seal of the Company thereto; provided, however, that said seal shall not be necessary for the validity of any such documents."

This power of attorney is signed and sealed under and by the following bylaws duly adopted by the board of directors of the Company.

Execution of Instruments. Any vice president, any assistant secretary or any assistant treasurer shall have the power and authority to sign or attest all approved documents, instruments, contracts, or other papers in connection with the operation of the business of the company in addition to the chairman of the board, the chief executive officer, president, treasurer or secretary; provided, however, the signature of any of them may be printed, engraved, or stamped on any approved document, contract, instrument, or other papers of the Company.

IN WITNESS WHEREOF, the Company has caused this instrument to be sealed and duly attested by the signature of its officer the 20th day of August, 2021.

Antonio C. Albanese, **Vice President** of Nationwide Mutual Insurance Company

ACKNOWLEDGMENT

STATE OF NEW YORK COUNTY OF NEW YORK: ss
On this 20th day of August, 2021, before me came the above-named officer for the Company aforesaid, to me personally known to be the officer described in and who executed the preceding instrument, and he acknowledged the execution of the same, and being by me duly sworn, deposes and says, that he is the officer of the Company aforesaid, that the seal affixed hereto is the corporate seal of said Company, and the said corporate seal and his signature were duly affixed and subscribed to said instrument by the authority and direction of said Company.

Stephanie Rubino McArthur
Notary Public, State of New York
No. 02MC6270117
Qualified in New York County
Commission Expires October 19, 2024

Notary Public
My Commission Expires
October 19, 2024

CERTIFICATE

I, Laura B. Guy, Assistant Secretary of the Company, do hereby certify that the foregoing is a full, true and correct copy of the original power of attorney issued by the Company; that the resolution included therein is a true and correct transcript from the minutes of the meetings of the boards of directors and the same has not been revoked or amended in any manner; that said Antonio C. Albanese was on the date of the execution of the foregoing power of attorney the duly elected officer of the Company, and the corporate seal and his signature as officer were duly affixed and subscribed to the said instrument by the authority of said board of directors; and the foregoing power of attorney is still in full force and effect.

IN WITNESS WHEREOF, I have hereunto subscribed my name as Assistant Secretary, and affixed the corporate seal of said Company this 13TH day of SEPTEMBER, 2022.

Laura B. Guy
Assistant Secretary

BDJ 1(08-21)00

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: Burtech Pipeline, Incorporated

Certified By: Dominic J. Burtech (Name) Title: President & CEO

Signature Date: 10/5/2022

USE ADDITIONAL FORMS AS NECESSARY

Mandatory Disclosure of Business Interests Form

BIDDER/PROPOSER INFORMATION

Legal Name		DBA	
Burtech Pipeline, Incorporated			
Street Address	**City**	**State**	**Zip**
1325 Pipeline Drive	Vista	CA	92081
Contact Person, Title		**Phone**	**Fax**
Buddy Aquino - Chief Estimator		(760) 634-2822	(760) 634-2415

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
Dominic J. Burtech	President & CEO
City and State of Residence	**Employer (if different than Bidder/Proposer)**
Encinitas, CA	
Interest in the transaction	
51%	

Name	Title/Position
Julie J. Burtech	Exec. VP & Secretary
City and State of Residence	**Employer (if different than Bidder/Proposer)**
Encinitas, CA	
Interest in the transaction	
49%	

*** 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.

Dominic J. Burtech - President & CEO	✓	10/5/2022
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
Dominic J. Burtech	President & CEO
Julie J. Burtech	Exec. VP & Secretary

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: Burtech Pipeline, Incorporated

Certified By Dominic J. Burtech Title President & CEO

Name

Date 10/5/2022

Signature

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
R & C Structures, Inc.	
Kelly Santar	President
Peter Santar	Vice President

☑ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Makelele Systems Landscape & Maintenance, Inc.	
Jose Cardenas	President

☑ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
Siege Electric, Inc.	
Joshua Middleton	President

☑ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE
NOVA Engineering	
Mellor Landy	President

Contractor Name: Burtech Pipeline, Incorporated

Certified By Dominic J. Burtech Title President & CEO

Name

Date 10/5/2022

Signature

****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
In-Line Construction	
David Ortiz	President

☐ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE

☐ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE

☐ SUBCONTRACTOR ☐ SUPPLIER ☐ MANUFACTURER

NAME	TITLE

Contractor Name: Burtech Pipeline, Incorporated

Certified By: Dominic J. Burtech (Name) Title: President & CEO

Signature Date: 10/5/2022

****USE ADDITIONAL FORMS AS NECESSARY****

City of San Diego

CITY CONTACT: Rosa Riego, Senior Contract Specialist, Email: RRiego@sandiego.gov
Phone No. (619) 533-3426

ADDENDUM A

e - Bidding

FOR

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT

BID NO.: **K-23-2064-DBB-3-A**
SAP NO. (WBS/IO/CC): **B-20002**
CLIENT DEPARTMENT: **2000**
COUNCIL DISTRICT: **8**
PROJECT TYPE: **CC**

BID DUE DATE:

2:00 PM
September 22, 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. Section 44 30 00 paragraph 1.01.A calls for a positive displacement blower. The design criteria listed in paragraph 2.01 suggests that this specification is intended for a centrifugal fan. Can you please reconfirm what type of blower/fan is required?

A1. Correct. A centrifugal fan is required. Please see updates as part of this Addendum.

Q2. If Section 44 30 00 paragraph 1.01.A refers to a centrifugal fan application, can you advise if FRP can be accepted as the material of construction in lieu of the 316 or cast aluminum specified?

A2. FRP is acceptable.

C. NOTICE INVITING BIDS

1. To page 6, **ADD "PRE-BID NON-MANDATORY SITE VISIT":**

PRE-BID SITE VISIT: All those wishing to submit a bid are encouraged to visit the Work Site with the Engineer. The purpose of the Site visit is to acquaint Bidders with the Site conditions. The Pre-Bid Site Visit is scheduled as follows:

Time: **10:30 AM**
Date: **Thursday September 1st, 2022**
Location: **South Bay Water Reclamation Plant, 2411 Dairy Mart Road, San Diego, CA 92154**

D. ATTACHMENTS

1. To Attachment E, Supplementary Special Provisions, Technicals, page 322, **SECTION 44 30 00, FOUL AIR BLOWER,** Part 1 - GENERAL, **1.01 SUMMARY,** Item **A, DELETE** in its entirety and **SUBSTITUTE** with the following:

   A. Section includes centrifugal fan (air blower). Air blower will transfer air from the sanitary sewer pump station to the water reclamation plant's existing odor control system.

Rania Amen, Director
Engineering & Capital Projects Department

Dated: *August 26, 2022*
San Diego, California

MK/AP/yk

City of San Diego

CITY CONTACT: Rosa Riego, Senior Contract Specialist, Email: RRiego@sandiego.gov
Phone No. (619) 533-3426

ADDENDUM B

e - Bidding

FOR

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT

BID NO.: **K-23-2064-DBB-3-B**
SAP NO. (WBS/IO/CC): **B-20002**
CLIENT DEPARTMENT: **2000**
COUNCIL DISTRICT: **8**
PROJECT TYPE: **CC**

BID DUE DATE:

2:00 PM
October 5, 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.

THE SUBMITTAL DATE FOR THIS PROJECT HAS BEEN **EXTENDED AS STATED ON THE COVER PAGE.**

Rania Amen, Director
Engineering & Capital Projects Department

Dated: *September 19, 2022*
San Diego, California

MK/AP/yk

City of San Diego

CITY CONTACT: Rosa Riego, Senior Contract Specialist, Email: RRiego@sandiego.gov
Phone No. (619) 533-3426

ADDENDUM C

e - Bidding

FOR

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT

BID NO.: **K-23-2064-DBB-3-A**
SAP NO. (WBS/IO/CC): **B-20002**
CLIENT DEPARTMENT: **2000**
COUNCIL DISTRICT: **8**
PROJECT TYPE: **CC**

BID DUE DATE:

2:00 PM
October 5, 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:

Kathleen S Haynes	09/20/22	Seal:	
1) For Registered Engineer	Date		
Brian Vitelle	09/20/2022	Seal:	
2) For City Engineer	Date		

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. References are made to (DCS) Distributed Control System throughout the specifications. Under the control strategy Specification 40 61 96 and P&ID drawing I-02, existing Plant DCS is capable of controlling pumps, monitoring pump status, monitoring wet well, monitoring check valves, monitoring 00PNL101, and foul air exhaust fan Via Software or communication Link. Is the existing Plant DCS being programmed and or modified? Which includes Hardware that may need to be modified. Will this scope be performed by the City of San Diego Operations or is this scope the awarded contractor's responsibility for the programming and the set up to the existing Plant DCS?

A1. Please refer to updated specifications 40 91 00 and 40 92 07 and plans for clarification. (See Section C. of this Addendum)

Q2. Can a list of the Certified SLBEs/ELBEs be provided with addresses? I have used the current Certified SLBEs/ELBEs posted online.

A2. The City does not have a list of certified SLBE/ELBE firms including business addresses. As a reminder, three follow up phone calls to SLBE/ELBE subcontractors is required. Please refer to the Small Local Business (SLBE) Program Instructions For Bidders Completing The Good Faith Effort Submittal: https://www.sandiego.gov/sites/default/files/legacy/eoc/pdf/slbegfeinst.pdf

Q3. Drawing S-6 refers to designing the shoring and placing compacted fill per the geotechnical report. The geotechnical report does not provide any information for the location of the wet well location nor at the depth required.

The project geotechnical report, Kleinfelder dated April 19, 2021, reports two bores for the project. Boring B-1 is 19.5' deep next to the 96" diversion structure, to an approx. elevation of 37 feet with no groundwater. Boring B-2 is 20' deep next to a 48" diversion structure to

an elevation of approx. elevation of 39 feet also with no groundwater. Both are approx. 200’ from the new wet well that is approx. 35’ deep, that extends to an elevation of 22.15 feet. Drawing S-6 shows a groundwater elevation of 40 feet.

Can the city provide additional geotechnical information regarding the soils/groundwater at the wet well location and depth?

A3. The groundwater elevation of 40 ft msl on Drawing S-6 was noted as a long-term high-water elevation for project design and possible maximum seasonal fluctuation during construction. The two nearby Kleinfelder borings referenced in the RFI encountered refusal on cobbles at approximate elevations of 37 and 39 feet MSL and did not encounter groundwater.

The site is located within the Tijuana River Valley with associated tributaries. As a result, groundwater elevations are subject to seasonal fluctuations with geotechnical borings only providing a snapshot of the day of drilling which could be within the dry season or extended drought such as we are currently experiencing. It is not known when construction excavation may occur, and it is not possible to forecast the severity of upcoming rainy season.

For the Kleinfelder 2021 study, we reviewed previous geotechnical reports in the area with selected results summarized below. The 1995 report by Woodward Clyde was an extensive study for initial development of the entire facility. In addition to the groundwater elevations of 27 to 28 feet MSL measured at the time of drilling, The 1995 report estimated that maximum seasonal groundwater elevations may be on the order of approximately 35 to 40 ft MSL, and that 40 ft MSL be used for design of structures.

The contractor is responsible for selecting the groundwater elevation and designing a dewatering system to maintain a dry excavation and stable shoring system throughout the duration of construction.

1995 Report (Woodward-Clyde) Prior to Construction: Borings from Feb/March 1995

- B-3: 600’ from wet well/Surface 47’ msl /GW @ 27 feet msl/ Total bore depth to el 15.5’ msl

- B-4: 300’ from wet well/Surface 50’ msl /GW @ 28 feet msl// Total bore depth to el 16.7 ’ msl
- B-5: 450’ from wet well/Surface 51’ msl /GW @ 28 feet msl// Total bore depth el 20.5’ msl

2014 Report: Borings from Dec 2013

- B-1: 200’ from wet well/Surface of boring 56’ msl/GW Level not encountered/ Total bore depth to el 39’ msl
- B-2: 250’ from wet well/Surface of boring 56’ msl/GW Level not encountered/ Total bore depth to el 39’ msl

C. ATTACHMENTS

1. To Attachment E, Supplementary Special Provisions, TECHNICALS, ADD “**Section 40 91 00, INSTRUMENTATION AND CONTROL COMPONENTS”**, pages 6 through 31of this Addendum.

2. To ATTACHMENT E, SUPPLEMENTARY SPECIAL PROVISIONS, TECHNICALS, Section **40 92 07, NETWORK COMPONENTS**, pages 319 through 321, **DELETE** in their entirety and **SUBSTITUTE** with pages 32 through 34 of this Addendum.

D. PLANS

1. To Drawing number **42199-33-D**, **DELETE** in its entirety and **REPLACE** with **42199-33-D**, page 35 of this Addendum.

Rania Amen, Director
Engineering & Capital Projects Department

Dated: *September 22, 2022*
San Diego, California

MK/AP/yk

SECTION 40 91 00

INSTRUMENTATION AND CONTROL COMPONENTS

PART 1 - GENERAL

1.01 WORK OF THIS SECTION

A. The WORK of this Section includes the general specification and requirements for the instrumentation and control WORK under this and other applicable Specifications. The WORK also includes providing instrumentation and related wiring as shown in these Contract Documents.

B. Contractor shall be responsible for the design, procurement, installation, testing, training, and documentation for instrumentation and control systems provided under this Contract.

C. Contractor shall be responsible for the generation of panel wiring diagrams and loop drawings which depict the interconnection between instruments, panels, and MCCs.

D. These drawings shall be forwarded to the Construction Manager. The Construction Manager will incorporate the Contractor's data and generate a complete loop drawing for each measuring or control loop. The loop drawing shall include a minimum of 3 sheets as required in paragraph 1.5 B.2.

E. Contractor shall be responsible for supplying and installing a pump control panel, and the programming of PLC control logic and configuration of the human machine interface (HMI) software of the pump control panel. Contractor shall be responsible for the supply and installation of the Emerson Ethernet Link Controller (ELC) Module and EIP license, and a Cisco integrated services router in the 29PCM01 Controller cabinet. Contractor shall coordinate with the City's DCS representative to provide a completely integrated control system free of signal and communication incompatibilities. The City's DCS representative shall be responsible for DCS programming and integration, which includes DCS control programming, DCS HMI programming, DCS control strategies, DCS ELC configuration and programming, and IP address assignments.

F. Control system field tests including loop tests, plant commissioning, and plant startup, shall be a responsibility of the Contractor. Contractor shall be responsible for providing personnel and equipment (current drivers, jumpers, read out devices, oscilloscopes, voltage-resistance meters, etc.) required to perform the loop test simulations. Devices used shall be traceable to the National Institute of Standards and Technology (NIST).

G. Contractor shall perform field engineering design as required for mounting and supporting field mounted components. Contractor shall develop any additional schematic and interconnection diagrams which may be required for complete and operable instrumentation.

1.02 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. Division 26 Electrical, as applicable

1.03 CODES

A. 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 Fire Code
   2. National Electrical Code

1.04 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1	ANSI/ASME B 16.5	Pipe Flanges and Flanged Fittings
2	API RP-550	Manual on Installation of Refinery Instruments and Control Systems, Part 1 - Process Instrumentation and Control Sections 1 Through 13
3	ASTM A 105	Specification for Forgings, Carbon Steel for Piping Components
4	ASTM A 193	Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
5	ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
6	ASTM A 283	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes, and Bars
7	ISA-RP60.6	Nameplates, Labels, and Tags for Control Centers
8	ISA-RP12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
9	ISA-S5.1	Instrument Symbols and Identification
10	ISA-S5.4	Instrument Loop Diagrams
11	ISA-S20	Specification Forms for Process Measurement and Control Instrumentation; Primary Elements and Control Valves
12	ANSI - B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
13	ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
14	ASTM B 61	Specification for Steam or Valve Bronze Castings
15	ANSI/AWWA	Ductile-Iron and Gray-Iron Fittings.

1.05 SHOP DRAWINGS AND SAMPLES

A. Pre-submittal Conference:
   1. Contractor shall arrange and conduct a Pre-submittal Conference within 60 days after Notice to Proceed. The purpose of the Pre-submittal Conference is to review and approve the manner in which the Contractor intends to carry out their responsibilities for shop drawing submittal on the WORK to be provided under this Section. Contractor and Construction Manager shall attend. Both the Contractor and the Construction Manager may invite additional parties at their discretion.
   2. Contractor shall allot 8 hours for the Conference.

3. Contractor shall prepare the following for discussion at the Conference:
    a. List of equipment and materials for the instrumentation systems, including proposed manufacturer names and model numbers.
    b. List of proposed clarifications to the indicated requirements plus a brief written explanation of each exception. Review and acceptance of proposed clarifications will be according to Division 1.
    c. One complete example of each type of submittal proposed.
    d. A flow chart showing the steps the Contractor will take in preparing and coordinating each submittal to the Construction Manager.
    e. A bar chart type schedule for the WORK provided under this Section, covering the time period beginning with the conference and ending after startup and training. Dates for the beginning and ending of submittal preparation, submittal review, design, fabrication, programming, factory testing, delivery to the site, installation, field testing, and training shall be scheduled. The schedule shall be subdivided into major items or groups of items which are on the same schedule.
4. Contractor shall furnish 3 copies of the items above to the Construction Manager.
5. Contractor shall take formal minutes of the Conference, including events, questions, and resolutions. Prior to adjournment, parties must concur with the accuracy of the minutes and sign accordingly.

B. Shop Drawings:
    1. General:
        a. Preparation of shop drawings shall not commence until adjournment of the Pre-submittal Conference.
        b. In the Contract Documents, systems, meters, instruments, and other elements are represented by symbology derived from the latest version of ANSI/ISA S5.1. The nomenclature and numbers indicated herein shall be used exclusively in shop drawings. No manufacturer's standard symbology or nomenclature shall replace those indicated in the Contract Documents.
        c. During the period of shop drawing preparation, Contractor shall maintain a direct, informal liaison with the Construction Manager for exchange of technical information. As a result of the exchange, certain minor refinements and revisions to the indicated systems may be authorized informally by the Construction Manager but these shall not alter the WORK or cause increase or decrease in the Contract Price. During informal exchanges, no statement by the Construction Manager shall be construed as approval of any component or method or exception to or variation from these Contract Documents.
        d. Shop drawings shall include the letterhead or title block of the Contractor. The title block shall include, as a minimum, the Contractor registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing.
        e. Shop drawing copies shall be submitted as standard size 3-ring, loose- leaf, vinyl plastic binders suitable for bookshelf storage. Maximum binder size shall be 2 inches.
        f. A complete index shall be placed at the front of each binder.
        g. A separate technical brochure or bulletin shall be included for each instrument, meter system, and other element. The brochures shall be indexed by systems or loops. If, within a single system or loop, a single item is employed more than once, one brochure may cover identical uses of that item in the system. Each brochure shall include a list of tag numbers to which it applies. System groups shall be separated by labeled tags.
        h. Shop drawings shall be submitted as a single package at one time within 90 days of the commencement data stated in the Notice to Proceed.

i. Shop drawings shall be produced in using CAD formats. Each shop drawing submittal shall include the requisite number of hard copies and one (1) Microstation electronic copy. Upon completion of this project, the Contractor shall submit four (4) electronic copies of current shop drawings.

2. Loop diagrams conforming to ISA 5.4 to verify the interfaces with instrumentation and devices being provided or installed under the project. The loop diagrams shall also define interfaces with equipment provided by area Contractors. The following three-sheet format is required:

a. Sheet 1: A device schedule developed from an electronic spreadsheet or database file, which will be submitted with the loop diagrams. The table will show the following.

Device tag number, with Prefix, Unit Process, ISA Tag Prefix, Tag No. (a three or four-digit number based on the loop number) and Tag suffix
Equipment Service
Device Type
Location
(1) Device Manufacturer
(2) Model No.
(3) Spec. No.
(4) Area Contractor (if applicable
(5) Submittal No.
(6) Calibrated Range/Remarks
(7) Data Sheet No.
(8) I/O Signal type (AI, AO, DI, or DO)
(9) Signal Level
(10) Device Range (full available instrument range)
(11) Engineering Units
(12) Process Set Point
(13) Loop Diagram No., reflecting the field instrument tag number.
(14) Loop Drawing File Name
(15) Interconnect Drawing File Name

b. Sheet 2: Provide loop drawing meeting the Requirements of ANSI/ISA S5.4, except that intermediate terminal junction boxes may be omitted and be shown on Page 3 for clarity. Butt splices and wire nuts shall be shown on as-builts, with the corresponding termination housing (JB, LB, etc. shown on Sheet 3).

c. Sheet 3: Provide point-to-point conduit and wiring diagram, showing instrument, wire and cable numbers, intermediate terminal junction boxes, and PLC terminations. Wire identification numbers will reflect the field instrument tag number, and not the PLC I/O number.

d. PLC I/O tag numbers will generally reflect the device tag number. Each I/O tag number will be unique. The tag prefix will be based on ISA-5.4, with the following additional special acronyms:

Acronym	Signal Use
YL	Ready Signal/Motor Run
ZL	In Computer Status
ZSO	Device Open
ZSC	Device Closed
YL	Motor run

HS	In Computer Switch

3. Technical brochures, bulletins and data sheets containing:
   a. Fully completed ISA S20 data sheets
   b. Component functional descriptions
   c. Locations or assembly at which component is to be installed
   d. Materials of a component's parts which will be in contact with process fluids or gases
4. Schematic and wiring diagrams for control circuits shall be submitted in two stages. Initially, schematic control diagrams shall show complete details on the circuit interrelationships of devices within and outside each Control Panel. Subsequent to acceptance of schematic control diagrams, by the Construction Manager, piping and wiring diagrams shall be submitted. The diagrams shall consist of component layout drawings to scale, showing numbered terminals on components together with the unique number of the wire to be connected to each terminal. Piping and wiring diagrams shall show terminal assignments from primary measurement devices, such as flow meters, and to final control devices, such as pumps, valves, chemical feeders and local control panels. Wiring diagrams shall include MCC Panel, circuit, and breaker number for each power feed
5. Installation, mounting, and anchoring details for components and assemblies to be field mounted, including conduit connection or entry details.
6. Complete control panel layouts, drawn to a 1-1/2 inch=1 foot scale showing:
   a. Physical arrangements which define and quantify the physical groupings of annunciators, hand stations, recorders, indicators, pilot lights and other instrumentation devices associated with control panel sections, auxiliary panels, subpanels and racks.
   b. Cutout locations fully dimensioned. Outside panel dimensions shall be shown.
   c. Locations of back-of-panel stiffeners.
   d. Terminal point locations for panel and back-of-panel piping and wiring connections. Terminations shall be coded with identifiers for wiring and piping connections for electric, hydraulic and pneumatic terminations.
   e. Nameplate engraving list.
   f. A complete and detailed bill of material list shall be submitted for each field mounted device or assembly as well as cabinet assemblies and subassemblies. Bills of material shall include items within an enclosure. An incomplete submittal shall be rejected, and no further evaluation performed until a complete and detailed bill of material is submitted

1.06 OWNER'S MANUAL

A. Information included in the Owner's Manual shall comply with the requirements of Division 1 with the following exceptions:
   1. Two copies of the Owner's Manual shall be submitted after acceptance of submittals. One set will be returned to the Contractor with comments.
   2. Final copies of the Owner's Manual, after revision, shall be submitted to the Construction Manager 15 days prior to startup.

B. The following shall be included in the Owner's Manual in accordance with Division 1:
   1. Installation, connection, operating, troubleshooting, maintenance, and overhaul instructions from the manufacturer.
   2. Exploded or details views of instruments, assemblies, and accessory components.
      a. Parts lists and ordering instructions.
      b. Wiring diagrams.

c. A list of spare parts for 1 year operation recommended by the manufacturers of analog equipment.

1.07 AS-BUILT DRAWINGS

A. As-built drawings shall be prepared in accordance with Division 1 with the following exceptions and changes:
   1. Contractor shall keep current an approved set of complete loop diagrams and schematic diagrams which shall include field and panel wiring, piping and tubing runs, routing, mounting details, point-to-point diagrams with cable, wire, tube and termination numbers. These drawings shall include instruments and instrument elements for the complete instrument loop as provided under Divisions 40, and 26 of this Contract.
   2. One set of original drawings and two copies of each as-built drawing under this Section shall be submitted to the Construction Manager after completion of field checkout but before placing the systems in service for the Owner's use.
   3. Drawings shall also be submitted in electronic format AUTOCAD.

1.08 SERVICES OF MANUFACTURER

A. Calibration, Testing and Startup: A technical service representative of the manufacturer shall visit the site and perform the following on flow meters and analyzers.
   1. Inspection, checking and calibrating the equipment.
   2. Startup and field testing for proper operation.
   3. Performing field adjustments to ensure that installation and operation comply with the Specifications.

B. Instruction of Owner's Personnel: The manufacturer's technical service representative shall instruct the Owner's personnel as indicated in Paragraph 3.4.

1.09 SPECIAL GUARANTEE

A. Contractor shall guarantee the WORK of this section for two years following final acceptance of the WORK. In making any warranty repairs, the Contractor shall utilize technical service personnel designated by the manufacturer of the failed device. Repairs shall be completed within 5 days after written notification by the Owner.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Products delivered to the site for incorporation into the WORK of this Section 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.

1.11 ENVIRONMENTAL CONDITIONS

A. General: I Instrumentation and control system components and associated wiring shall be suitable for use in a treatment facility environment where there may be high energy AC fields, DC control pulses, and varying ground potentials between transducers and system components. The system design shall be adequate to provide proper protection against interferences from such possible situations.

B. Field Situated Equipment: The instrumentation and control system shall be installed on a wastewater treatment plant site. Devices shall be designed to exist in environments rated G3

per ISA S71.04. The system design shall be adequate to provide proper protection the environment typically associated with these facilities. As a minimum, the instrumentation and control systems shall be designed and constructed for satisfactory operation and low maintenance requirements under the following environmental conditions:

1. Temperature Range: 0 through 50 degrees C (32 through 122 degrees F)
2. Thermal Shock: 0.55 degrees C per minute (1.0 degrees F per minute)
3. Relative Humidity: 20 through 95 percent (non-condensing)

C. Control Room Situated Equipment**:** Components of the instrumentation and control system shall be rated to operate in an environment where the ambient temperature is 15 through 35 degrees C (59 through 95 degrees F) and the relative humidity is 20 to 95 percent (non-condensing).

D. Noise Tolerance**:** The instrumentation and control system components shall not exceed a db level of 55 when monitored 3-feet away from the devices. If upon testing it is found that this limit is exceeded at the option of the Construction Manager and at no additional cost to the Owner, devices shall be replaced in order to achieve a maximum level of 55 db or sound absorption materials shall be added.

1.12 CABLE NUMBERING

A. The first two characters denote the facility or area number.

B. The second group of characters identifies the device being served (field device and loop number).

C. The third section uses one of the four suffixes in the table below. Where multiple 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 identification 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.

F. Nomenclature Table:

SUFFIX	CIRCUIT TYPE	EXAMPLE
(A)	24v dc analog (4-20 mA)	O1FIT022(A)-1(+)
(C)	120 volt AC control	05P320(C)-2
(D)	24v dc digital status or control	55LSH201(D)-1(+)
(P)	Power (120 volt, 480 v, 5 kv, 15 kv etc.)	01MCC6101(P)-2

PART 2 - PRODUCTS

2.01 GENERAL

A. Meters, instruments, and other components shall be of the most recent field- proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise indicated.

B. Panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one manufacturer.

C. Outdoor instrumentation shall be suitable for operation in the ambient conditions at the equipment installation locations. Heating, cooling, and dehumidifying devices shall be incorporated with the outdoor instrumentation in order to maintain it within its rated environmental operating ranges. Contractor shall provide power wiring for these devices. Outdoor enclosures suitable for the environment shall be provided.

D. Mercury switches and components containing liquid mercury shall not be used.

E. Instrumentation in hazardous areas shall be intrinsically safe or be approved for use in the particular hazardous classification in which it is to be installed.

F. Analog measurements and control signals shall be electrical and shall vary in direct linear proportion to the measured variable, except as indicated. Electrical signals outside control board(s) shall be 4 to 20 milliamperes DC except as noted. Signals within enclosures shall be 1-5 volts DC unless otherwise specified. Dropping resistors shall be installed at field side terminations in the control panels to ensure loop integrity.

G. The accuracy of each instrumentation system or loop shall be expressed as a probable maximum error; this shall be the square-root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of ± 0.5 percent of full scale and a minimum repeatability of ± 0.25 percent of full scale unless otherwise indicated. Instruments which do not conform to or improve upon these criteria are not acceptable.

H. Each control loop shall be individually fused.

I. Mounting of Instruments:
   1. Contractor shall provide cut-outs and shall mount instrument items indicated to be panel mounted, including any instruments indicated to be furnished by other manufacturers.
   2. Contractor shall also mount, behind the panels, other instrument accessory items as indicated.
   3. Rear of panel mounted equipment shall be installed with due regard to commissioning adjustments, servicing requirements and cover removal.
   4. Wiring shall be kept clear of spare space to give maximum space for future additions.

J. Electrical Requirements for Control Panels:
   1. Contractor shall provide wiring, conduit, wireways, and switches required to make instruments and other panel electrical devices operational.
   2. Conduit, wireways, junction boxes and fittings shall be installed for signal wire, thermocouple and resistance thermometer lead wire including those between temperature sensors and temperature indicators.

3. Each terminal connection shall have a plastic plate with a terminal and instrument tag number. Wiring shall be identified with stamped tubular wire markers.
4. Smaller panels shall be sized to adequately dissipate heat generated by equipment mounted in or on the panel.
5. Wiring Methods: Wiring methods and materials for panels shall be in accordance with the NEC requirements for General Purpose unless otherwise indicated. Opening wiring in close cabinet type panels is allowed when indicated.
6. Construction:
    a. Wire for 120-volt circuits shall be No. 12 AWG stranded with Type THHN/THWN-2 insulation. Terminals for external wiring connections shall be suitable for No. 12 AWG wire.
    b. Flexible conduit is not acceptable.
    c. Conduit fittings shall be cast fittings.
    d. Soldered or pressure crimped wire splicing in conduits shall be acceptable.
    e. For case grounding, panels shall be provided with a 1/4-inch by 1-inch copper ground buss completed with solderless connector for one No. 4 AWG bare stranded copper cable. Contractor shall connect the copper cable to a system ground loop.
    f. Terminal boxes for incoming and outgoing signal leads shall be located at the top or bottom of the panel as indicated or as otherwise required.
7. Power Supply Wiring:
    a. Unless otherwise indicated, instruments, alarm systems, and motor controls shall operate on 24 VDC circuits.
    b. Contractor shall furnish terminal box connections for the main power supply entry as indicated.
    c. Power supply switches for alarm units shall be three pole type, arranged to open both the power and alarm circuits. Each annunciator shall be equipped with a separate switch.
    d. Instruments located on a single panel section which serve one process unit may be connected to a common branch power circuit. The number of branch circuits shall be such that no circuit load exceeds 10 amps. Different panel sections and instruments serving different process units shall not use common branch circuits. A 15-amp, two-pole circuit breaker shall be provided in each branch circuit. When instruments do not come equipped with integral fuses, the panel fabricator shall furnish and install fuses as required for the protection of individual instrument against fault currents. Fuses shall be mounted on the back of the panel, in a fuseholder, with each fuse identified by a service name tag.
    e. Each potentiometer type instrument, electronic transducer, controller or analyzer shall have an individual disconnect switch. Disconnect switches shall have metal or plastic tags listing the associated instrument tag numbers. Individual plug and cord set power supply connections may be used without switches when indicated.
    f. Where alarm units are single unit types, one switch may be used to disconnect not more than six alarm units located on the same or adjacent panels.
8. Alarm Wiring: Contractor shall provide alarms including light cabinets, audible signal units, test and acknowledge switches and remote logic units as indicated. Interconnecting wiring to panel mounted initiating devices shall also be provided. Wiring from external initiating devices shall be provided by the Contractor. Where plug and cord sets are provided for component interconnection, Contractor shall harness and support the cables in a neat and orderly fashion. Where separate wire is required, Contractor shall install 16 AWG with THWN or THHN insulation between components.
9. Signal Wiring:

a. Computer and Non-Computer Use: Signal wire shall be twisted shielded pair or triads in conduit or troughs. Cable shall be constructed of No. 16 AWG copper signal wires with THHN/THWN-2 insulation. Color code for instrument signal wiring shall be:

Positive - Black (+)
Signal Ground Negative - White (-)
Equipment Ground - Green
Ungrounded - Red
Energized by voltage source external to panel - Yellow
DC circuit - Blue

b. Multiconductor cables where indicated shall consist of No. 16 AWG copper signal wires twisted in pairs, with 600-volt fault insulation. A copper drain wire shall be provided for the bundle with a wrap of aluminum polyester shield. The overall bundle jacket shall be PVC.

c. Multi-conductor cables, wireways and conduit shall provide for 10 percent allocation of spare, unused signal wires in addition to the indicated requirements.

10. Terminal Blocks: Terminal blocks shall be molded plastic with barriers and box lug terminals and shall be rated 15 amperes at 600-volts. White marking strips, fastened securely to the molded sections, shall be provided and wire numbers or circuit identifications shall be marked thereon with permanent marking fluid.

K. Color Conventions**:** Lens covers for indicating lights on panels will be colored as follows:
1. Red-ON when;
   a. Motor not running (STOPPED)
   b. Valve CLOSED (not fully opened)
   c. Device not energized.
   d. Circuit breaker OPENED
2. Green-ON when;
   a. Motor running in forward direction (fast speed for multi-speed motors)
   b. Valve OPEN (not fully closed)
   c. Device energized.
   d. Circuit breaker CLOSED
3. White-ON when;
   a. Power available
   b. System in AUTOMATIC mode.
   c. Monitoring taking place.
4. Amber-ON when;
   a. Malfunction trip.
   b. Equipment locked out.
   c. Alarm condition

L. Nameplates:
1. Nameplates shall be provided for instruments, function titles for each group of instruments, and other components mounted on the front panel(s) as indicated. A nameplate shall be provided for each signal transducer, signal converter, signal isolator, and electronic trip mounted inside the panel(s).
2. Nameplates shall be descriptive to define the function and system of such element. These nameplates shall be of the same material as those on the front of the panel(s). Adhesives shall NOT be used for attaching nameplates. Nameplates shall be mounted using stainless steel machine screws. Nameplates shall be fabricated from black face white-center laminated engraving plastic. Colors, lettering, styles, abbreviations and sizes shall be in conformance with ISA-RP60.6 with an intended viewing distance of 3 feet to 6 feet.

M. Factory Inspection:
   3. Panels shall be inspected for compliance with requirements at the factory before shipment to the site. Contractor shall notify the Construction Manager 2 weeks in advance of the testing date. A representative of the Construction Manager will visit the factory to make the inspection.
   4. Contractor shall perform the following tests prior to arrival of the Construction Manager:
      a. Air lines adequately tested for leaks.
      b. Alarm circuits rung out to determine their operability.
      c. Electrical circuits checked for continuity and where applicable, operability.
      d. Nameplates checked for correct spelling and correct size of letters.
      e. Other test required to place the panel in an operating condition.
   5. It shall be the responsibility of Contractor to furnish necessary testing devices and sufficient manpower to perform the tests required by the Construction Manager to determine conformance to the requirement of the Contract documents.
   6. If the above tests have not been performed prior to the arrival of the Construction Manager, the Contractor shall reimburse the Owner for the cost of the extra time required for the inspector's services and travel expenses.

N. Shipment:
   1. Panels shall be crated for shipment using a heavy framework and skids. Panel sections shall be cushioned to protect the finish of the instruments and panel during shipment. Instruments which are shipped with the panel shall have suitable shipping stops and cushioning material installed to protect instrument parts from mechanical shock damage during shipment. Each panel crate shall be provided with removable lifting lugs to facilitate handling

2.02 GENERAL INSTRUMENTATION ENCLOSURE COMPONENTS

A. Signal Isolators, Converters, and Power Supplies: Signal isolators shall be provided in each measurement and control loop, wherever required, to match adjacent component impedances, or where feedback paths may be generated or to maintain loop integrity when the removal of a component of a loop is required. Signal converters shall be provided where required to resolve any signal incompatibilities. Signal power supplies shall be provided to supply sufficient power to each loop component.

B. General Purpose Relays: General purpose relays in the Control Panels shall be plug- in type with contacts rated 10 amperes at 24 volts DC; quantity and type of contacts shall be as indicated. Each relay shall be enclosed in a clear plastic heat and shock resistant dust cover. Sockets for relays shall have screw type terminals.

C. Slave Relays: Slave relays shall be provided when the number or type of contacts indicated exceed the contact capacity of the indicated relays and timers.

D. Circuit Breakers: Circuit breakers shall be single pole, 120-volt, 15 ampere rating or as required to protect wiring and equipment. Circuit breakers shall be mounted inside the panels as shown.

2.03 PROGRAMMABLE LOGIC CONTROLLER (PLC):

A. Contractor shall furnish, install, program, test, calibrate, fully configure and place into operation Programmable Logic Controllers (PLCs) and appurtenances as specified herein. The PLC shall be Allen-Bradley CompactLogix.

B. Contractor shall furnish necessary PLC modules, interconnecting cables, accessories, and appurtenances as indicated herein or as required for proper operation of the system. Major

components of the system shall be of the same manufacturer. Equipment shall be capable of tolerating and capable of riding through a power interruption of 8 milliseconds or less without interruption of normal operation.

C. Design: The PLC shall be furnished with I/O (input/output) modules suitable for the interface with the new and existing field devices. The I/O's shall be 4-20 mA signals for analog inputs and analog outputs and shall be 24 VDC for discrete inputs and discrete outputs. The PLC shall provide internal fault analysis with a fail-safe mode and a dry contact output for remote location alarming, and a local indicator on the PLC frame in the event of a fault in the PLC.

D. Memory: The PLC shall be supplied with sufficient memory to implement the specified control function plus a reserve capacity of 20 percent of the total provided. This reserve capacity shall be totally free from any system use. The memory shall be programmed in a multi-node configuration with multiple series or parallel contacts, counters, timers, and arithmetic functions.

E. Controller: The controller program shall be standard IEC 61131-3 in Studio 5000 or RSLogix 5000. The Custom PLC control application shall be written in Derived Function Block DFB. The PLC shall be easily reprogrammed with a portable programming unit or laptop computer. The PLC system shall be programmed by the vendor to perform the specified control and monitoring functions. Two documented copies of the operating program shall be furnished which shall allow direct, step-by-step, reloading of the system program. Copies of this program shall be furnished in the format used in the contract diagrams for conventional relay control systems. These diagrams shall reflect equipment name designations used in the PLC as well as the contract diagram equipment name designations (i.e., timer "Q" in the Contract drawing may become timer OL in PLC program).

F. Power Supply: The PLC power supply shall operate 24 VDC.

G. Input/Output Modules: I/O housings and I/O modules shall be of rugged construction with modules in place. Sufficient input and sufficient output modules shall be provided with the PLC to implement the specified control functions plus a reserve capacity of 25 percent of the total provided.
   1. 32-point Discrete Input Modules: Defined as contact closure inputs from devices external to the programmable logic controller module. Input modules shall operate at 24VDC. Input modules shall be shielded from short time constant noise and 60-Hz pickup. Individual inputs shall be optically isolated for low energy common mode transients to 1500 volts peak from user's wiring or other I/O Modules. The modules shall have LED lights to indicate a discrete input.
   2. 32-point Discrete Output Modules: Defined as contact closure outputs for ON/OFF operation of devices external to the programmable logic controller module. Output modules shall operate at 24VDC. The output modules shall be fused with blown fuse indicator lights. The output modules shall be optically isolated from inductively generated, normal mode and low energy, common mode transients to 1500 volt peak. Output modules shall have LED lights to indicate output has been cycled ON by the controller.
   3. 8-point Analog Input Modules: Defined as analog inputs for 4 to 20 mA dc signals, where an analog to digital conversion is performed and the digital result is entered into the processor. New inputs shall be provided for every scan.
   4. 4-point Analog Output Modules: Defined as analog output for 4 20 mA dc signals, where a digital to analog conversion is performed and the analog result is produced as an output. New outputs shall be produced on every scan.

H. Programming Unit: Programming shall be accomplished with a laptop computer. The programmer shall be capable of being directly plugged into the PLC system without the

requirements of additional hardware. Programming, monitoring, searching, and editing shall be accomplished with the programmer. These functions shall be capable of being done both "on line" while the processor is scanning or "off line" while the processor is not scanning. The programmer shall display multiple series and parallel contacts, coils, timers, counters, and calculation functions. The programmer shall also be able to monitor the status of inputs, outputs, timers, counters, and coils. It shall have the capability to disable/force inputs, outputs, and coils to simulate system operation. It shall also indicate "power flow" through elements and include a search function to locate any element and its program location. The processor status information, such as error indication and amount of memory remaining, shall be shown on the laptop. The programmer shall be of rugged construction and be portable, allowing it to be used in an industrial environment without special protection. Contractor shall provide one new programmer complete with manuals to the Owner to enable future system support. The device shall be turned over to the Owner at START-UP.

I. PLC Control System Software: This Section covers the furnishing of standard and customized software, fully installed and fully configured in the control systems specified herein. It is the intent of this specification to have the PLC System Supplier furnish a latest generation, standard, field proven, fully debugged and supported software package for this application with a minimum of additions or changes. Customized or specially written software shall be furnished if required to meet the functional requirements specified herein. Any custom applications software required shall be fully integrated into the basic software and shall not require unique command structures. Software specified herein is described in broad, functional categories. The System Supplier shall furnish a complete software package including the functional requirements specified herein along with whatever additional software is required by the supplier for proper and efficient operation of the PLC Control System. No attempt has been made to list software or list characteristics of software required by the System Supplier to meet the functional requirements specified herein.
    1. General: The software package shall provide a system capable of controlling system level activities and a higher-level process control language allowing the operator to monitor and control the process through an interactive human interface. The software environment shall support a multi-programming atmosphere allowing concurrent execution of more than one program in a background/foreground mode or multi-tasking mode.
    2. Throughout the execution of software modules, the operator shall be presented with the command or operation choices available at that point in the program using sufficient verbiage or symbols to make the choices self-explanatory and unambiguous. Question and answer or fill-in-the-blank requests shall only be permitted where file names, tag names, or other unique text or numerical information is required.
    3. System-level software shall include a real time operating system, a calendar/time program, a file management program and a system of diagnostic routines in addition to any compilers, editors, loaders, or assemblers required to support the process control software language.
    4. Programs shall be self-configuring, such that they obtain the size and configuration of the system from parameters contained in the various files created during system generation. No parameters related to the hardware configuration shall be hard coded into any of the software.
    5. System Level Software: System-level software shall include a complete and unmodified operating system furnished by the System Supplier that provides system-level functions as specified herein. Operating system software shall function automatically without operator intervention, except as required to establish file names and similar information.
    6. Operating System Software: The real-time operating system software shall be the standard uncorrupted product of the host computer and shall provide the following minimum functions:
        a. Respond to demands from a program request or to demands from an operator.

b. Dynamic allocation of the resources available in the system. These resources shall include main memory usage, computation time, peripheral usage, and I/O channel usage.
c. Allotment of system resources on the basis of task priority levels such that a logical allocation of resources and suitable response times are assured.
d. Queuing of requests in order of priority if one or more requested resources are unavailable.
e. Resolution of contending requests for the same resource in accordance with priority.
f. Service requests for execution of one program by another.
g. Transfer data between programs as requested.
h. Management of information transfers to and from peripheral devices.
i. Control and recovery from program fault conditions.
j. Diagnose and report real-time hardware device errors.

7. Program execution shall be scheduled on a priority basis. A multilevel priority interrupt structure is required. A program interrupted by a higher priority program shall be entered into a list of pending programs. Its execution shall be resumed once it becomes the currently highest priority program. Initiation of programs shall, as a minimum, be activated in the following ways:
   a. In response to external interrupts.
   b. At a scheduled time of the day.
   c. On an elapsed time interval basis.
   d. On request by another program.
   e. On request from the data access panel.
8. The system shall allow periodic programs to be scheduled. The allocation of resources to a time scheduled program shall be based on its relative priority and the availability of computer system resources.
9. Start-up and Restart: Software shall be provided which initializes and brings a computer or any microprocessor-based hardware unit from an inactive condition to a state of operational readiness. Initialization shall include determination of computer system status prior to start-up of initializing operating system software and initializing application software. Initialization shall also include the loading of memory resident software, initialization of timers, counters, and queues, and initialization of dynamic database values.
10. Shutdown: The software shall provide an orderly shutdown capability for shutdowns resulting from equipment failure, including computer processor failure, primary power failure, or a manually entered shutdown command. When the loss of primary power is sensed, a high-priority hardware interrupt shall initiate software for an immediate, orderly shutdown. When a shutdown occurs in response to a command or malfunction, the software shall control the affected hardware quickly and automatically to a secure state.
11. Diagnostics: Diagnostic programs shall be furnished with the software package to detect and isolate hardware problems and assist maintenance personnel in discovering the causes for system failures. The system manufacturer's standard diagnostic routines shall be used as much as possible. Diagnostic software and test programs shall be furnished for each significant component in the system. Diagnostic routines shall test for power supply, central processing unit, memory, and I/O bus failures as a minimum.
    a. Calendar/Time Program: The calendar/time program shall update the second, minute, hour, day, month and year in the operating system and transfer accurate time and date information to system level and application software. Variations in the number of days in each month and in leap years shall be handled automatically by the program. The operator shall be able to set or correct the time and date from the data access panel, only at the highest security level.
12. Algorithms: System software shall support the implementation of algorithms for the determinations of control actions and special calculations involving analog and discrete

inputs. These algorithms shall be capable of outputting positional or incremental control outputs or providing the product of calculations. The algorithms shall include alarm checks where appropriate. As a minimum, the following types of algorithms shall be provided.

a. A calculator algorithm which performs functions such as summing several variables, raising to a power, roots, dividing, multiplying, and subtracting.
b. A switch algorithm which reads the current value from its input address and stored it as the value of its output address. Two types of switches shall be accommodated, 2 outputs with one input and one output with 2 inputs.
c. A 3 mode Proportional-integral-Derivative (PID) controller algorithm, with each of the 3 modes independently adjustable. The algorithm shall support both direct and reverse acting modes.
d. Algorithms for lead, lag, dead time, and ration compensators.
e. Algorithms to perform integration and totalization of analog process variables.
Algorithms that drive the setpoint of a controller shall include provisions for bumpless transfer, which shall be implemented by use of a bias value.
Algorithms shall be implemented and modified in the system at any time through the use of interactive software modules in a manner consistent with other interactive modules and shall not required any direct source of code changes.

13. Alarm Processing
    a. Alarm processing software shall be provided to recognize and report alarm events and conditions to Central SCADA in an organized, unambiguous, clear, and convenient manner. Alarms shall be classified into at least 2 priority levels and at least 2 independent classes.
14. Alarm processing software shall generate alarms for the following conditions:
    a. Discrete input or output change of state is defined as an alarm in the control software.
    b. Analog value exceeding alarm limits defined in the control software.
    c. Analog rate of change exceeding limits defined in the control software.
    d. Failure of the PLC processor, mass memory device, process input/output hardware, or other major hardware component.
    e. Alarms shall be generated in each case above at the time of occurrence and at the time the condition returns to normal.

J. Testing: The Construction Manager shall witness testing of the units. Solid-state logic systems shall be tested as complete assemblies. Testing of individual components or modules shall not be acceptable.

K. Factory Test: Provide factory testing of the PLC and telefast system with program loaded. Provide factory test report showing satisfactory operation prior to shipping to the field for installation.

L. Training: A manufacturer's representative shall supply two 8-hour days of on-site training for the Owner’s personnel. The training shall include but not be restricted to, operation of programming unit, trouble shooting of system hardware and software, and program development.

M. Thirty Day Acceptance Test: After startup has been completed, the System shall undergo a 30-day acceptance test. The System must run continuously for 30 consecutive days. During this period, System functions shall be exercised. Any System interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as time of occurrence and duration of each failure. A failure shall cause termination of the 30-day acceptance test. When the cause of a failure has been corrected, a new 30-day acceptance test shall be started.

N. Each time the Contractor's technician is required to respond to a System malfunction, he must complete a report which shall include details concerning the nature of the complaint or malfunction and the resulting repair action required and taken.

O. Operation and Maintenance Manuals: Contractor shall furnish to the Owner 5 complete sets of operation and maintenance manuals. The manuals shall include date, information drawings, etc., for the system, subsystem, and components, and shall include names, addresses and telephone numbers of equipment suppliers, representatives and repair facilities.

P. This shall include a complete description of the recommended operating procedures, maintenance procedures, and spare/replacement parts list for equipment items with catalog data, diagrams, and drawings or cuts describing the equipment. Each set shall include full size assembly and wiring diagrams; drawings showing "as-build" conditions shall be furnished to the Owner.

2.04 ETHERNET SWITCH

A. Provide industrial ruggedized 5 port 24 VDC ethernet switches. Provide Ntron 105FX unmanaged industrial Ethernet switch or approved equal.

2.05 ETHERNET LINK CONTROLLER (ELC) MODULE

A. Provide Emerson Ovation Ethernet Link Controller (ELC) module, part number Emod 5X00419G01, complete with Pmod 1X00569H01. ELC module shall be supplied with Emerson EIP license. ELC and license shall be procured via Emerson. No substitutions.

2.06 INTEGRATED SERVICES ROUTER

A. Provide Cisco integrated services router, model number ISR4321-K9 (part number 1X00474G10). Router shall be procured via Emerson No substitutions.

2.07 PRESSURE GAUGES

A. Manufacturer: Pressure gauges shall be Ashcroft Model 1279 "Duragage" or approved equal.

B. Type: Bourdon Tube Pressure Element Type

C. Operation Purpose: To sense and display locally, gauge pressure.

D. Design Standards: Gauges shall meet ASME B40.100 Grade 2A

E. Performance:
   1. Accuracy: ±1.0 percent of span after friction errors are eliminated by tapping or vibration. Maximum allowable friction inaccuracy: ±1.0 percent of span.
   2. Range and Scale: See schedule below.

F. Design:
   1. Size: 4.5-inch.
   2. Connection: 1/2-inch male NPT back or bottom as required.
   3. Case Style: Solid front with pressure relief back.
   4. Case Material: Phenolic
   5. Wetted Materials: 316 Stainless Steel
   6. Window: Acrylic
   7. Dial: Aluminum, white background, black scale.

8. Bourdon Tube and Socket: Type 316 Stainless Steel, heliarc welded unless otherwise specified in the Instrument Schedule.
9. Movement: Rotary, adjustable, 400 SS, Teflon® coated pinion gear and segment.
10. Pointer: Micrometer, adjustable, aluminum
11. Weather Protection: Liquid Filled (glycerin), NEMA 4X or IP66
12. Connection and Mounting
    a. Direct mount and suitable for outdoor installation
    b. ½-inch NPT
    c. Connection material: 316 Stainless Steel

G. Accessories
13. Snubber
    a. 316 stainless steel snubber threaded into gauge socket or in external stainless steel housing with 1/2 NPT male and female connections.
    b. Install snubber between the diaphragm seal and process pipe.
14. Diaphragm Seal:
    a. 316 stainless steel body and diaphragm.
    b. Fill Fluid: 50/50 Glycerin/Water
    c. Diaphragm seal and pressure gauge shall be assembled by Manufacturer and shipped as an assembly.
    d. The diaphragm seals shall be Ashcroft Model 101, U.S. Gauge (Ametek) SG, Marshalltown Series 225-01, or approved equal.
15. Isolation Valve:
    a. Valve manifold and pressure gauge shall be assembled by manufacturer and shipped as an assembly.

H. Source Quality Control
1. Factory calibrate each pressure gauge at a facility that is traceable to the National Institute of Standards and Technology (NIST).
2. Provide complete documentation covering the traceability of calibration instruments.

I. Pressure Gauge Schedule:

Tag No.	Service	Range	Scale
00PI-901	Foul Air	0 – 15	in. H20
00PI-101	Sanitary Sewer/Storm Water	0 – 60	psi
00PI-102	Sanitary Sewer/Storm Water	0 – 60	psi
00PI-103	Sanitary Sewer/Storm Water	0 – 60	psi

2.08 LEVEL SWITCHES

A. Manufacturer:
1. Siemens Water Technologies Corp 9G-EF.
2. ITT Flygt Model ENM-10.
3. Anchor Scientific Incorporated Ecofloat/Solofloat.
4. or approved equal.

B. General:
1. Free hanging ball float, encapsulated body with a switch to determine position of float.

C. Element:

1. Mechanical switch encapsulated in waterproof floating ball of nominal diameter, supported by flexible PVC cable and jacket or heavy neoprene.
2. Minimum length of PVC cable: Equal to sump depth plus 5 feet.
3. Float: Provide type 316SS, minimum 3 inches in diameter. The float shall provide a minimum of 2 pounds of buoyancy in solutions with specific gravity of 1 and shall have an operating temperature rating of -30 degrees Fahrenheit to +150 degrees Fahrenheit.
4. Mercury switches are not acceptable.
5. Lead Wires: Mounted in flexible waterproof PVC cable from switch to junction box terminals without splices.

D. Switch:
1. Single pole double throw contacts rated 10 amps resistive at 120 VAC.
2. Provide the number of floats per level system as shown on the Drawings.
3. Suspend ball float and adjust for level setpoint as required.

E. Components:
1. Floats shall include type 316 stainless steel clamp and brackets and 1/4-inch cable to allow testing of the float without entering the basin or wet well.
2. Provide strain relief at both ends of the float cable.
3. Float Anchors:
   a. Furnish 15 pound PVC coated anchor kit with 10 feet of 316 stainless steel chain.
   b. Provide stainless steel shackles and float clamps.
   c. Manufactured by:
      1) Conery Mfg., Inc.
      2) Approved equal.

F. Level Switch Schedule:

Tag No.	Service
00LSHH-101	High-High Alarm Sanitary Sewer/Stormwater
00LSH-101	High Alarm Sanitary Sewer/Stormwater
00LSL-101	Low Alarm Sanitary Sewer/Stormwater
00LSLL-101	Low-Low Alarm Sanitary Sewer/Stormwater

2.09 LEVEL TRANSMITTER-ULTRASONIC

A. Manufacturer:
1. Siemens: MultiRanger 200.
2. Endress+Hauser: Prosonic S.
3. Or equal

B. General
1. Continuous non-contact level measurement device with remote transmitter using ultrasonic echo sensing. The transducer generates an ultrasonic pulse in the range of 12 to 45 kHz and measures the time required for the pulse to travel to the process surface and return. The distance is calculated from the send and receive times. Each 4 wire level transmitter system includes, but not limited to:
   a. Ultrasonic Transducer.
   b. Signal cable.
   c. Transmitter

C. Performance Requirements

1. Accuracy: 0.25 percent of range.
2. Repeatability: 0.1 percent of range.

D. Ultrasonic Transducer:
1. Encapsulated in chemical and corrosion-resistant material as indicated on the Instrument Data Sheet or Instrument Index.
2. Class I, Division 1.
3. Operating Temperature Range: -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius).
4. Operating Relative Humidity Range: 5 to 95 percent.
5. Functions: Temperature compensation

E. Transmitter:
1. Level indicating transmitter:
a. Indicator: Liquid Crystal Display with approximately 0.50-inch display scaled to read in engineering units.
b. Sensitivity: Able to ignore momentary level spikes or momentary loss of echo and indicate loss of echo condition on indicating transmitter unit.
c. Ability to allow for signal profiles and echo mapping:
1) Provide manufacturers software for re-mapping the signal.
2. Functions: Single level measurement.
3. Power supply: 120 VAC
4. Power consumption: 36 VA maximum
5. Outputs:
a. Isolated 4-20mA DC with HART communication protocol.
b. Relay outputs:
1) 3 Form C contacts.
(1) Rated 5 amps at 250 VAC.
(2) Programmable.
6. Enclosure: NEMA 4X, suitable for wall or pipe stand mounting.
7. Operating temperature range: -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius).
8. Operating Relative Humidity: 10 to 100 percent.

2.10 MAGNETIC FLOWMETERS

A. General:
1. Electromagnetic type flowtubes using Faraday's law of induction to measure flow volume computed on basis of pipe's diameter (i.e., Flowrate proportional to induced voltage). Factory-calibrated transmitter.
2. Complete zero stability shall be an inherent characteristic of the flowmeter system.
3. Include for each magnetic flowmetering system:
a. A metering tube with electrodes (sensor).
b. Signal cable.
c. Flowmeter grounding rings.

B. Operation Purpose: To measure and transmit flow for process variable monitoring and control.

C. Process Fluid: Storm and Wastewater

D. Performance:
1. Accuracy: 0.25 percent of flow rate from 10 to 100 percent full scale for velocities ranging between 1 and 15 feet per/second.
2. Repeatability: 0.1 percent of rate.

E. Element
    1. Metering Tube:
        a. Constructed of austenitic stainless steel (unless specifically noted otherwise) with flanged connections to match with piping material.
        b. Liner shall be in conformance with Manufacturer's recommendations for the intended service.
        c. Electrodes in conformance with:
            1) Manufacturer's recommendations for the intended service.
            2) Utilize a minimum of 2, self-cleaning electrodes.
        d. Meter terminal housing: NEMA 4X.
        e. Meter coating shall consist of manufacturer's recommended coating for intended service.
            1) Manufacturer's recommendations for the intended service.
            2) Utilize a minimum of 2, self-cleaning electrodes.
        f. Components
            1) 2 Grounding Rings:
                Which are in conformance with the manufacturer's bore and material recommendation for the meter's intended service.
                (a) Designed to protect and shield from abrasion of the liner's edge interface at the meter's end.
a)

F. Transmitter:
    1. Power supply:
        a. 120 VAC.
        b. Power consumption: 60 VA maximum.
    2. Outputs:
        a. Isolated 4-20mA DC with HART communication protocol.
    3. Microprocessor-based signal converter/transmitter.
    4. Utilize DC pulse technique to drive flux-producing coils.
    5. Contain a 6-digit display for flow rate, percent of span, and totalizer.
    6. Operator keypad interface.
    7. Integral zero return to provide a consistent zero output signals in response to an external dry contact closure.
    8. Integral low flow cut-off zero return.
    9. Bi-directional flow.
    10. Empty Pipe Detection.
    11. Programmable parameters including:
        a. Meter size.
        b. Full-scale flow rate.
        c. Magnetic field frequency.
        d. Time constant.
    12. Data retention for a minimum of 5 years without auxiliary main or battery power.
    13. Self-diagnostics and automatic data checking.
    14. Protected terminals and fuses in a separate compartment which isolates field connection from electronics.
    15. Ambient operating temperature limits of -5 to 140 degrees Fahrenheit (-29 to 60 degrees Celsius).
    16. Class I, DIV 1 compliant.

G. Manufacturers:
    1. Rosemount
    2. Krohne
    3. Sparling

4. ABB
5. Endress+Hauser
6. Or Approved Equal

H. Flow Meter Schedule:

Tag	Size (in.)	Range (MGD)	Process Fluid	Transmitter Location	NEMA Rating (Body Transmitter)
00FIT-101	8	0 to 2	Sanitary Sewer/Storm Water	Local	7/4X, IP68

2.11 FLOW SWITCH

A. General:
1. Flow switch components shall be suitable for gas associated with sewage.
2. Flow switches will not be constructed of plastic materials.

B. Process Connection:
1. 1-1/2" MNPT
2. Pipe fittings must be sized to allow full actuation of switch paddle and appropriate insertion into the pipe

C. Mounting: Horizontal mounting per manufacturer instructions

D. Insertion Length: Per manufacturer Instructions

E. Materials:
1. Wetted components: 316 Stainless Steel
2. Packing gland: Metallic components shall be 316/316L Stainless Steel

F. Enclosure Material:
1. Weather Proof
2. Explosion Proof: Conformance with NFPA 70 Class 1 Groups C and D

G. Temperature Rating: Electronics and sensors shall be suitable for temperatures of -4°F to 275°F

H. Operating Pressure: 5 PSI.

I. Vane: 316 SS

J. Switch Type: SPDT Switch Standard

K. Electrical Connections 16 AWG, 6" long.

L. Manufacturers:
1. Dwyer Series V4
2. Or approved equal.

M. Flow Switch Schedule

Tag No.	Service	Range (in. H20)
00PI-101	Foul Air	0 – 15

PART 3 - EXECUTION

3.01 INSTALLATION

A. Employ installers who are skilled and experienced in the installation and connection of elements, instruments, accessories, and assemblies provided under this Contract.

B. Install instruments according to the manufacturer's installation instructions and the following:
   1. Perform field engineering as required for mounting and supporting field mounted components.
   2. Prepare any additional schematic and interconnection diagrams required for installation.
   3. Assemble and interconnect instrument components disconnected for shipping purposes.
   4. Remove temporary supports, bracing, and padding inserted in instrument control panels and other equipment to prevent damage during shipping, storage, or installation.
   5. Piping shall be field measured prior to fabrication and erection. Any significant discrepancies between drawings and field conditions shall be reported to the Construction Manager. The Owner will not be responsible for any costs to the Contractor for rework because of Contractor failure to take measurements prior to fabrication.
   6. Adequately support and protect capillary tubing. Extra tubing shall be carefully coiled, tied, and protected at the instrument location.

C. The Contractor shall install pneumatic instrument air systems according to the manufacturer's installation instructions and the following:
   1. Install pneumatic tubing and make connections at control panels, instruments, and control valves.
   2. Perform field engineering as required for instrument air supply headers and individual air supply taps and lines.
   3. Check air supply branch headers by blowing with clean air and checking for tightness.
   4. Clean transmission and control tubing by blowing with dried and filtered air prior to connecting to instrument components.
   5. Leak test pneumatic control circuits in accordance with ISA Recommended Practice RP-7.1.
   6. Set instrument air regulators at manufacturer's recommended supply pressures.

D. It is the intent of the Contract Documents that wiring external to Control Panels be provided under the requirements of Division 26. Further, it is the general intent that 4-20 mA signal circuits, process equipment control wiring, signal wiring to field instruments, and Control Panel input and output wiring, be provided under Division 26 and be terminated and identified under Division 13.

E. Contractor's attention is directed to the electrical and mechanical schematics and details of this project. Referral to these portions of the Contract Documents shall be required in order to understand the full intent and scope of work required.

F. Monitoring and control system configurations are diagrammatic only. Locations of equipment are approximate unless dimensioned on the drawings. Exact locations and routing of wiring and cables shall be governed by structural conditions, physical interferences, and locations of electrical terminations on equipment.

G. Where job conditions require minor changes in approximated locations and arrangements, Contractor shall make such changes without additional cost to the Owner.

H. Instruments shall be located and installed for ready access by the Owner's operation and maintenance staff. The Owner reserves the right to require minor changes in location of equipment prior to roughing without any additional cost to the Owner.

3.02 CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

A. Wiring Installation: Wires shall be in plastic wireways except (1) field wiring, (2) wiring between mating blocks in adjacent sections, (3) wiring from components on a swing-out panel to components on the fixed structure, and (4) wiring to panel-mounted components. Wiring from components on a swing-out panel to other components on fixed panels shall be tied into bundles with nylon wire ties and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.

B. Wiring to control devices on the front panels shall be tied together at short intervals with nylon wire ties and secured to the inside face of the panel using adhesive mounts.

C. Wiring to rear terminals on panel-mount instruments shall be in plastic wireways secured to horizontal brackets above or below the instruments in about the same plane as the rear of the instruments.

D. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on shop drawings. These numbers shall be marked on conductors at every terminal using white numbered wire markers which shall be permanently marked heat-shrink plastic.

3.03 INSTRUMENT CABLE TESTS

A. General: The following tests shall be performed on each instrumentation and control system cable. Tests shall be end-to-end tests of installed cables with the ends supported in free air, not adjacent to any grounded object. Test data shall be recorded on forms which are available from the Construction Manager. Complete records of tests shall be made and delivered to the Construction Manager. Each form shall be signed by the Construction Manager or the Construction Manager's Representative who witnessed the testing.

B. Continuity tests shall be performed by measuring wire/shield loop resistance of each signal cable as the wires, taken one at a time, are shorted to the channel shield. No loop resistance measurement shall vary by more than plus or minus 2 ohms from the calculated average loop resistance value.

C. Insulation resistance tests shall be performed by using a 500 volt megometer to measure the insulation resistance between each channel wire, between each channel wire and the channel shield, between individual channel shields in a multichannel cable, between each individual channel shield and the overall cable shield in a multi-channel cable, between each wire and ground, and between each shield and ground. Values of resistance less than 1 megohms shall be unacceptable.

3.04 INSTALLATION, CALIBRATION, TESTING, PRECOMMISSIONING, STARTUP AND INSTRUCTION

A. Installation and Connection: Contractor shall install and connect field- mounted components and assemblies under the following criteria:
   1. Process sensing lines and air signal tubing shall be installed to the installation of conduit indicated under Division 26. Individual tubes shall be run parallel and near the surfaces from which they are supported. Supports shall be used at intervals not longer than 3 feet of tubing.
   2. Bends shall be formed with the proper tool and to uniform radii and shall be made without deforming or thinning the walls of the tubing. Plastic clips shall be used to hold individual plastic tubes parallel. Ends of tubing shall be square- cut and cleaned before insertion into fittings. Bulkhead fittings shall be provided at panels requiring pipe or tubing entries.

3. Flexible cables and capillary tubing shall be provided in flexible conduits. Lengths shall be sufficient to withdraw the cables and tubing for periodic maintenance.
4. Thermocouple or RTD lead wire shall be provided in dedicated conduit or wireway from the thermocouple to the control panel. Conduit or wireway shall be sized in accordance with the capacity of the instrument.
5. Power and signal wires shall be terminated with spade type lugs.
6. Connectors shall be, as a minimum, watertight.
7. After installation and connections have been completed, a technical field representative of the Contractor shall check the WORK for polarity of electric power and signal connections, leaks at process connections, and conformance with requirements. The technical field representative shall certify in writing to the Contractor that each loop and system meets requirements.
8. Wire and cable shall be connected from terminal to terminal without splices, arranged in a neat manner and securely supported in cable groups. Wiring shall be protected from sharp edges and corners.

B. Calibration: Analog instrumentation and control system equipment shall be calibrated and tested after installation to verify that requirements are satisfied. Contractor shall provide necessary labor, tools, and equipment to calibrate and test each instrument in accordance with the manufacturer's instructions. Each instrument shall be calibrated at a minimum of three points using test equipment to simulate inputs and read outputs. Test equipment and instruments used to simulate inputs and read outputs shall be suitable for the purpose intended and shall have an accuracy better than the required accuracy of the instrument being calibrated. Test equipment shall have accuracies traceable to the NIST as applicable. Analog instruments shall be calibrated and tested in place without removal. Test data, applicable accuracy requirements, instrument manufacturer published performance specifications and permissible tolerances at each point of calibration shall be entered on test forms available from the Construction Manager. These test forms shall verify compliance. A report shall be delivered to the Construction Manager for each instrument, certifying that the instrument has been calibrated in the presence of the Construction Manager or the Construction Manager’s designated representative and meets contract and system requirements.

C. Analog Loop Tests: Contractor shall be responsible for loop checking and testing instrumentation loops with this project. Contractor shall coordinate loop check functions with the CSP to ensure that a single total loop check is conducted. The intent of the loop checks is to confirm and document each loop's component specification conformance up to and including field situated CSP devices. The CSP will have designated operators present to witness and confirm loop check results at the CRT level. Contractor shall provide necessary labor, tools, and equipment to field test, inspect and adjust each instrument to its indicated performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or any published manufacturer performance specification for functional and operational parameters, whether or not indicated in the Contract Documents, shall be repaired or replaced, at the discretion of the Construction Manager at no additional cost to the Owner.
   1. At least 15 days before installation testing begins, Contractor shall submit to the Construction Manager a detailed description, in duplicate, of the installation tests to be conducted to demonstrate correct installation of the instrumentation and control system and the anticipated dates the testing will occur.
   2. Controllers and electronic function modules shall be tested and exercised by the Contractor to demonstrate correct operation, first individually and then collectively as functional analog networks. Each hardwired analog control network shall be tested to verify proper performance within indicated accuracy tolerances. Accuracy tolerances for each analog network are defined as the root-mean-square-summation of individual component accuracy tolerances. Individual component accuracy tolerances shall be as

indicated by contract requirements, or by published manufacturer accuracy specifications, whenever contract accuracy tolerances are not indicated.

3. Each analog network shall be tested by applying simulated inputs to the first element(s). Simulated sensor inputs corresponding to 10 percent, 50 percent, and 90 percent of span shall be applied, and the resulting outputs read to verify compliance to network accuracy tolerance requirements. Continuously variable analog inputs shall be applied to verify the proper operation of discrete devices. Temporary settings shall be made on controllers, alarms, etc., during analog loop tests. Analog loop test data shall be recorded on test forms, which include calculated root-mean-square-summation system accuracy tolerance requirements for each output.
4. Air systems shall be tested for leaks in compliance with ISA RP7.1.
5. When installation tests have been successfully completed for individual instruments and separate analog control networks, a certified copy of test forms signed by the Construction Manager or the Construction Manager's representative as a witness, with test data entered, shall be submitted together with a clear and unequivocal statement that instrumentation has been success fully calibrated, fully inspected, and fully tested.

D. System Pre-commissioning: Demonstrate the operability of systems provided under this specification. The CSP will assist and coordinate the operability assessment with the Contractor. Pre-commissioning shall commence after acceptance of wire, calibrating and loop tests, and inspections have been conducted. Pre-commissioning shall demonstrate proper operation of systems with process equipment operating over full operating ranges under actual operating conditions.
   1. Contractor shall develop and submit to the Construction Manager for approval a Pre-Commissioning Plan which describes detailed test procedures, checklists, blank forms and data to be recorded, test equipment to be used and calculated tolerance limits.
   2. System pre-commissioning activities shall include the use of water to establish service conditions that simulate, to the greatest extent possible, normal final control element operating conditions in terms of applied process loads, operating ranges and environmental conditions. Final control elements, control panels, and ancillary equipment shall be tested under start-up and steady-state operating conditions to verify that proper and stable control is achieved using motor control center and local field mounted control circuits. Hardwired and software control circuit interlocks and alarms shall be operational. The control of final control elements and ancillary equipment shall be tested using both manual and automatic (where provided) control circuits. The stable steady-state operation of final control elements running under the control of field mounted automatic analog controllers or software based controllers shall be assured by adjusting the controllers, as required, to eliminate oscillatory final control element operation. The transient stability of final control elements operating under the control of field mounted, and software based automatic analog controllers shall be verified by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations (if any) and making necessary controller adjustments, as required, to eliminate excessive oscillatory amplitudes and decay rates.
   3. Electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset or rate setting(s) as required to achieve a proper response. Measured final control element variable position/speed setpoint settings shall be compared to measured final control element position/speed values at 10 percent, 50 percent and 90 percent of span and the results checked against indicated accuracy tolerances. Accuracy tolerances are defined as the root-mean-square summation of individual component accuracy tolerances. Individual component accuracy tolerances shall be as indicated in the Contract Documents or as specified by published manufacturer accuracy specifications whenever not indicated.

4. Contractor shall submit an instrumentation and control system pre-commissioning completion report which shall state that Contract requirements have been met and which shall include a listing of instrumentation and control system maintenance and repair activities conducted during the pre-commissioning testing. Construction Manager must accept the instrumentation and control system pre- commissioning testing before the 30 day operational testing may begin. Final acceptance of the control system shall coincide with final acceptance of the WORK.

E. 30-Day Operational Testing: Contractor shall furnish his own personnel, electrical personnel, and any instrument manufacturer's representatives as required during the testing period to produce a fully operational system.

F. Instruction: Contractor shall train the Owner's maintenance personnel in the maintenance, calibration and repair of instruments provided under this contract.
   1. The training shall be scheduled a minimum of 3 weeks in advance of the first session. The training shall be performed concurrent with the pre- commissioning in subparagraph D.
   2. The training shall be performed by qualified representatives of the instrument manufacturers and shall be specific to each instrument model provided. Instructors shall have training experience.
   3. Each training class shall be a minimum of 8 hours in duration and shall cover Operational Theory, Maintenance, Trouble Shooting/Repair, and Calibration of the instrument.
   4. Proposed training material, including resumes for the proposed instructors and a detailed outline of each lesson shall be submitted to the Construction Manager at least 30 days in advance of when the lesson is to be given. The Construction Manager shall review the submitted data for suitability and provide comments which shall be incorporated into the course.
   5. Within 10 days after the completion of each lesson the Contractor shall present to the Construction Manager the following:
      a. A list of Owner personnel that attended the lesson.
      b. An evaluation of Owner personnel knowledge through written testing or equivalent.
      c. A copy of text utilized during the lesson with notes, diagrams, and comments.

3.05 INSTRUMENT SUMMARY

A. General: The Instrument Summary (IS) contained herein itemizes the instrumentation devices, including control panels, to be furnished under this contract.

B. Each column on the IS is defined as follows:
   1. Tag Number: The identifier assigned to a device which performs a function in the control system. Contractor shall use this identifier in tagging devices in the field.
   2. Description: A process-oriented functional description which defines the measured/monitored/controlled parameter and the associated process/process equipment.
   3. P&ID Drawing Number: The Process and Instrumentation drawing upon which the device appears.

END SECTION

SECTION 40 92 07

NETWORK COMPONENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section gives the requirements for furnishing Ethernet network components and accessories including switches, routers, and firewalls.

1.02 RELATED SECTIONS

A. Related sections include the following: Division 1, General Requirements.

1.03 SUBMITTALS

A. Action Submittals:

1. Purchase Quotation: Listing of network components and accessories to be provided. Include applicable tag numbers and functional names of components.
2. Order Confirmation Summary: Final listing of network components and accessories to be provided.
3. Network Components Data Sheets:
   a. Neat and legible markups of the Network Components Data Sheets provided in this Section.
   b. Markup the Network Components Data Sheets to include complete product information and corrections to reflect items in the purchase quotation.

B. Informational Submittals:

1. Operation and Maintenance Information:
   a. Provide sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for Ethernet components.
   b. Name, address and telephone number of the Network Components supplier's local service representative.
   c. Complete list of supplied network components with full model numbers, including spare parts and test equipment provided.
2. Manufacturer's Original Copies of Hardware, Software and Installation, Assembly and Operations Manuals for network components. Manuals shall include the following information:
   a. General descriptive information covering the basic features.
   b. Physical description covering layout and installation requirements and environmental constraints.
   c. Functional and operational descriptions covering the procedures for programming, operation, startup, shutdown, and of the Ethernet equipment and explaining how the various functions are performed.
   d. Maintenance procedures covering checkout and troubleshooting:
      1) Checkout procedures shall provide the means to verify the satisfactory operation of equipment.
      2) Troubleshooting procedures shall serve as a guide in determining faulty components.

e. Wiring and schematic diagrams.
f. Safety considerations relating to operation and maintenance procedures.

3. Content for each O&M Manual:
   a. Table of Contents.
   b. Operations procedures.
   c. Installation requirements and procedures.
   d. Maintenance requirements and procedures.
   e. Troubleshooting procedures.
   f. Internal schematic and wiring diagrams.
4. List of spares, expendables, test equipment and tools provided.
5. List of additional recommended spares, expendables, test equipment, and tools. Include quantities, unit prices, and total costs.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers protected against impact, abrasion, corrosion, discoloration and/or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment.

B. Prior to shipment, include corrosive inhibitive vapor capsules in shipping containers, and related equipment as recommended by capsule manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide components that are listed in the Ethernet Components List in Article Supplements at the end of this Section. Specific component requirements are defined in the Ethernet Components Data Sheets in Article Supplements at the end of this Section.

PART 3 - EXECUTION

3.01 ONSITE CONFIGURATION AND TESTING

A. IGMP Snooping functionality for switches and routers on the Ethernet/IP networks will be configured and tested as specified by Rockwell Automation.

3.02 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are part of this Specification.
   1. Network Components List.

1. Network Components List.

ITEM	DESCRIPTION	MANUFACTURER	MODEL
1	Network switch (for Sanitary Pump Station Panel 00PNL101)	NTRON	105FX
2	Network switch (for Network Cabinet 29PCM01)	NTRON	105FX
3	Ovation Ethernet Link Controller (ELC) module	Emerson	Emod 5X00419G01 Pmod 1X00569H01
4	Field LAN Router Cisco ISR4321-K9 with 8-port RJ45 Network Interface Module, Rackmount	Cisco (procured via Emerson)	1X00474G10

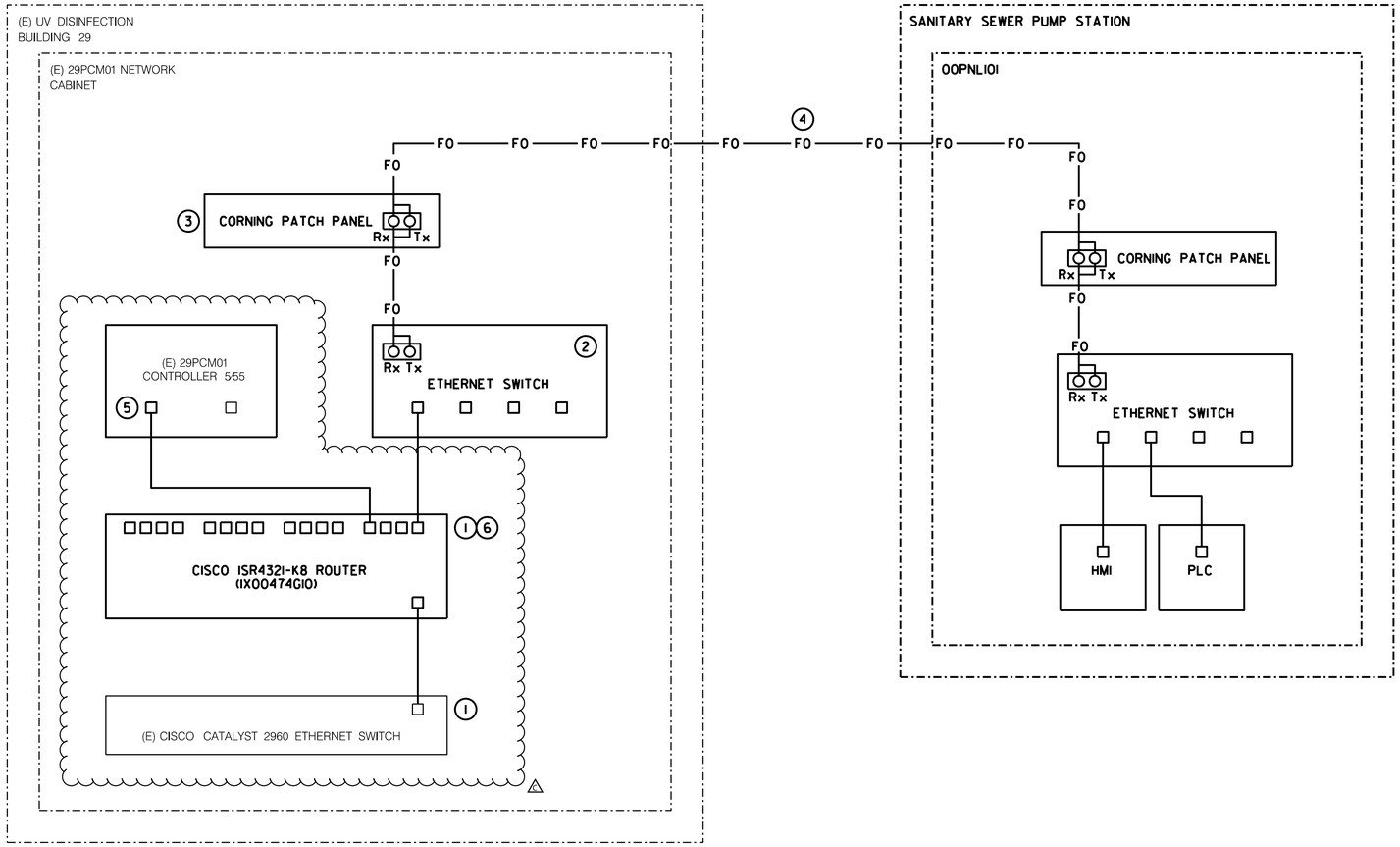
END OF SECTION

NOTES:

1. INSTALL ETHERNET PATCH CORDS AND CONFIRM ALL PORT TERMINATIONS WITH CITY DCS REPRESENTATIVE.
2. INSTALL ETHERNET SWITCH IN PANEL. PROVIDE FUSED TERMINALS, DIN RAIL, AND WIRE AS REQUIRED TO CONNECT TO EXISTING 24VDC POWER SUPPLY. △
3. INSTALL CORNING WCH-02P PATCH PANEL IN EXISTING NETWORK CABINET.
4. FIBER OPTIC CABLE SHALL BE 12 STRAND.
5. INSTALL ELC MODULE ON EXISTING CONTROLLER 29PCM01. SUPPLY EIP LICENSE FOR ELC MODULE.
6. INSTALL ROUTER IN NETWORK CABINET AS PER MANUFACTURER'S INSTRUCTIONS. CONFIRM POWER SOURCE WITH CITY DCS REPRESENTATIVE. △

LEGEND:

- FO — FIBER OPTIC, SINGLE MODE ETHERNET
- CAT6 TWISTED SHIELDED PAIR ETHERNET CABLE, COPPER
- NEW
- EXISTING



NETWORK DETAILS

I–03

STORM WATER DIVERSION AT THE SOUTH BAY WATER RECLAMATION PLANT

NETWORK DETAILS

CONSULTANT

KLEINFELDER
Bright People. Right Solutions.
KLEINFELDER.COM

DATE OF SIGNATURE:09/20/2022

REGISTERED PROFESSIONAL ENGINEER — RONALD K. ERNE — E 14351 — ELECTRICAL — STATE OF CALIFORNIA

CITY OF SAN DIEGO, CALIFORNIA
ENGINEERING & CAPITAL PROJECTS DEPARTMENT
SHEET 33 OF 34 SHEETS

WBS B-20002

APPROVED: FOR CITY ENGINEER — 7/13/2022 DATE
BRIAN VITELLE PRINT DCE NAME — C73039 RCE#

SUBMITTED BY: MARYAM KARGAR PROJECT MANAGER
CHECKED BY: JOEY FLORES PROJECT ENGINEER

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	KLF		7/13/22	
△ ADDENDUM C	KLF		9/20/22	

138-1748 CCS27 COORDINATE
1778713-6309809 CCS83 COORDINATE

CONTRACTOR
INSPECTOR
NTP DATE
NOC DATE

42199–33–D

ADDENDUM C

Bid Results

Bidder Details

Vendor Name	Burtech Pipeline Incorporated
Address	1325 Pipeline Drive Vista, California 92081 United States
Respondee	DOMINIC J. BURTECH
Respondee Title	PRESIDENT & CEO
Phone	760-634-2822
Email	buddy@burtechpipeline.com
Vendor Type	CADIR, PQUAL
License #	718202
CADIR	1000006324

Bid Detail

Bid Format	Electronic
Submitted	10/05/2022 1:31 PM (PDT)
Delivery Method	
Bid Responsive	
Bid Status	Submitted
Confirmation #	306578

Respondee Comment

Please include Lota@burtechpipeline.com for all correspondences. Thank you!

Buyer Comment

Attachments

File Title	File Name	File Type
Contractors Certification of Pending Actions.pdf	Contractors Certification of Pending Actions.pdf	Contractor's Certification of Pending Actions
Mandatory Disclosure of Business Interests Form.pdf	Mandatory Disclosure of Business Interests Form.pdf	Mandatory Disclosure of Business Interest
Prime Debarment and Suspension Certification.pdf	Prime Debarment and Suspension Certification.pdf	Prime Contractor - Debarment and Suspension Certification
Subs Debarment and Suspension Certification.pdf	Subs Debarment and Suspension Certification.pdf	Subcontractor - Debarment and Suspension
Bid Bond - Storm Water.pdf	Bid Bond - Storm Water.pdf	Bid Bond

Subcontractors

Showing 5 Subcontractors

Name & Address	Desc	License Num	CADIR	Amount	Type
In-Line Construction, Inc. PO Box 2637 Ramona, California 92065	Constructor - Fence an Gate	769516	1000002605	$28,381.00	DBE, HUBZ, MBE, CADIR, SDB, MALE, LAT, Local
Makelele Systems Landscape & Mai PO BOX 2044 Makelele Systems San Marcos, California 92079	Constructor - Salvage & Reinstall Irrigation	987557	1000028415	$19,528.00	MBE, CADIR, MALE, LAT, Local
NOVA Services, Inc. DVBE/SLBE 4373 Viewridge Ave Suite B San Diego, California 92123	Services - AL for Specialty Inspections	SLBE	1000007909	$10,000.00	CADIR, DVBE, SLBE, SDVSB, Local
R&C Structures, Inc. 1615 La Mirada Drive San Marcos, California 92078	Constructor - Valve Vault, Precast Wet Well and Diversion Structures	425215	1000004446	$290,781.78	WBE, WOSB, FEM, CAU, Local
Siege Electric Inc 2911 State St Suite I Carlsbad, California 92008	Constructor - Electrical & Instrumentation Scopes	1001521	1000059145	$399,950.00	CADIR, DBE, DVBE, ELBE, MBE, SDVSB, Local

Line Items

Discount Terms No Discount

Item #	Item Code	Type	Item Description	UOM	QTY	Unit Price	Line Total	Response	Comment
Main Bid							$2,840,650.00		
1	524126		Bonds (Payment and Performance)	LS	1	$30,000.00	$30,000.00	Yes	
2	236220		Building Permits (EOC Type I)	AL	1	$8,000.00	$8,000.00	Yes	
3	237110		Sewage and Storm Water Bypasses and Pumping Plans (Diversion Plan)	LS	1	$20,000.00	$20,000.00	Yes	
4	238910		Site Storage and Handling of Construction and Demolition Waste	TON	180	$200.00	$36,000.00	Yes	
5	238910		Disposal of Construction and Demolition Waste	TON	180	$300.00	$54,000.00	Yes	
6	237110		Mobilization	LS	1	$200,000.00	$200,000.00	Yes	
7	541330		Specialty Inspection Paid For By the Contractor (EOC Type II)	AL	1	$10,000.00	$10,000.00	Yes	
8			Field Orders (EOC Type II)	AL	1	$160,000.00	$160,000.00	Yes	
9	238910		Clearing and Grubbing	LS	1	$75,000.00	$75,000.00	Yes	
10	237310		Asphalt Pavement Repair	TON	30	$650.00	$19,500.00	Yes	
11	237310		Class 2 Aggregate Base	TON	60	$230.00	$13,800.00	Yes	
12	237310		Asphalt Concrete	Ton	1	$2,100.00	$2,100.00	Yes	
13	237310		Sand and Seal Coat	SF	4250	$1.00	$4,250.00	Yes	
14	238910		Concrete Pavement (4 Inch Thick)	CY	10	$1,000.00	$10,000.00	Yes	
15	237310		Remove and Replace Existing Sidewalk	SF	1200	$30.00	$36,000.00	Yes	
16	237310		Curb and Gutter (6-Inch Curb, Type SDG-151)	LF	100	$100.00	$10,000.00	Yes	
17	238990		Chain Link Fence	LF	100	$190.00	$19,000.00	Yes	
18	238990		Chain Link Gate	EA	1	$14,000.00	$14,000.00	Yes	
19	237110		Additional Bedding	CY	100	$100.00	$10,000.00	Yes	
20	237110		Storm Drain (18", PVC)	LF	16	$1,000.00	$16,000.00	Yes	
21	237110		Storm Drain (24", PVC)	LF	10	$1,300.00	$13,000.00	Yes	
22	237110		Storm Drain (30", PVC)	LF	109	$1,000.00	$109,000.00	Yes	
23	237110		Water Main (2 Inch)	LF	20	$100.00	$2,000.00	Yes	
24	237110		Sewer Force Main (6 Inch)	LF	20	$5,000.00	$100,000.00	Yes	
25	237110		Engineered Trench Shoring	LS	1	$35,000.00	$35,000.00	Yes	
26	237110		Potholing Existing Utilities Not Shown on Plans (Depth up to 7 feet)	EA	6	$1,000.00	$6,000.00	Yes	
27	238210		Remove and Reinstall Existing Light Pole	EA	1	$6,000.00	$6,000.00	Yes	
28	561730		Salvage and Reinstall Irrigation System	LS	1	$22,000.00	$22,000.00	Yes	
29	237310		Construction Fencing and Access Route	LS	1	$10,000.00	$10,000.00	Yes	
30	541330		WPCP Development	LS	1	$1,000.00	$1,000.00	Yes	
31	237310		WPCP Implementation	LS	1	$10,000.00	$10,000.00	Yes	
32	238910		Open-Graded Aggregate Stone	CY	100	$100.00	$10,000.00	Yes	
33	237110		96" Diversion Structure with Flexible Duckbill Check Valve	EA	2	$190,000.00	$380,000.00	Yes	
34	237110		Pump Station Sheeting & Shoring	LS	1	$67,000.00	$67,000.00	Yes	
35	238910		Demolition of Existing Pump Station and Valve Vault	LS	1	$75,000.00	$75,000.00	Yes	
36	237110		Precast Concrete Packaged Pump Station	LS	1	$650,000.00	$650,000.00	Yes	
37	238210		Site Electrical - Duct Banks, Pull Boxes & Cabling	LS	1	$70,000.00	$70,000.00	Yes	
38	238210		Instrumentation	LS	1	$400,000.00	$400,000.00	Yes	
39	238210		Fiber Optic System Improvements	LS	1	$12,000.00	$12,000.00	Yes	
40	237110		Dewatering Permit and Discharge Fees (EOC Type II)	AL	1	$110,000.00	$110,000.00	Yes	
41	237110		Dewatering Non-Hazardous Contaminated Water	LS	1	$5,000.00	$5,000.00	Yes	

Line Item Subtotals

Section Title	Line Total
Main Bid	**$2,840,650.00**
Grand Total	**$2,840,650.00**

SUBCONTRACTOR LISTING (OTHER THAN FIRST TIER)

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 is to list below the name, address, license number, DIR registration number of any (known tiered subcontractor) -** who will perform work, labor, render services or specially fabricate and install a portion [type] of the work or improvement pursuant to the contract. **If none are known at this time, mark the table below with non-applicable (N/A).**

Prime Contractor Name: Burtech Pipeline, Incorporated

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	DIR REGISTRATION NUMBER	SUBCONTRACTOR LICENSE NUMBER	TYPE OF WORK
Name: N/A Address: City: State: Zip: Phone: Email:				
Name: Address: City: State: Zip: Phone: Email:				
Name: Address: City: State: Zip: Phone: Email:				
Name: Address: City: State: Zip: Phone: Email:				

**** USE ADDITIONAL FORMS AS NECESSARY ****