

# CITY OF MERCER ISLAND

9611 SE 36th Street  
Mercer Island, WA 98040



## WATER DISTRIBUTION SCADA EQUIPMENT REPLACEMENT BID SET

Project Number: 153585

Bid Number: 21-01

VOLUME 1 OF 2  
CONTRACT DOCUMENTS  
December 2020



701 Pike Street Suite 1200  
Seattle, WA 98101

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## FOREWORD

THE ITEMS WHICH MAKE UP THE CONTRACT DOCUMENTS ARE AS FOLLOWS:

### DIVISION 0

#### NOTICES, BIDDING REQUIREMENTS, AND AGREEMENT FORMS

Notices, Bidding Requirements, and Agreement Forms have been copied and bound together with the remainder of the Contract Documents to facilitate the bidder's submittal of this proposal and other required documents.

#### GENERAL TERMS AND CONDITIONS

#### TECHNICAL SPECIFICATIONS

#### DRAWINGS (Bound Separately)

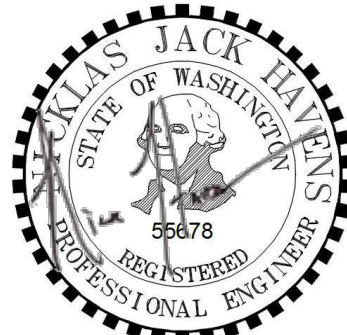
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The Project Manual for the Water Distribution SCADA Equipment Replacement Project for the City of Mercer Island has been prepared under the direction of the following Registered Professional Engineers.



2020.12.16 09:01:07-08'00'

Caitlin Bliesner  
Divisions 01 and 40



2020.12.16 12:54:31-08'00'

Nicklas Havens  
Division 26

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## NOTICES

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## Advertisement for Bids City of Mercer Island

Project Title: Water Distribution SCADA Equipment Replacement

Bid No.: 21-01

Engineers Estimated Cost (range): \$329,000 - \$465,000

Sealed bids will be received, not sent, electronically by the City until **2:00 PM on January 12, 2021**. Due to the Covid-19 pandemic and the temporary closure of the City Hall building, bidders shall submit bids in PDF format to the City Clerk at [cityclerk@mercerisland.gov](mailto:cityclerk@mercerisland.gov). Upon receipt of e-bid, the City Clerk will send a Zoom link to the same email that sent the bid (no exceptions).

A Virtual Bid Opening is scheduled for **January 14, 2021 at 10:00 AM**. Bid results will be posted on the City's website, after the Virtual Bid Opening, at <https://www.mercerisland.gov/rfps>.

Work to be performed under this contract, includes, but is not limited to: furnishing all labor, equipment, and materials necessary in upgrading the City's supervisory control and data acquisition (SCADA) equipment at five (5) remote water sites. This will consist of replacing the programmable logic controller (PLC) panels at each site, field testing and commissioning services for the new control system equipment, all associated electrical work, and training. The remote water sites include the following, as indicated on the Contract drawings:

1. First Hill Pump Station
2. SPU Station 171
3. South Fire Station
4. North Fire Station
5. Reservoir Pump Station

The City reserves the right to reject any and all bids and to waive minor irregularities.

Plans, specifications, addenda, and bidders list are available on-line through Builders Exchange of Washington, Inc. at <http://www.bxwa.com>. Click on "Posted Projects", "Public Works", "City of Mercer Island", "Projects Bidding". Builders Exchange manages the official bidders list. Bidders are encouraged to register in order to receive automatic email notification of future addenda and to be placed on the official bidders list.

Plans and specifications are also available at the City of Mercer Island website <https://www.mercerisland.gov/rfps>. Addenda may not be available or updated on this website.

A bid deposit in the amount of five percent (5%) of the bid total price must accompany each bid.

Bidder questions are to be directed to Maya Giddings, Project Coordinator, by email only at [maya.giddings@mercerisland.gov](mailto:maya.giddings@mercerisland.gov). The City will receive questions until **10:00am on December 30, 2020**. Questions received after this date will not be answered. All questions and responses will be posted by **January 6, 2021** to the Builders Exchange site.

The City of Mercer Island, in accordance with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations, Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Nondiscrimination in Federally-assisted programs of the Department of Transportation issued pursuant to such Act, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises as defined at 49 CFR Part 23 will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin, or sex in consideration for an award.

Deborah Estrada, MMC, City Clerk

Published: Seattle Daily Journal of Commerce – December 21, 2020 through January 12, 2021

## **City of Mercer Island Instructions to Bidders**

### 1. ELIGIBILITY TO BID:

It is the intent of the City to award a contract to the low responsible bidder. Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. To be eligible to bid, each Bidder must:

- A. At the time of bid submittal, have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW; and
- B. Have a current Washington Unified Business Identifier (UBI) number; and
- C. If applicable:
  - i. Have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW; and
  - ii. Have a Washington Employment Security Department number, as required in Title 50 RCW; and
  - iii. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW; and
- D. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3); and
- E. Within the three-year period immediately preceding the date of the bid solicitation, not have been determined by a final and binding citation and notice of assessment issued by the department of labor and industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of chapter 49.46, 49.48 or 49.52 RCW; and
- F. Have not filed for bankruptcy under any business name over the past five (5) years; and
- G. Have a minimum of five (5) years of documented company experience for projects of similar scope, size, and complexity.

A contract shall only be awarded to a Bidder that demonstrates to the City's satisfaction that the Bidder is qualified to perform the Work and is, therefore, a responsible bidder.

2. SUBCONTRACTOR RESPONSIBILITY CRITERIA:

The Bidder must verify responsibility criteria for each first-tier subcontractor, and each subcontractor of any tier that hires other subcontractors must verify responsibility criteria for each of its subcontractors. Upon request of the City the Bidder shall promptly provide documentation to the City demonstrating that the subcontractor(s) meets the subcontractor responsibility criteria below. The requirements of this section apply to all subcontractors regardless of tier.

At the time of subcontract execution, the Bidder shall verify that each of its first-tier subcontractors meets the following bidder responsibility criteria:

- A. Have a current certificate of registration in compliance with chapter 18.27 RCW; and
- B. Have a current Washington Unified Business Identifier (UBI) number; and
- C. If applicable:
  - i. Have Industrial Insurance (workers' compensation) coverage for the subcontractor's employees working in Washington, as required in Title 51 RCW; and
  - ii. Have a Washington Employment Security Department number, as required in Title 50 RCW; and
  - iii. Have a Washington Department of Revenue state excise tax registration number as required in Title 82 RCW; and
  - iv. Have an electrical contractor license, if required by Chapter 19.28 RCW; and
  - v. Have an elevator contractor license, if required by Chapter 70.87 RCW; and
- D. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065 (3); and
- E. Key personnel must hold an appropriate license in the applicable discipline.

3. EXAMINATION OF PLANS, SPECIFICATIONS AND SITE:

Each bidder is instructed to examine the Plans, Specifications, Addenda, the site of the proposed improvements, and conduct any other examination and investigation which the bidder may desire to make as to the accuracy of the nature of the work and the difficulties to be encountered. The Bidder shall be responsible for all costs associated with these additional examinations including all restoration work and damages which may be a result of such investigation. Bidders shall consider Federal, State, and local laws and regulations that may affect cost, progress, or performance of the work.

4. BIDDER QUESTIONS:

All questions about the meaning or intent of the Contract Documents are to be directed to Maya Giddings, Project Coordinator, in writing by email only at [maya.giddings@mercerisland.gov](mailto:maya.giddings@mercerisland.gov). No telephone questions will be accepted or considered. Bidders should include a reference to the specific Specification Section and paragraph number and/or Drawing number in the Contract Documents and should quote the passage being questioned.

The City will receive questions until **10:00am on December 30, 2020**. Questions received after this date will not be answered. All questions and responses will be posted by **January 6, 2021** to the Builders Exchange site. The City will delete bidder names from the text of question(s) and answers being sent.

Interpretations or clarifications considered necessary by the City in response to such questions will be issued by Addenda. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

5. WAGES:

This Contract is subject to Chapters 39.12 and 49.28 RCW, amendments thereto and regulations issued thereunder, relating to prevailing wages, benefits and other requirements. Bidders shall examine and be familiar with such requirements. No claim for additional compensation will be allowed which is based upon a lack of knowledge or a misunderstanding of any such requirements by the Bidder or a failure to include in Bidder's price adequate increases in such wages during the performance of this Contract. The State of Washington prevailing wage rates for King County apply to work performed under this contract. The applicable prevailing wage rates may be found at the following website address of the Department of Labor and Industries: <https://fortress.wa.gov/lni/wagelookup/prvWagelookup.aspx>. Based on the bid submittal date for this project, the applicable date for prevailing wages for this project is April 3, 2020. A copy of the applicable prevailing wage rates are also available for viewing at the City of Mercer Island, Maintenance Department located at 9611 SE 36<sup>th</sup> Street.

6. PROGRESS AND COMPLETION:

Time is of the essence for this Project. Progress and completion of the Work shall comply with all requirements herein, and intermediate and final completion dates as may be set forth in the specifications. The submission of a bid constitutes the Bidder's acknowledgement that such progress and completion requirements have been taken into account in formulating a price for this Work.

7. PREVENTION OF ENVIRONMENTAL POLLUTION AND PRESERVATION OF PUBLIC NATURAL RESOURCES:

If awarded the Contract, the Bidder shall fully comply with all such environmental protection laws, ordinances and regulations dealing with prevention and environmental pollution and the preservation of public natural resources that may be applicable to this Project. The cost of such compliance shall be included in the bid prices.

8. BID FORM:

The Bid Form is included in the Contract Documents. The Bid Form must be completed in ink. Bids that contain omissions, erasures or irregularities of any kind may be rejected. Any qualification, addition, limitation or provision attached to or contained in a bid may render the bid non-responsive and not eligible for award. No oral, facsimile, telegraphic or telephonic bids or modifications will be considered.

All bids shall be signed by the Bidder, or the Bidder's authorized representative. If the bid is made:

- A. By an individual, the Bidder's name, signature, and address must be shown;
- B. By a partnership or joint venture, it shall contain the names of each partner, the mailing address of the partnership or joint venture and shall be signed in the firm name, followed by the signature of the person signing, indicating that person's position in the partnership or joint venture;
- C. By a corporation or limited liability company ("LLC"), the name of the state under the laws of which the corporation or LLC is chartered, the name and post office address of the corporation or LLC and the title of the person who signs on behalf of the corporation or LLC must be shown.

Upon the City's request, the Bidder shall provide copies of the articles of incorporation, bylaws, resolutions of board of directors, partnership papers, joint venture agreements, and any other documents evidencing the legal status of the Bidder and the authority of the Bidder's officer or representative who signed the bid on behalf of the Bidder.

The City is not responsible for any cost incurred in responding to this Call for Bids.

9. ACKNOWLEDGEMENT OF ADDENDA:

Each Bidder shall include on the Bid Form specific acknowledgment of receipt of each Addendum issued by the City during the bidding period. If the Bidder does not specifically acknowledge each addendum, the City may reject the bid as non-responsive unless the City determines from delivery records or from inclusion of information in the bid of information contained in the addenda that the Bidder received constructive notice of the addenda.

10. BID SECURITY:

The Bid shall be accompanied by a bid deposit in the amount equal to at least 5% of the Total Bid Price. The bid deposit shall be in one of the following formats and made payable to the City:

- A. A bid guaranty bond, in accordance with and using a form acceptable to the City which contains provisions substantially similar to those in the bid bond form included with the Contract Documents, duly completed by a guaranty company authorized to carry on business in the state of Washington; or
- B. A postal money order, a certified check, or cashier's check drawn upon a banking institution with a branch office in the state of Washington.

The surety signing the bid guaranty bond shall be registered with the Washington State Insurance Commissioner, and the surety's name shall appear in the current Authorized Insurance Company List in the State of Washington published by the Office of the Insurance Commissioner. A Power of Attorney must accompany the bid guaranty bond and must appoint the surety's true and lawful attorney-in-fact to make, execute, seal and deliver the bid guarantee bond. Failure to submit the required bid security with the Bid shall render the bid non-responsive and the Bid shall be rejected.

11. NON-COLLUSION:

Each bid shall be accompanied by a signed Non-Collusion Declaration in accordance with, and using the form provided by the City. Failure to submit a signed Declaration with the Bid shall render the bid non-responsive and the Bid shall be rejected.

More than one Bid from an individual, firm, partnership, corporation, or association under the same or different names will not be considered. If the City believes that any Bidder is interested in more than one Bid for the work contemplated, all Bids in which such Bidder is interested will be rejected. If the City believes that collusion exists among the Bidders, all Bids will be rejected.

12. DELIVERY OF BID:

Each Bid shall be submitted in PDF format via electronic transmission. Due to the Covid-19 pandemic and the temporary closure of the City Hall building, bidders shall submit bids in PDF format to the City Clerk at [cityclerk@mercerisland.gov](mailto:cityclerk@mercerisland.gov). The City will not consider bids received after the time fixed for opening bids in the Advertisement for Bids.

The submission of a Bid will constitute an incontrovertible representation by the Bidder that the Bidder has complied with every requirement of these instructions, that without exception the Bid is premised upon performing the work required by the Contract Documents and such means, methods, techniques, sequences, or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the work.

13. MODIFICATION OF BID:

A modification of a Bid will be considered only if the modification is received prior to the time announced for the opening of Bids. All modifications shall be made in writing executed and submitted in the same form and manner as the original Bid.

14. RETURN OF BID SECURITY:

After the bid prices have been compared, the City may return the bid security if, in the City's judgment, the Bidder would not be considered for award. All other Proposal Guarantees will be held until the Contract and the Performance Bond of the successful bidder have been executed.

15. EVALUATION OF BIDS AND BID ERRORS:

After opening the Bids, the City will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit will control. The total of extensions, corrected where necessary, will be used by the City for award purposes.

Irregular Bids:

- A. A Bid will be considered irregular and will be rejected if:
  - i. The authorized Bid Form furnished by the City is not used or is materially altered;
  - ii. The completed Bid Form contains any unauthorized additions, deletions, alternate bids, or conditions;
  - iii. The bidder adds provisions reserving the right to reject or accept the Award, or enter into the Contract;
  - iv. A price per unit cannot be determined from the Bid Form;
  - v. The Bid Form is not properly executed;
  - vi. An executed non-collusion certificate is not provided; or
  - vii. Proper bid security does not accompany the Bid.
  
- B. A Bid may be considered irregular and may be rejected if:
  - i. The Bid Form does not include a unit price for every Bid item;
  - ii. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the City;
  - iii. Receipt of Addenda is not acknowledged;
  - iv. A member of a joint venture or partnership and the joint venture or partnership submit Bid Forms for the same project (in such an instance, both Bids may be rejected); or
  - v. If Bid Form entries are not made in ink.

Bids will be evaluated by the City to determine which bid is the apparent lowest, responsive bid.

Bid results will be posted on the City's website at <https://www.mercerisland.gov/rfps>.

The City, in its sole discretion, reserves the right to waive minor bid errors, informalities, and immaterial irregularities when it is in the City's best interest to do so.

16. EVALUATION OF BIDDER RESPONSIBILITY:

A Contract shall only be awarded to a Bidder that demonstrates to the City's satisfaction that the Bidder is qualified to perform the Work and is, therefore, a responsible bidder.

- A. Bidder Responsibility Criteria. To be determined responsible, the Bidder must, in addition to satisfying the bidder responsibility criteria listed in Section 1. ELIGIBILITY TO BID above:
  - i. Have adequate financial resources to perform the contract, or the ability to obtain them;
  - ii. Have a satisfactory performance record;
  - iii. Have a satisfactory record of integrity and business ethics;
  - iv. Have the necessary production, construction, and technical equipment and facilities or the ability to obtain them;



- v. Be otherwise qualified and eligible to receive an award under applicable laws and regulations;
  - vi. Be in compliance with training requirements in RCW 39.04.350(1)(f); and
  - vii. Provide a statement in accordance with RCW 9A.72.085 verifying compliance with responsible bidder criteria requirement of RCW 39.04.350(1)(g).
- B. Reference Checking. To assist the City in the review of the Bidder's qualifications, the Bidder shall, within five (5) days of being requested to do so by the City, provide the following information:
- i. Past Experience in Similar Projects. Provide a list of all construction contracts (whether completed or in progress) entered into or performed by the Bidder within the past five (5) years for projects similar in scope, time and complexity to the work called for under this Contract. Provide the names of the contracts, the contract price, and the names and phone numbers of the owners.
  - ii. References. Provide a list of five (5) references. References will be asked to rate performance on the following items: overall project performance; acceptable experience and technical knowledge; effective coordination of subcontractors; ability to coordinate and work with utility companies and governmental entities; responsiveness to owner requests; attention to safety; quality and timeliness of submittals, change order proposals, project schedule, schedule updates and other applicable paperwork.

If the Bidder is a joint venture, the Bidder shall submit information for the joint venture if the members have worked together in the past and also information about each member of the joint venture. The Joint Venture Agreement shall be included in the submission.

If the Bidder fails to supply information requested concerning responsibility within the time and the manner specified, the City may base its determination of responsibility upon any available information related to the responsibility criteria or may find the Bidder is not responsible.

The City reserves the right to inspect records, reports and other information which may be maintained by or for the Bidder to the extent necessary, as determined by the City to verify, clarify or otherwise consider the information provided by the Bidder.

17. DETERMINATION OF NON-RESPONSIBILITY:

If the City determines a Bidder to be not responsible, the City will provide, in writing, the reasons for the determination. The Bidder may appeal the determination within ten (10) days of its receipt of the City's determination of non-responsibility by presenting additional information to the City. The City shall consider the additional information before issuing its final determination. If the City's final determination affirms that the Bidder is not responsible, the City shall not execute a contract with any other bidder until two (2) business days after the Bidder determined to be not responsible has received the final determination.

18. CONTRACT AWARD:

If a Contract is awarded, the City will award the contract to the responsible bidder that submits the lowest total responsive bid for the schedule(s) selected by City after bid opening and prior to award.

If the Contract is to be awarded, City will give the successful Bidder a Notice of Award within sixty (60) days after the day of the Bid opening. No other act of the City or others will constitute acceptance of a Bid.

The City reserves the right to request bidders to extend the effective period of their bids.

19. REJECTION OF ALL BIDS:

The City reserves the right to reject any or all Bids at any time up to actual execution of the Public Works Contract, even if there has been an award of the Contract.

Any or all Bids will be rejected if the City has reason to believe that collusion exists among the Bidders.

20. EXECUTION OF PUBLIC WORKS CONTRACT:

The Bidder to whom award is made shall execute a written Public Works Contract with the City on the form provided, shall secure all insurance, and shall furnish all certificates, endorsements and bonds required by the Contract Documents within ten (10) calendar days after receipt of the forms from the City. Failure or refusal to execute the Public Works Contract as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the Bid security. If the lowest responsive, responsible Bidder refuses or fails to execute the Public Works Contract, the City may award the Contract to the second lowest responsive, responsible Bidder. If the second lowest responsive, responsible Bidder refuses or fails to execute the Public Works Contract, the City may award the contract to the third lowest responsive, responsible Bidder. On the failure or refusal of such second or third lowest Bidder to execute the Agreement, each such Bidder's Bid securities shall be likewise forfeited to the City.

21. BID PROTEST PROCEDURES:

- A. Form of Protest. In order to be considered, a Protest shall be in writing, addressed and delivered to the attention of the project manager at the City of Mercer Island, 9611 SE 36th Street, Mercer Island, Washington 98040. The Protest shall include the following:
- i. The name, address, and phone number of the Bidder protesting, or the authorized representative of the Bidder;
  - ii. A complete, detailed statement of all grounds for protest, supporting authority, and any supporting documentation. Supplemental information will not be considered unless the supplementation contains information not available at the time of protest;
  - iii. The specific ruling or relief requested; and
  - iv. Evidence that all persons with a financial interest in the procurement have been given notice of the Protest or if such persons are unknown, a statement to that effect.

- B. Who May Protest:
- i. Protests based on specifications: Any prospective Bidder.
  - ii. Protests following Bid opening: Any Bidder with a substantial financial interest in the award of a Contract.
- C. Time to Protest:
- i. Protests based on specifications or other terms in the Contract Documents must be received by the City no later than ten (10) calendar days prior to the date established for submittal of Bids.
  - ii. The City must receive protests based on other circumstances within five (5) calendar days after the bids are opened and publicly read.
  - iii. In no event shall a Protest be considered if all bids are rejected or after execution of the Contract.
- D. Determination of Protest. Upon receipt of a timely written Protest, the City shall investigate the Protest and shall respond in writing to the Protest prior to the award of Contract. If protest is submitted in accordance with the procedures set forth above, the City will not execute a contract any sooner than two (2) business days after the City's decision on the Protest.
- E. Failure to Comply. Failure to comply with the procedures set forth herein may render a Protest untimely or inadequate and may result in rejection thereof by the City.
- F. Exhaustion of Administrative Remedies. By submitting a bid, the Bidder agrees the Bidder's compliance with the protest procedures set forth herein are a mandatory condition precedent to the Bidder initiating a lawsuit against the City.
- G. Venue. By submitting a bid, the Bidder acknowledges and agrees that a lawsuit or action related to or arising out of this procurement shall be brought in the Superior Court of King County, Washington.

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## **Bidder's Checklist**

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**ALL BIDDERS** must properly complete, execute and submit the following with their bids:

1. **NON-COLLUSION DECLARATION:** Failure to submit the certificate shall make the bid non-responsive and not eligible for award.
2. **BID FORM:** Bidders must bid on all items contained in the Bid Form and the Form must be signed. The omission or deletion of any bid item may render the bid non-responsive and result in the rejection of the bid. Bidders are reminded to comply with RCW 39.30.060.
3. **CONTRACTOR DECLARATION PURSUANT TO RCW 39.04.350(2):** Failure to submit the declaration shall make the bid non-responsive and not eligible for award.
4. **BID GUARANTY BOND:** Failure to furnish a bid deposit of a minimum of five percent (5%) shall make the bid non-responsive and not eligible for award.
5. **BIDDERS QUALIFICATION CERTIFICATE:** To be completed and signed. The City reserves the right to check all statements and to judge the adequacy of the bidder's qualifications.

To assist the City in the review of the responsible Bidder's qualifications, the Bidder(s) shall, within five (5) days of being requested to do so by the City, provide the information required in Evaluation of Bidder Responsibility of the Instructions to Bidders, including a statement in accordance with RCW 9A.72.085 verifying compliance with responsible bidder criteria requirement of RCW 39.04.350(1)(g).

The **SUCCESSFUL BIDDER** shall properly complete, execute (as required) and submit the following after receiving notice of the award of the Project.

1. Public Works Contract,
2. Performance Bond,
3. Payment Bond,
4. Certificate of Insurance,
5. Retainage Agreement,
6. Statement of Intent to Pay Prevailing Wages,
7. Other documents requested by City.

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# Bidder's Qualification Certificate

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The undersigned hereby certifies and submits the following:

Company Name \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_  
Owner Name \_\_\_\_\_  
Contact Person \_\_\_\_\_  
Contact Person's Title \_\_\_\_\_  
Phone \_\_\_\_\_  
E-mail \_\_\_\_\_

Washington State Contractor Registration # \_\_\_\_\_  
Washington State Unified Business Identifier (UBI) # \_\_\_\_\_  
Federal Tax ID # \_\_\_\_\_  
City of Mercer Island Business License # \_\_\_\_\_  
(required prior to award of contract)

	Yes or No	Account / Registration Number (as applicable)
Does the contractor have industrial insurance coverage for its employees working in Washington as required by Title 51 RCW?	_____	_____
Does the contractor have a Washington State excise tax registration number as required by Title 82 RCW?	_____	_____
Does the contractor have a Washington State Employment Security Department number as required by Title 50 RCW?	_____	_____
Has the contractor been disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3)?	_____	_____

**By:** \_\_\_\_\_  
**Signature**

\_\_\_\_\_  
**Print Name**

\_\_\_\_\_  
**Title**

\_\_\_\_\_  
**Date**

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## **BIDDING REQUIREMENTS**

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## Non-Collusion Declaration

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**Project Name:** WATER DISTRIBUTION SCADA EQUIPMENT REPLACEMENT

**Bidder/Contractor:** \_\_\_\_\_

I, \_\_\_\_\_, declare under penalty of perjury under the laws of the State of Washington that the following statements are true and correct:

1. I am the representative for the above-named bidder/contractor, and as its \_\_\_\_\_, I am authorized to make the declaration herein on its behalf.
  
2. That the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.

---

Date and Place

---

Signature

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# BID FORM

(NOTE TO BIDDER: This BID FORM shall be completed in ink or typewritten)

**TO:** City of Mercer Island

**ADDRESS:** 9611 SE 36<sup>th</sup> Street  
Mercer Island, Washington 98040

**PROJECT TITLE:** WATER DISTRIBUTION SCADA EQUIPMENT REPLACEMENT

## Bidder Declaration and Understanding

The undersigned Bidder hereby declares that they have carefully examined the Contract Documents for the construction of the project, that they have personally inspected the site, that they have satisfied themselves as to the quantities involved, including materials and equipment, and conditions of work involved, including the fact that the description of the quantities of work and materials, as included herein, is brief and is intended only to indicate the general nature of the work and to identify the quantities with the detailed requirements of the Contract Documents, and that this Proposal is made according to the provisions and under the terms of the Contract Documents, which Documents are hereby made a part of this Proposal. The Bidder further declares that they have exercised their own judgment regarding the interpretation of subsurface information and has utilized all data, which they believe pertinent from the Engineer, Owner, and other sources and have made such independent investigations as the Bidder deems necessary in arriving at their conclusions.

The Bidder is hereby notified that no goal for disadvantaged business enterprise utilization has been established for this project. As part of the City's affirmative action effort, however, the City encourages participation of certified disadvantaged businesses and women business enterprises to act as prime contractors as well as subcontractors on this project.

The undersigned Bidder hereby declares that Bidder has carefully examined the Contract Documents including the following addenda, receipt of all is hereby acknowledged:

Addendum Number	_____	Date	_____
	_____		_____
	_____		_____
	_____		_____

## Start of Construction and Contract Completion Time

The Bidder agrees that he/she will begin work within 10 calendar days of the Notice to Proceed, and Final Completion of the entire project will be achieved by the Final Completion Date (except for extensions of time granted in accordance with the General Terms and Conditions). The Bidder further agrees he/she will, if necessary, accelerate his work, provide additional workers and equipment, and expedite materials delivery to meet these dates, all at no additional expense to the OWNER.

By submitting this bid, the bidder agrees that, if award this contract, they will achieve Final Completion within 215 calendar days from the Notice to Proceed and the Substantial Completion Date will be 30 calendar days prior to the Final Completion Date.

Project timeline and work limitations for this contract are:

1. Notice to Proceed with construction is anticipated by the week of March 1, 2021.
2. The project shall be substantially complete no later than September 30, 2021.
3. Refer to Section 01 12 16 Work Sequence and Constraints for additional information on project milestones, construction sequencing requirements, work restrictions, and constraints for the Work.

#### Lump Sum or Unit Price Work

The Bidder proposes to accept as full payment for the work proposed herein the amounts computed under the provisions of the Contract Documents and based on the following lump sum or unit price amounts, it being expressly understood that the unit prices are independent of the exact quantities involved. The Contractor shall be compensated for the actual unit quantities performed in accordance with the General Terms and Conditions set forth in these Contract Documents. The Bidder agrees that the lump sum prices and the unit prices represent a true measure of the labor, services, and materials required to perform the work, including all allowances for Contractor-paid taxes, overhead, and profit for each type and unit of work, as well as any auxiliary costs associated with completing a unit of work called for in these Contract Documents. The City does not guarantee the quantities estimated for unit price items, nor does the City limit itself to the estimated number.

If any material, item, or service required by the Contract Documents has not been mentioned specifically, the same shall be furnished and placed with the understanding that the full cost to the Owner has been merged with the prices named in the Proposal.

To the extent possible, standard bid items have been utilized for the work listed in the Proposal. The Bidder is directed to review the Standard Specifications and the City of Mercer Island's Amendments (Special Provisions herein) for descriptions of bid item work, measurement, and payment.

Bid Schedule

Item No.	Specification Reference Number Classification of Unit Price Work	Quantity Unit	Unit Price	Amount
1	Lump sum price to perform the general conditions and administrative work identified in Division 1 of the Contract Documents. To include, but not limited to the construction progress schedule, project meetings, construction facilities and temporary controls, and traffic control.	1 Lump Sum	\$--	\$
2	Section 26 05 00: Lump sum price to perform the electrical work identified in the Contract Documents. To include, but not limited to trace existing electrical circuits, label or re-label external circuits, install and route conduit, pull and terminate cable, adding enclosure nameplate and warning signage, provide temporary power and control circuits, demolition of obsolete field wiring/raceway, and provide new power panel board.	1 Lump Sum	\$--	\$
3	Division 40: Lump sum price to perform the process control system work identified in the Contract Documents. To include, but not limited to control panel work, factory testing, field testing and commissioning in coordination with the Programmer, and control system hardware training.	1 Lump Sum	\$--	\$
4	Allowance to cover unforeseen items identified during construction.	1 Lump Sum	\$--	\$40,000

Total Bid (Sum of 1, 2, 3, 4) = \$\_\_\_\_\_

Subcontractor Listing – RCW 39.30.060

Pursuant to RCW 39.30.060, the Bidder shall list as part of its Bid either itself or the names of the subcontractors with whom the Bidder, if awarded the contract, will subcontract for performance of the work of heating, ventilation and air conditioning (“HVAC”), plumbing as described in chapter 18.106 RCW, and electrical as described in chapter 19.28 RCW. The bidder shall list as part of its Bid either itself or the name of the subcontractor for performance of the work of Systems Integrator specified in Division 40, and meeting the qualifications specified in Section 40 61 13. The Bidder shall not list more than one subcontractor for each category of work.

Failure of the Bidder to submit as part of the Bid the names of such subcontractors or to name itself to perform such work or the naming of two or more subcontractors to perform the same category of work shall render the Bidder’s Bid nonresponsive and therefore, void.

The requirement of this section to name the Bidder’s proposed HVAC, plumbing, electrical, and systems integration subcontractors applies only to proposed HVAC, plumbing, electrical, and systems integration subcontractors who will contract directly with the general contractor submitting the Bid to the City.

Electrical work must be performed by a licensed electrical contractor. Bidders are cautioned that installation of electrical equipment (PVC or metal conduit, junction boxes or similar work) may be considered electrical work even if for future use and no electrical current is involved.

If the subcontract work categories as described above are not applicable to the work being bid, the bidder must indicate that the subcontract category is “NOT APPLICABLE.”

**HVAC**

Subcontractor Name: \_\_\_\_\_

UBI Number: \_\_\_\_\_

**Plumbing**

Subcontractor Name: \_\_\_\_\_

UBI Number: \_\_\_\_\_

**Electrical**

Subcontractor Name: \_\_\_\_\_

UBI Number: \_\_\_\_\_

**Systems Integrator**

Subcontractor Name: \_\_\_\_\_

UBI Number: \_\_\_\_\_



# PROPOSAL SIGNATURE SHEET

## If Sole Proprietor, Partnership or Joint Venture

IN WITNESS hereto the undersigned have set their hands this

\_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_.

Name of Bidder (name each partner  
or joint venture partner) \_\_\_\_\_

Washington Contractor's Registration  
No. \_\_\_\_\_

Address \_\_\_\_\_

Authorized Signature \_\_\_\_\_

Position/Title \_\_\_\_\_

## If Corporation or Limited Liability Company (LLC)

IN WITNESS WHEREOF the undersigned corporation has caused this instrument to be executed and its seal affixed by its duly authorized officers this

\_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_.

Name of Corporation or Limited  
Liability Company (LLC) \_\_\_\_\_

Washington Contractor's Registration  
No. \_\_\_\_\_

Address \_\_\_\_\_

State of Incorporation or Organization \_\_\_\_\_

Authorized Signature \_\_\_\_\_

Position/Title \_\_\_\_\_

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**Contractor Declaration Pursuant to RCW 39.04.350(2)**

**Project Name:** WATER DISTRIBUTION SCADA EQUIPMENT REPLACEMENT

**Bidder/Contractor:**

I, \_\_\_\_\_, declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct:

1. I am the representative for the above-named bidder/contractor, and as its \_\_\_\_\_, I am authorized to make the declaration herein on its behalf.
  
2. Within the three-year period immediately preceding the date of the bid solicitation for the above-named project, the above-named bidder/contractor has not been determined by a final and binding citation and notice of assessment issued by the department of labor and industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of chapter 49.46, 49.48, or 49.52 RCW.

\_\_\_\_\_  
Date and Place

\_\_\_\_\_  
Signature

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## BID GUARANTY BOND

KNOW ALL BY THESE PRESENTS: That we, \_\_\_\_\_,  
as Principal, and \_\_\_\_\_, as Surety, are jointly and  
severally held and firmly bound unto the City of Mercer Island, hereinafter called the Obligee,  
each in the penal sum of five percent (5%) of the Principal's Total Bid Price for the work, this  
sum not to exceed \_\_\_\_\_ DOLLARS (\$\_\_\_\_\_) (hereinafter  
referred to as "penal sum") of lawful money of the United States, for the payment whereof  
unto the Obligee.

WHEREAS, the Principal is herewith submitting its bid proposal for the

### **WATER DISTRIBUTION SCADA EQUIPMENT REPLACEMENT Bid Number: 21-01**

NOW, THEREFORE, the condition of this obligation is such that if the Principal is awarded the  
Contract, and if the Principal, within the time specified, fulfills all of the requirements of the  
Contract Documents which are conditions precedent to the execution of the Agreement, enters  
into, executes and delivers to the Obligee an agreement on the form provided herein complete  
with evidences of insurance, and if the Principal, within the time specified, gives to the Obligee  
the performance and payment bond on the forms provided herein, then this obligation shall be  
void; otherwise, the Principal and Surety shall pay unto the Obligee the penal sum; provided  
however, in no event shall the Surety's liability exceed the penal sum. Provided further, if the  
difference in money between the Principal's Total Bid Price and the amount for which the  
Obligee legally contracts with another party to fulfill the Contract is greater than the penal sum,  
the Principal shall pay unto the Obligee the difference between the penal sum and the amount  
the Obligee pays another to fulfill the Contract.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable under this obligation  
as Principal, and that nothing of any kind or nature whatsoever that will not discharge the  
Principal shall operate as a discharge or a release of liability of the Surety.

IT IS HEREBY FURTHER DECLARED AND AGREED that this obligation shall be binding upon and  
inure to the benefit of the Principal, the Surety and the Obligee and their respective heirs,  
executors, administrators, successors and assigns.

SIGNED this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

Principal: \_\_\_\_\_

Surety: \_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Address: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: ( ) \_\_\_\_\_

Telephone: ( ) \_\_\_\_\_

**Note: A power of attorney must be provided which appoints the Surety's true and lawful attorney-in-fact to make, execute, seal and deliver this bid guaranty bond.**

## AGREEMENT FORMS

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**PUBLIC WORKS CONTRACT  
FOR  
WATER DISTRIBUTION SCADA EQUIPMENT REPLACEMENT**

THIS PUBLIC WORKS CONTRACT ("Contract") dated \_\_\_\_\_, 20\_\_\_\_, is effective on the date the Contract is fully executed by the Parties. The Parties to this Contract are the CITY OF MERCER ISLAND, a Washington municipal corporation ("City" or "Owner"), and \_\_\_\_\_, a Washington Corporation ("Contractor").

A. The City desires to retain an independent contractor to furnish all labor and materials necessary to perform work at \_\_\_\_\_, Mercer Island, Washington ("Property"); and

B. The Contractor has the requisite skill and experience to perform such work and has submitted a proposal dated \_\_\_\_\_, 20\_\_\_\_ to complete such work ("Proposal").

NOW, THEREFORE, the parties ("Parties") agree to the following terms and conditions:

**1. SERVICES BY CONTRACTOR**

1.1 Description of Work. Contractor shall perform all work and furnish all tools, materials, supplies, equipment, labor and other items incidental thereto necessary for the construction and completion of the work, more particularly described in the Contract Documents for the Water Distribution SCADA Equipment Replacement Project, including this Public Works Contract, the Contractor's completed Bid Form, the City's General Terms and Conditions (February 2013 ed.), any Supplemental and/or Special Conditions, Technical Specifications, Drawings and Addenda, which documents are incorporated by this reference, ("Work"), which Work shall be completed to the City's satisfaction, within the time period prescribed by the City and pursuant to the direction of the City Manager or his or her designee.

1.2 Completion Date. The Work shall be commenced within ten (10) days of receipt by the Contractor of the City's Notice to Proceed and shall be Substantially Completed by \_\_\_\_\_, (the "Contract Time") as may be extended in accordance with the Contract Documents. In the event the Work is not completed within the time specified, Contractor agrees to pay to the City liquidated damages in the amount set forth in Section 1.3 of this Contract.

1.3 Liquidated Damages. TIME IS OF THE ESSENCE OF THIS CONTRACT. Delays inconvenience the residents of Mercer Island and cost taxpayers undue sums of money, adding time needed for administration, engineering, inspection and supervision. It is impractical for the City to calculate the actual cost of delays. Accordingly, the Contractor agrees to pay liquidated damages as follows: Liquidated damages for failure to achieve timely Substantial Completion shall be in the amount of \$ \_\_\_\_\_ per day.

1.4 Performance Standard. Contractor shall perform the Work in a manner consistent with accepted practices for highly skilled and competent contractors performing this type of work in this area.

1.5 Compliance with Laws. Contractor shall perform the Work in accordance with all applicable federal, state and City laws, including but not limited to all City ordinances, resolutions, standards or policies, as now existing or hereafter adopted or amended, and obtain all necessary permits and pay all permit, inspection or other fees, at its sole cost and expense.

1.6 Utility Location. Contractor is responsible for locating any underground utilities affected by the Work and is deemed to be an excavator for purposes of Chapter 19.122 RCW, as amended. Contractor shall be responsible for compliance with Chapter 19.122 RCW, including utilization of the "one call" locator system before commencing any excavation activities.

1.7 Air Environment. Contractor shall fully cover any and all loads of loose construction materials including without limitation, sand, dirt, gravel, asphalt, excavated materials, construction debris, etc., to protect said materials from air exposure and to minimize emission of airborne particles to the ambient air environment within the City of Mercer Island.

## **2. TERM**

This Contract shall commence on the effective date of this Contract and continue until the Work is complete, and formally accepted by City, and all warranties have expired.

## **3. REQUISITE SKILL**

The Contractor warrants that it has the requisite skill to complete the Work, and is appropriately accredited and licensed by all applicable agencies and governmental entities, including but not limited to being registered to do business in the City of Mercer Island by obtaining a City of Mercer Island business registration. Contractor represents that it has visited the site and is familiar with all of the plans and specifications in connection with the completion of the Work.

## **4. COMPENSATION**

4.1 Total Compensation. In consideration of the Contractor performing the Services, the City agrees to pay the Contractor an amount not to exceed \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), based on the Proposal submitted by Contractor dated \_\_\_\_\_ and as may be adjusted under the Contract Documents.

4.2 Contractor Responsible for Taxes. Except as otherwise stated in the Contract Documents, the Contractor shall be solely responsible for the payment of any taxes imposed by any lawful jurisdiction as a result of the performance and payment of this Contract.

4.3 Method of Payment. Payment by the City for the Work will only be made after the Work has been completed, a voucher or invoice is submitted in a form satisfactory to the City, and such invoice is approved by the appropriate City representative. Payment shall be made within thirty (30) days of receipt of such invoice or voucher unless otherwise set forth in the Bid Form. The Contractor's acceptance of such payment for the Work shall constitute full compensation for the performance of the Work. Invoices shall be submitted to:

City of Mercer Island  
9611 S.E. 36th Street  
Mercer Island, WA 98040  
ATTN: (staff), (title)

4.4 Retainage. Pursuant to Chapter 60.28 RCW, five percent (5%) of the Total Compensation shall be retained by the City to assure payment of Contractor's state taxes as well as payment of subcontractors, suppliers and laborers. Upon execution of this Contract, Contractor shall complete, execute and deliver to the City the Contractor's Retainage Agreement set forth in the Contract Documents. No payments shall be made by the City from the retained percentage fund ("Fund") nor shall the City release any retained percentage escrow account to any person, until the City has received from the Department of Revenue a certificate that all taxes, increases, and penalties due from the Contractor and all taxes due and to become due with respect to the Contract have been paid in full or that they are, in the Department's opinion, readily collectible without recourse to the State's lien on the retained percentage. Upon non-payment by the general contractor, any supplier or subcontractor may file a lien against the retainage funds, pursuant to Chapter 60.28 RCW. Subcontractors or suppliers are required to give notice of any lien within thirty (30) days of the completion of the Work and in the manner provided in RCW 39.08.030. Within sixty (60) days after completion of all Work on this Contract, the City shall release and pay in full the money held in the Fund, unless the City becomes aware of outstanding claims made against this Fund.

## **5. EQUAL OPPORTUNITY EMPLOYER**

In all Contractor services, programs or activities, and all Contractor hiring and employment made possible by or resulting from this Contract, there shall be no discrimination by Contractor or by Contractor's employees, agents, subcontractors or representatives against any person because of sex, sexual orientation, age (except minimum age and retirement provisions), race, color, creed, national origin, marital status or the presence of any disability, including sensory, mental or physical handicaps, unless based upon a bona fide occupational qualification in relationship to hiring and employment. This requirement shall apply, but not be limited to the following: employment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. Contractor shall not violate any of the terms of Chapter 49.60 RCW, Title VII of the Civil Rights Act of 1964, the Americans With Disabilities Act, Section 504 of the Rehabilitation Act of 1973 or any other applicable federal, state or local law or regulation regarding non-discrimination. Any material violation of this provision shall be grounds for termination of this Contract by the

City and, in the case of the Contractor's breach, may result in ineligibility for further City agreements.

## **6. INDEPENDENT CONTRACTOR/CONFLICT OF INTEREST**

It is the intention and understanding of the Parties that the Contractor shall be an independent contractor and that the City shall be neither liable nor obligated to pay Contractor sick leave, vacation pay or any other benefit of employment, nor to pay any social security or other tax which may arise as an incident of employment. The Contractor shall pay all income and other taxes as due. Industrial or any other insurance which is purchased for the benefit of the City, regardless of whether such may provide a secondary or incidental benefit to the Contractor, shall not be deemed to convert this Contract to an employment contract. It is recognized that Contractor may perform work during the Term of this Contract for other third parties; provided, however, that such performance of other work shall not conflict with or interfere with the Contractor's ability to perform the Work. Contractor agrees to resolve any such conflicts of interest in favor of the City.

## **7. INDEMNIFICATION**

### **7.1 Indemnification and Hold Harmless.**

- A. The Contractor shall protect, defend, indemnify, and hold harmless City, its elected officials, officers, agents and employees, from any and all claims, demands, suits, penalties, losses, damages, judgments, or costs of any kind whatsoever (hereinafter "claims"), arising out of or in any way resulting from the Contractor's officers, employees, agents, and/or subcontractors of all tiers, acts or omissions, performance or failure to perform this Contract, to the maximum extent permitted by law or as defined by RCW 4.24.115, now enacted or as hereinafter amended.
- B. The Contractor's obligations under this section shall include, but not be limited to,
  - i. The duty to promptly accept tender of defense and provide defense to City at the Contractor's own expense.
  - ii. The duty to indemnify and defend City, its elected officials, officers, agents and employees, from any claim, demand, and/or cause of action brought by or on behalf of any of its employees, or agents. The foregoing duty is specifically and expressly intended to constitute a waiver of the Contractor's immunity under Washington's Industrial Insurance Act, RCW Title 51, as respects City with a full and complete indemnity and defense of claims made by the Contractor's employees. The parties acknowledge that these provisions were mutually negotiated upon by them.
  - iii. To the maximum extent permitted by law, the Contractor shall indemnify and defend City, its elected officials, officers, agents and employees,

from and be liable for all damages and injury which shall be caused to owners of property on or in the vicinity of the work or which shall occur to any person or persons or property whatsoever arising out of the performance of this Contract, whether or not such injury or damage is caused by negligence of the Contractor or caused by the inherent nature of the work specified.

- C. City may, in its sole discretion, (1) withhold amounts sufficient to pay the amount of any claim for injury, and/or (2) pay any claim for injury of which City may have knowledge, regardless of the formalities of notice of such claim, arising out of the performance of this Contract.
- D. Any amount withheld will be held until the Contractor secures a written release from the claimant, obtains a court decision that such claim is without merit, or satisfies any judgment on such claim. In addition, the Contractor shall reimburse and otherwise be liable for claims costs incurred by City, including, without limitation, costs for claims adjusting services, attorneys, engineering, and administration.
- E. In the event City incurs any judgment, award, and/or costs arising therefrom, including attorneys' fees, to enforce the provisions of this article, all such fees, expenses, and costs shall be recoverable from the Contractor.
- F. This provision has been mutually negotiated by the City and the Contractor.

7.2 Survival. The provisions of this Section shall survive the expiration or termination of this Contract with respect to any event occurring prior to such expiration or termination.

## **8. INSURANCE**

The Contractor agrees to carry as a minimum, the following insurance against claims for injuries to persons or damage to property which may arise from or in connection with the performance of the Work by Contractor, its agents, representatives, employees or subcontractors with a carriers having a current A.M. Best rating of not less than A:VII:

8.1 Workers' Compensation and Employer's Liability Insurance in amounts sufficient pursuant to the laws of the State of Washington.

8.2 Commercial general liability insurance shall be written on Insurance Services Office (ISO) occurrence form CG 00 01 and shall cover liability arising from premises, operations, independent contractors, products-completed operations, stop gap liability, personal injury and advertising injury, and liability assumed under an insured contract. The Commercial General Liability insurance shall be endorsed to provide the Aggregate Per Project Endorsement ISO form CG 25 03 11 85. There shall be no endorsement or modification of the Commercial General Liability insurance for liability arising from explosion, collapse or underground property damage. The City shall be named as an additional insured under the Commercial General Liability insurance policy

with respect to the Work performed for the City using ISO Additional Insured endorsement CG 20 10 10 01 and Additional Insured Completed Operations endorsement CG 20 37 10 01 or substitute endorsements providing equivalent coverage with limits of no less than \$1,000,000 each occurrence, \$2,000,000 general aggregate and a \$2,000,000 products-completed operations aggregate limit.

8.3 Automobile liability insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be written on ISO form CA 00 01 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage with combined single limits for bodily injury and property damage of not less than \$1,000,000 per accident.

8.4 Asbestos Abatement or Hazardous Materials. If asbestos abatement or hazardous materials work is performed, Contractor shall review coverage with the City Attorney's office and provide scope and limits of coverage that are appropriate for the scope of Work and are satisfactory to the City. Contractor shall not commence any Work until its coverage has been approved by the City Attorney's office.

The City shall be named as additional insured on all such insurance policies, with the exception of workers' compensation coverages. Contractor shall provide certificates of insurance, concurrent with the execution of this Contract, evidencing such coverage and, at City's request, furnish the City with copies of all insurance policies and with evidence of payment of premiums or fees of such policies. All insurance policies shall contain a clause of endorsement providing that they may not be terminated or materially amended during the Term of this Contract, except after thirty (30) days prior written notice to the City. Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to all of the same insurance requirements as stated herein for the Contractor. Contractor's failure to maintain such insurance policies shall be grounds for the City's immediate termination of this Contract.

The provisions of this Section shall survive the expiration or termination of this Contract with respect to any event occurring prior to such expiration or termination.

## **9. PERFORMANCE/PAYMENT BOND OR ADDITIONAL RETAINAGE**

Pursuant to RCW 39.08.010, Contractor shall provide Performance Bond and Payment Bond each in an amount equal to 100% of the amount of this Contract to cover the performance of all provisions of this Contract and the payment of all laborers and suppliers. The Contract bonds shall be in a form set forth in the Contract Documents. The Contract bond shall assure that the Contractor will faithfully perform all of the provisions of the Contract as well as pay all laborers, mechanic subcontractors, materialmen and suppliers. Contractor's obligations under this Contract shall not be limited to the bond amount.

Alternatively, pursuant to RCW 39.08.010, on contracts of Fifty-Five Thousand Dollars (\$55,000) or less, at the option of the Contractor, the City may, in lieu of a bond, retain ten percent (10%) of the Contract amount for a period of thirty (30) days after the

date of final acceptance, or until receipt of all necessary releases from the Department of Revenue and the Department of Labor and Industries and settlement of any liens filed under Chapter 60.28 RCW, whichever is later.

## **10. SAFETY**

Contractor shall take all necessary precautions for the safety of its employees on the work site and shall comply with all applicable provisions of federal, state and municipal safety and health laws and codes, including without limitation, all OSHA/WISHA requirements, Safety and Health Standards for Construction Work (Chapter 296-155 WAC), General Safety and Health Standards (Chapter 296-24 WAC), and General Occupational Health Standards (Chapter 296-62 WAC). Contractor shall erect and properly maintain, at all times, all necessary guards, barricades, signals and other safeguards at all unsafe places at or near the Work for the protection of its employees and the public, safe passageways at all road crossings, crosswalks, street intersections, post danger signs warning against known or unusual hazards and do all other things necessary to prevent accident or loss of any kind. Contractor shall protect from damage all water, sewer, gas, steam or other pipes or conduits, and all hydrants and all other property that is likely to become displaced or damaged by the execution of the Work. The Contractor shall, at its own expense, secure and maintain a safe storage place for its materials and equipment and is solely responsible for the same.

## **11. PREVAILING WAGES**

11.1 Wages of Employees. This Contract is subject to the minimum wage requirements of Chapter 39.12 of the Revised Code of Washington, as now existing or hereafter amended or supplemented. In the payment of hourly wages and fringe benefits to be paid to any of Contractor's laborers, workpersons and/or mechanics, Contractor shall not pay less than the "prevailing rate of wage" for an hour's work in the same trade or occupation in the locality within the State of Washington where such labor is performed, as determined by the Industrial Statistician of the Department of Labor and Industries of the State of Washington. Prevailing wages paid pursuant to this Agreement shall be the prevailing wage rates which are in effect on the date when the bids, proposals, or quotes were required to be submitted to the City.

The State of Washington prevailing wage rates applicable for this public works project, which is located in King County, may be found at the following website address of the Department of Labor and Industries: <https://fortress.wa.gov/lni/wagelookup/prvWagelookup.aspx>. A copy of the applicable prevailing wage rates are also available for viewing at the office of the City located at 9611 SE 36th St, Mercer Island, WA 98040. Upon request, the City will mail a hard copy of the applicable prevailing wages for this project.

11.2 Reporting Requirements. Contractor shall comply with all reporting requirements of the Department of Labor and Industries of the State of Washington. Upon the execution of this Contract, Contractor shall complete and file a Statement of Intent to Pay Prevailing Wages with the Department of Labor and Industries. If requested by the City, the Contractor shall provide certified payroll records for its employees and the

employees of its subcontractors. Upon completion of the Work, Contractor shall complete and file an Affidavit of Wages Paid with the Department of Labor and Industries. Contractor shall deliver copies of both the Statement of Intent to Pay Prevailing Wages and the Affidavit of Wages Paid, certified by the Department of Labor and Industries, to the City.

## **12. SUBCONTRACTOR RESPONSIBILITY**

Contractor shall verify responsibility criteria for each first tier subcontractor, and a subcontractor of any tier that hires other subcontractors must verify responsibility criteria for each of its subcontractors. Verification shall include that each subcontractor, at the time of subcontract execution, meets the responsibility criteria listed in the Instructions to Bidders and possesses an electrical contractor license, if required by chapter 19.28 RCW, or an elevator contractor license, if required by chapter 70.87 RCW. This verification requirement must be included in every public works subcontract or every tier.

## **13. OWNERSHIP OF DOCUMENTS**

All originals and copies of work product, including plans, sketches, layouts, designs, design specifications, records, files computer disks, magnetic media, all finished or unfinished documents or material which may be produced or modified by Contractor while performing the Work shall become the property of the City and shall be delivered to the City at its request.

## **14. CONFIDENTIALITY**

If it is necessary to provide proprietary information, the Contractor shall clearly mark the information on each page of the document(s) as "Proprietary and Confidential". The City is subject to laws regarding the disclosure of public records and document. Proposals and other materials, submitted by the Contractor become public record and may be subject to public disclosure, in whole or in part, and may be released by the City in the event of a request for disclosure. In the event the City receives a public record request for information and the Contractor has marked the requested document as "Proprietary and Confidential", the City shall notify the Contractor of such request and withhold disclosure of such information for not less than five (5) business days, to permit the Contractor to seek judicial protection of such information; provided that the Contractor shall be solely responsible for all attorney fees and costs in such action and shall save and hold harmless the City from any costs, attorneys fees or penalty assessments under Chapter 42.56 RCW for withholding or delaying public disclosure of such information.

## **15. BOOKS AND RECORDS**



The Contractor agrees to maintain books, records, and documents which sufficiently and properly reflect all direct and indirect costs related to the performance of this Contract and such accounting procedures and practices as may be deemed necessary by the City to assure proper accounting of all funds paid pursuant to this Contract. These records shall be subject at all reasonable times to inspection, review or audit by the City, its authorized representative, the State Auditor, or other governmental officials authorized by law to monitor this Contract.

**16. CLEAN UP**

At any time ordered by the City and immediately after completion of the Work, the Contractor shall, at its own expense, clean up and remove all refuse and unused materials of any kind resulting from the Work. In the event the Contractor fails to perform the necessary clean up, the City may, but in no event is it obligated to, perform the necessary clean up and the costs thereof shall be immediately paid by the Contractor to the City and/or the City may deduct its costs from any remaining payments due to the Contractor.

**17. GENERAL PROVISIONS**

This Contract, the Contract Documents and any supporting contract documents contain all of the agreements of the Parties with respect to any matter covered or mentioned in this Contract and no prior agreements or understandings shall be effective for any purpose. No provision of this Contract may be amended except by written agreement of the Parties. Any provision of this Contract which is declared invalid, void or illegal shall in no way affect, impair, or invalidate any other provision hereof and such other provisions shall remain in full force and effect. The Contractor shall not transfer or assign, in whole or in part, any or all of its obligations and rights hereunder without the prior written consent of the City. In the event the City consents to any such assignment or transfer, such consent shall in no way release the Contractor from any of its obligations or liabilities under this Contract. Subject to the preceding sentence, this Contract shall be binding upon and inure to the benefit of the Parties' successors in interest, heirs and assigns. In the event the City or the Contractor defaults on the performance of any terms in this Contract, and the Contractor or City places the enforcement of the Contract or any part thereof, or the collection of any monies due, in the hands of an attorney, or files suit, each Party shall pay all its own attorneys' fees and expenses. The venue for any dispute related to this Contract shall be King County, Washington. Failure of the City to declare any breach or default immediately upon occurrence thereof, or delay in taking any action in connection with, shall not waive such breach or default. This Contract shall be governed by and interpreted in accordance with the laws of the State of Washington. Each individual executing this Contract on behalf of the City and Contractor represents and warrants that such individuals are duly authorized to execute this Contract. Time is of the essence of this Contract and each and all of its provisions in which performance is a factor. Adherence to completion dates is essential to the Contractor's performance of this Contract.

IN WITNESS WHEREOF, the Parties have executed this Contract the \_\_\_\_\_ day  
of \_\_\_\_\_, 20\_\_\_\_.

CITY OF MERCER ISLAND

By: \_\_\_\_\_  
Jessi Bon, City Manager

ATTEST:

\_\_\_\_\_  
Deborah A. Estrada, MMC, City Clerk

APPROVED AS TO FORM:

\_\_\_\_\_  
Bio Park, City Attorney

\_\_\_\_\_  
(Name of Contractor)

By: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Signature Name and Title)

\_\_\_\_\_  
(Address)

\_\_\_\_\_  
(Phone)

# PERFORMANCE BOND

To City of Mercer Island, WA

Bond No. \_\_\_\_\_

The City of Mercer Island, Washington has awarded to \_\_\_\_\_ (Principal), a contract for the construction of the project designated as Water Distribution SCADA Equipment Replacement, Bid No. 21-01, in Mercer Island, Washington (Contract), and said Principal is required to furnish a bond for performance of all obligations under the Contract.

The Principal, and \_\_\_\_\_ (Surety), a corporation, organized under the laws of the State of \_\_\_\_\_ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the City, in the sum of \_\_\_\_\_ US Dollars (\$) Total Contract Amount, subject to the provisions herein.

This statutory performance bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall well and faithfully perform all of the Principal's obligations under the Contract and fulfill all terms and conditions of all duly authorized modifications, additions, and changes to said Contract that may hereafter be made, at the time and in the manner therein specified; and if such performance obligations have not been fulfilled, this bond shall remain in force and effect.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the office executing on behalf of the surety.

PRINCIPAL

SURETY

\_\_\_\_\_  
Principal Signature Date

\_\_\_\_\_  
Surety Signature Date

\_\_\_\_\_  
Printed Name Date

\_\_\_\_\_  
Printed Name Date

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

Name, address, and telephone of local office/agent of Surety Company is:

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**PAYMENT BOND**  
**to City of Mercer Island, WA**

Bond No. \_\_\_\_\_

The City of Mercer Island, Washington has awarded to \_\_\_\_\_ (Principal), a contract for the construction of the project designated as Water Distribution SCADA Equipment Replacement, Bid No. 21-01, in Mercer Island, Washington (Contract), and said Principal is required under the terms of that Contract to furnish a payment bond in accord with Title 39.08 Revised Code of Washington (RCW) and (where applicable) 60.28 RCW.

The Principal, and \_\_\_\_\_ (Surety), a corporation organized under the laws of the State of \_\_\_\_\_ and licensed to do business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Dept., are jointly and severally held and firmly bound to the City, in the sum of \_\_\_\_\_ US Dollars (\$\_\_\_\_\_ ) Total Contract Amount, subject to the provisions herein.

This statutory payment bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall pay all persons in accordance with RCW 39.08, 39.12, and 60.28 including all workers, laborers, mechanics, subcontractors, and materialmen, and all person who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and all taxes incurred on said Contract under Titles 50 and 51 RCW and all taxes imposed on the Principal under Title 82 RCW; and if such payment obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any changes, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

This bond may be executed in two (2) original counterparts, and shall be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed and original power of attorney for the office executing on behalf of the surety.

PRINCIPAL

SURETY

\_\_\_\_\_  
Principal Signature Date

\_\_\_\_\_  
Surety Signature Date

\_\_\_\_\_  
Printed Name Date

\_\_\_\_\_  
Printed Name Date

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

Name, address, and telephone of local office/agent of Surety Company is:

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RETAINAGE AGREEMENT

Contract Title Water Distribution SCADA Equipment Replacement  
Bid Number: 21-01

Contract Date \_\_\_\_\_

Contractor Name \_\_\_\_\_

Contractor Address \_\_\_\_\_

Contractor Phone \_\_\_\_\_

Contractor Federal ID # \_\_\_\_\_

State Law on How Contract Retainage Monies can be Reserved:

RCW 60.28.010 Retained percentage, labor and material Contracts for public improvements or work other than for professional services, provides that there shall be reserved by the city from the monies earned by the contractor on estimates during the progress of the improvement or work, a sum of five percent of such estimates, said sum to be retained by the city as a trust fund for the protection and payment of any persons performing work or supplying provisions or supplies during the work. The monies reserved for contract retainage may be reserved by the contractor choosing one of the following four options:

**All investments selected below are subject to City approval.**

Contractor Options (Contractor shall place an "x" in one of the boxes below.)

- [ ] (a) Retained in a non-interest bearing fund by the public body until released in accordance with applicable state statutes;
- [ ] (b) Deposited by the public body in an interest bearing account in a bank, mutual savings bank, or savings and loan association, not subject to withdrawal until released in accordance with applicable state statutes, provided that interest on such account shall be paid to the contractor;
- [ ] (c) Placed in escrow with a bank or trust company by the public body until released in accordance with applicable state statutes. The cost of the investment program and the risk thereof is to be borne entirely by the contractor.
- [ ] (d) Contractor may submit a Retainage Bond equal to 5% of the total awarded bid amount for all schedules to be held by the public body until released in accordance with applicable state statutes.

Contractor's Bank

If Contractor selects options (b) or (c) above, Contractor shall designate below the bank in which the retainage is to be deposited:

ACCOUNT NO. \_\_\_\_\_

BANK NAME \_\_\_\_\_

BANK ADDRESS \_\_\_\_\_

BANK PHONE # \_\_\_\_\_

Agreement

Contractor and City agree that all or part of the monies in the account can only be approved for disbursement by Bank to Contractor upon written authorization of the City Finance Director, or his/her authorized designee.

By \_\_\_\_\_ By \_\_\_\_\_  
City of Mercer Island Contractor

Date \_\_\_\_\_ Date \_\_\_\_\_

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## GENERAL TERMS AND CONDITIONS

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**CITY OF MERCER ISLAND  
GENERAL TERMS AND CONDITIONS  
MAY 2020 EDITION  
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## ARTICLE 1: GENERAL PROVISIONS

### 1.1 DEFINITIONS

- A. **“Addendum”** or **“Addenda.”** Alteration or clarification of the plans or specifications provided to bidders by City prior to bid time, which becomes part of the Contract Documents when the Contract is executed.
- B. **“Claim.”** A written demand by the Contractor seeking (1) a change to Contract Price; (2) a change of Contract Time; (3) a payment of money or damages; and/or, (4) any other relief arising out of or relating to this Contract.
- C. **“Change Order.”** A written instrument designated to be a Change Order which alters the Contract, and identifies the following: (1) a change in the Work; (2) a change in Contract Price; and/or (3) a change in Contract Time.
- D. **“Change Proposal.”** A document prepared by the Contractor at the request of City, which proposes changes to the Work and/or changes to the Contract Price and/or Contract Time. City initiates all requests for Change Proposals.
- E. The **“Contract”** or **“Contract Documents.”** The entire integrated agreement between City and the Contractor for the performance of the Work in accordance with the Contract Documents. The Contract Documents include the following:
  - 1. The signed Agreement between City and Contractor (the “Public Works Contract”);
  - 2. The Contractor’s completed Bid Form;
  - 3. The City’s General Terms and Conditions (May 2020 ed.);
  - 4. Any Supplemental or Special Conditions.
  - 5. Technical Specifications;
  - 6. Drawings;
  - 7. Addenda; and
  - 8. Any Change Orders.
- F. **“Contract Execution.”** occurs when City Manager or his/her designee signs the Contract, which shall only occur after the Contractor signs the Contract.
- G. **“Contract Price”** means the total amount payable by City to the Contractor for performance of the Work in accordance with the Contract.
- H. **“Contract Time.”** The number of days or the specific date set forth in the Contract to achieve Substantial Completion of the Work.
- I. **“Contract Work”** or **“Work.”** The labor, supervision, materials, equipment, supplies, services, other items, and requirements of the Contract necessary for the execution, completion and performance of all requirements of the Contract by the Contractor to the satisfaction of City.
- J. **“Contractor.”** The individual, association, partnership, firm, company, corporation, or combination thereof, including joint ventures, contracting with City to do the Contract Work.

- K. **“Critical Path.”** The longest, continuous sequence of interrelated activities that begins at the start of the Project (Notice to Proceed) and extends to Substantial Completion of the Project. These activities are critical because delay to an activity on this path will extend Contract Time.
- L. **“Day.”** A calendar day, unless otherwise specified.
- M. **“Differing Site Conditions.”** (1) Subsurface or latent physical conditions at the site which differ materially from those indicated in the Contract Documents (Type I), or (2) Unknown physical conditions at the Site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in the construction activities of the character provided for in the Contract (Type II).
- N. **“Engineer.”** The City representative who administers the Contract for the City.
- O. **“Final Acceptance.”** Written acceptance of the Project by City.
- P. **“Force Majeure.”** An event that is unforeseeable at the time of Contract Execution and that is beyond the reasonable control of the Contractor and City and includes:
1. Natural Disaster declared by Governor of Washington or President of the United States, including but not limited to earthquakes;
  2. Acts or omissions of any government entity acting within its governmental capacity;
  3. Fire and/or flood for which the Contractor or its Subcontractors is not responsible;
  4. Quarantine or epidemic;
  5. Strike or defensive lockout;
  6. Unusually Severe Weather Conditions; and
  7. Acts of terrorism.
- Q. **“Hazardous Material.”** Any pollutant, contaminant, toxic or hazardous waste, dangerous substance, potentially dangerous substance, noxious substance, toxic substance, flammable material, explosive material, radioactive material, urea formaldehyde foam insulation, asbestos, PCBs, or any other substances the removal of which is required, or the manufacture, preparation, production, generation, use, maintenance, treatment, storage, transfer, handling, or shipment of which is restricted, prohibited, regulated, or penalized by any and all federal, state, City, or municipal statutes or laws and regulations promulgated thereunder, now or at any time hereafter in effect, including, but not limited to, the Comprehensive Environmental Response, Compensation, and Liability Act (42 U. S. C. §§ 9601, *et seq.*), the Hazardous Materials Transportation Act (49 U. S. C. §§ 1801, *et seq.*), the Resource Conservation and Recovery Act (42 U. S. C. §§ 6901, *et seq.*), the Federal Water Pollution Control Act (33 U. S. C. §§ 1251, *et seq.*), the Clean Air Act (42 U. S. C. §§ 7401, *et seq.*), the Toxic Substances Control Act, as amended (15 U. S. C. §§ 2601, *et seq.*), the Occupational Safety and Health Act (29 U. S. C. §§ 651, *et seq.*, and the Model Toxics Control Act (RCW 70.105), or similar state or local statute or code), as the laws have been amended and supplemented.
- R. **“City”** or **“Owner”** may be used interchangeably and refer to the City of Mercer Island.

- S. **“Notice.”** A written document issued by the Engineer or Contractor’s Representative which is submitted to the other party and delivered by:
1. Depositing in the U. S. Mail (or other method of commercial express mail), which notice shall be effective on the date of receipt;
  2. Service on the Parties’ representative or at the Contractor’s home office or field office, which notice shall be effective on the date of service; or,
  3. Facsimile to the Parties’ representative or Contractor’s home office or field office, which notice shall be effective upon receipt.
- T. **“Notice To Proceed.”** A written directive issued by City authorizing the Contractor to perform some or all of the Work.
- U. **“Overhead.”** Charges that may be incurred or allocated in support of the Contract but are not part of the cost of directly performing the physical Contract construction activity. Overhead includes Site or Field Overhead and Home Office Overhead.
1. **Site or Field Office Overhead**  
Site or Field Overhead costs are typically those costs that are related to, but are not limited to supervision, including general foremen and their supervisors, planners, schedulers, engineers, managers, etc. and the direct payroll costs of their project-related service, clerical salaries and their direct payroll costs, the costs of all vehicles, travel, meal and lodging costs associated with those personnel, Site or Field office and utility expense, expenses associated with all regulatory compliance, Hand and Other Small Tools provided by the Contractor for the use of its forces, all expendable supplies, and all other items incidental to or integral in supporting the physical completion of the Work.
  2. **Home Office Overhead**  
Home office Overhead costs are typically those that include all general office expenses. Such costs include, but are not limited to those associated with officer and office salaries and related payroll taxes and benefits, costs of office occupancy and maintenance, all supporting services (such as utilities, office machines computers, and related items and support) related to the home office function, business taxes and licenses, and all such other costs necessary to operate the business entity. Home office overhead includes unabsorbed home office overhead.
  3. In addition to the above, whether treated as Site or Field Overhead or as Home Office Overhead, costs of any and all bonds, insurance(s), and taxes associated with this Contract are to be considered as Overhead. All items as those identified above are to be treated as Overhead for this purpose regardless of how the Contractor chooses to account for them in its books of account.
  4. Under no circumstances shall City pay the Contractor for direct or allocated costs or charges for officer bonus and profit sharing, project personnel bonuses, charitable contributions, income taxes, or any costs relating to illegal activity.
- V. **“Parties.”** The Contractor and City.
- W. **“Project.”** All activity relative to this Contract including activity of the Contractor, its Subcontractors, and City.

- X. **“Request for Change Order.”** A document, designated as a Request for a Change Order, prepared by the Contractor requesting either (1) a change in Contract Price; (2) a change in Contract Time; (3) a change in t Work; (4) a payment of money or damages; and/or, (5) any other relief arising out of or relating to this Contract.
- Y. **“Request for Information.”** A request from the Contractor to City seeking an interpretation or a clarification of some requirement of the Contract Documents.
- Z. **“Site” or “Project Site.”** The location, at which construction, equipment or services furnished by the Contractor under the Contract will be performed, completed and/or delivered.
- AA. **“Subcontractor.”** An individual, firm, partnership, or corporation having a contract, purchase order, or agreement with the Contractor, or with any Subcontractor of any tier for the performance of any part of the Contract. When City refers to Subcontractor(s) in this document, for purposes of this document and unless otherwise stated herein, the term Subcontractor(s) includes, at every level and/or tier, all subcontractors and subconsultants.
- BB. **“Supplier(s).”** Any person or firm who is not performing work or supplying labor on Site and is engaged in the business of supplying a manufactured product or resource to City, Contractor, or Subcontractors. The term Suppliers includes materialmen, manufacturers, and fabricators.
- CC. **“Substantial Completion.”** That stage in the progress of the Work where:
  1. City has full and unrestricted use and benefit of the Project for the purpose intended;
  2. All the systems and parts of the Contract Work are functional;
  3. Utilities are connected and operate normally;
  4. Only minor incidental work or correction or repair remains to complete all Contract requirements; and
  5. The City has received all certificates of occupancy and any other permits, approvals, licenses and other documents from any governmental authority with jurisdiction necessary for beneficial occupancy of the project.

## 1.2 INTENT AND INTERPRETATION OF THE DOCUMENTS

- A. The Contract Documents constitute the entire and integrated agreement between the parties hereto and supersede all prior negotiations, representations, or agreements, either written or oral.
- B. The Contract Documents shall not be construed to create a contractual relationship between any parties other than City and the Contractor. No contract between City and a third party shall be construed to create any duty on the part of City or such third party to the Contractor. The Contractor is not an intended or incidental beneficiary of any promises made in City’s contract with a third party, if any.
- C. The Contract Documents are intended to be complementary. What is required by one part of the Contract shall be as binding as if required by all. Should any conflict or inconsistency be found in the Contract Documents, the provision imposing the more expensive duty or obligation on the Contractor shall take precedence.



- D. The words “similar,” “typical” (or other equivalents) shall mean nearly corresponding or having a likeness. Such words shall not be construed to mean that all parts of the Work referred to are identical or substantially identical, or that such elements of the Work are connected identically or substantially identically to the rest of the Work. The Contractor has the responsibility to determine all details of the Work in relation to their location and connection to other parts of the Work. The singular includes the plural and vice versa. Male includes female and vice versa.
- E. The organization of the specifications into divisions, provisions and articles and the organization of the drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

### **1.3 CLARIFICATION OF DRAWINGS AND DETAIL DRAWINGS**

- A. Where on any drawing a portion of the Work is drawn out and the remainder is indicated in outline, the drawn out parts shall apply also to other similar portions of the Work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall apply to all other similar parts of the Work, unless otherwise indicated.
- B. With regard to drawings the following shall apply:
  - 1. Written dimensions shall be followed; drawings may not be to scale.
  - 2. Figure dimensions on drawings shall govern over scale dimensions; and detail drawings shall govern over general drawings.

## **ARTICLE 2: CITY**

### **2.1 AUTHORITY**

- A. Unless City, in writing, indicates otherwise, the authority to (1) commit to or bind City to any Change Orders or change in the Work, Contract Price and/or Contract Time; or (2) sign the Contract or Change Orders rests solely in the City Manager or his or her designee.
- B. The Engineer shall have the authority to administer the Contract. Administration of the Contract by the Engineer includes but is not limited to:
  - 1. Receiving all correspondence and information from the Contractor;
  - 2. Issuing request for Change Proposals;
  - 3. Responding to Requests For Information;
  - 4. Reviewing the schedule of values, project schedules, submittals, testing and inspection reports, substitution requests, and other documentation submitted by the Contractor;
  - 5. Negotiating Change Proposals and Change Orders;
  - 6. Recommending Change Orders for approval by the City Manager or its designee;
  - 7. Issuing decisions with respect to Requests for Change Orders and Claims;
  - 8. Processing payment requests submitted by the Contractor, and recommending payment;

9. Monitoring the quality of the Work, rejecting noncompliant Work, and recommending acceptance of the Work;
  10. Transmitting executed Change Orders, amendments, and other Contract correspondence to the Contractor; and
  11. Performing all other contract administrative functions.
- C. All correspondence, questions, and/or documentation shall be submitted to the Engineer.
- D. The Engineer may designate representatives to perform functions under the Contract, such as review and/or inspection and acceptance of supplies, services, including construction, and other functions of a technical or administrative nature.

## **2.2 INFORMATION SUPPLIED BY CITY**

- A. Unless otherwise specifically provided in the Contract, surveys and site information provided by City are intended to describe the general physical characteristics of the Site. City does not represent that this information is complete or sufficient for the Contractor's performance of the Work.
- B. City shall furnish to the Contractor a copy of the Contract Documents. The Contractor shall pay City for any additional copies of Contract Documents.

## **2.3 WORK BY CITY OR SEPARATE CONTRACTORS**

City reserves the right to perform work not included in the Contract or to let other contracts in connection with this Project. The Contractor shall coordinate its Work with City and other City contractors and, at City's request, participate in meetings for the purpose of coordinating the Contractor's construction schedule with those of other contractors at no additional cost to City.

# **ARTICLE 3: CONTRACTOR**

## **3.1 CONTRACTOR REPRESENTATIONS**

The Contractor makes the following representations to City:

- A. Before submission of its bid, the Contractor has:
1. Carefully reviewed the Contract Documents, and visited and examined the Site;
  2. Become familiar with the general and local conditions in which the Work is to be performed, and satisfied itself as to the nature, location, character, quality and quantity of Contract Work, the labor, materials, equipment, goods, supplies, work, services and other items to be furnished and all other requirements of the Contract Documents, as well as the surface and reasonably ascertainable subsurface conditions and other matters that may be encountered at the Site or affect performance of the Work or the cost or difficulty thereof;
  3. Become familiar with and satisfied itself as to the conditions bearing upon transportation, disposal, handling, and storage of materials; and
  4. Become familiar with and satisfied itself as to the availability of labor, water, electric power, and roads; and the uncertainties of access, traffic, parking and weather. Any failure of the Contractor to take the action described in this provision (3.0) or elsewhere in the Contract Documents will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of

successfully performing the Work, or for proceeding to successfully perform the Work without additional expense to City.

- B. The Contract Price is reasonable compensation for the Work and the Contract Time is adequate for the performance of the Work as represented by the Contract, site visit, and the general conditions (including but not limited to weather, site, soil) known or reasonably anticipated for the Site.

### **3.2 GENERAL DUTIES**

- A. The Contractor shall give sufficient supervision to the Work, using its best skill and attention. The Contractor is on notice that City will be relying on the accuracy, competence and completeness of the Work. The Contractor shall supervise and be solely responsible for the proper performance of the Work in accordance with the Contract, including the construction means, methods, techniques, sequences, procedures, and for coordination of all portions of the Work.
- B. Unless specified elsewhere in the Contract, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction machinery, utilities, transportation, and other facilities and services (including federal and state tax, industrial insurance, social security liability and all other applicable taxes) necessary for the proper execution and completion of the Work.
- C. The Contractor shall also provide sufficient staffing and supervision to process Requests for Information, Change Proposals, Submittals, Change Orders, close out documentation, and to perform all other requirements of the Contract and all Work.
- D. The Contractor shall lay out its Work from baselines and benchmarks indicated in the Contract, if any, and shall be responsible for the accuracy of all field measurements and surveys used in the lay out.

### **3.3 DUTY TO INSPECT CONTRACT DOCUMENTS**

- A. The Contractor shall carefully study and compare all Contract Documents and check the conditions, dimensions, and instructions as stated therein. Contractor will not be required to provide professional services which constitute the practice of architecture and engineering except to the extent provided for in the technical specifications and drawings.
- B. The Contractor shall immediately notify City in writing of any:
  - 1. Error, inconsistency, or omission in the Contract Documents that a reasonable contractor knew or through the exercise of reasonable diligence should have discovered under the same and similar circumstances;
  - 2. Requirement in the Contract Documents that conflict with any local, state, and federal laws, regulations and/or permits, licenses, and easement conditions that a reasonable contractor knew or through the exercise of reasonable diligence should have discovered under the same and similar circumstances.
- C. The Contractor should not proceed with the work in question until the Contractor receives written direction from the Engineer.
- D. If the Contractor proceeds with the work in question without written direction from the Engineer, the Contractor shall be responsible for any costs or damages associated with:

1. Fines or penalties;
2. Demolition, tear out, removal, cleanup, remediation, or fixing the work in question; and
3. Delay, disruption, and loss of productivity.

### **3.4 CONTRACTOR'S SUPERVISION AND EMPLOYEES**

- A. Contractor shall provide qualified and competent people to administer the contract and perform all the Work.
- B. During performance of the Work the Contractor shall have supervisory personnel on-site and available to administer, manage and coordinate the Work. City shall not be responsible for the acts or omissions of the supervisory personnel or their assistants.
- C. The Contractor shall at all times enforce good order among all persons furnishing labor or materials on-site and shall only employ workers skilled in the work assigned. If requested by the Project Representative, Contractor shall provide the Project Representative with copies of licenses, registrations, and certifications.
  1. City shall have the right to require the Contractor to remove personnel from the Site that do not have the appropriate qualifications and experience to meet or uphold the requirements of the Contract. City shall also have the right to order the Contractor to replace personnel who demonstrate unprofessional behavior.
  2. Failure by City to require removal of any Contractor personnel shall not be deemed an admission that any such personnel are satisfactory, nor shall such failure relieve the Contractor from any contractual responsibility.

### **3.5 SUBCONTRACTORS AND SUPPLIERS**

- A. This Contract is between City and the Contractor.
  1. The Contractor's subcontracting shall not create a contract between City and the Subcontractor and Suppliers. Subcontractors and Suppliers are not intended as incidental third party beneficiaries to the Contract. The Subcontractor and Suppliers shall have no rights against City by reason of their agreements with the Contractor.
  2. The Contractor is responsible for performing all work required by the Contract. The Contract has not been written with the intent of, and City shall not be a party to, defining the division of work between the Contractor and its Subcontractors and Suppliers.
- B. **Selection of Subcontractors and Suppliers**
  1. Subcontractors and Suppliers shall be properly licensed, registered or certified, as applicable, and capable to perform the assigned work.
  2. If requested by City, the Contractor shall provide documentation that the proposed Subcontractors and Suppliers have adequate experience and skill.
  3. The Contractor shall require each Subcontractor and Supplier to comply with all provisions of this Contract. At the request of Subcontractors or Suppliers, Contractor shall make available for copying all Contract Documents.

### **C. Responsibility for Work of Subcontractors and Suppliers**

The Contractor shall be responsible for the acts and omissions of Subcontractors and Suppliers. The Contractor shall also be responsible for the suitability of any materials, components, equipment or supplies furnished by a Subcontractor and/or Supplier irrespective of whether such were designated or approved by City.

### **3.6 SCHEDULE OF WORKING HOURS**

- A. As specified in the Contract, the Contractor shall submit a schedule of working hours, including overtime to City for acceptance. This schedule shall comply with all Contract requirements. Except as permitted elsewhere in the Contract Documents or in the case of an emergency, all Work at the Site shall be performed between the hours of 7am and 6 pm Monday through Friday.
- B. The schedule of working hours accepted by City shall be the only schedule used by the Contractor during performance of the Contract, unless amended to maintain Work progress.
- C. The Contractor shall provide 48 hours advance written Notice of any intent to work outside of approved working hours. Any work at the Site performed outside approved working hours shall be performed without additional expense to City, except as otherwise provided in the Contract Documents. Contractor shall comply with Mercer Island Code Section 8.24.020 (Q) which prohibits construction related noise outside designated hours except in cases of emergency or demonstrated necessity.

### **3.7 RECORD DOCUMENTS**

- A. The Contractor shall maintain an accurate, readable, and orderly set of drawings and specifications, updated as the job progresses to show all approved changes, options, alternates, and all actual deviations from the original Contract Documents. This set of drawings and specifications shall be the Record Documents.
  - 1. The Record Documents shall be maintained in hard copy.
  - 2. In addition to all approved changes, options, alternates, and all actual deviations from the original Contract Documents, the Record Documents shall be marked as follows:
    - a. Record all materials used where options, alternates and/or change orders were indicated, specified and/or authorized;
    - b. Accurate measurements referenced as required by the technical specifications shall be recorded to show the exact location and changes in direction of all underground services and utilities, as well as their depth below finished grade; and
    - c. Record all other requirements as specified in the Technical Specifications.
- B. The Record Documents shall be kept up-to-date and be available for review by City at all times, including but not limited to at each job progress meeting. Failure to have the record set up-to-date shall be sufficient reason for City to withhold payment in accordance with paragraph 7.2, *Payments Withheld*, until all such information is recorded.

- C. Record Documents may be used to assist City to verify the appropriate progress payment.
- D. Neither Final Acceptance nor Final Payment will be issued until a complete set of Record Documents is submitted and the Engineer is satisfied as to its quality and accuracy.

### **3.8 COST RECORDS**

- A. The Contractor, Subcontractors, and Suppliers shall maintain Project cost records by cost codes and shall segregate and separately record at the time incurred all costs (1) directly associated with each work activity and (2) directly or indirectly resulting from any event or condition for which the Contractor seeks an adjustment in the Contract Price, Contract Time, and/or damages.
  - 1. Any costs claimed to result from any such event or condition, including, but not limited to, delay and impact costs, acceleration costs, loss of productivity or efficiency, and increased or extended overhead shall be recorded at the time incurred and be fairly and reasonably allocated to each such event or condition and to other causes of such costs.
  - 2. City shall be provided with a detailed description of all such costs and the basis of allocation. The Contractor, Subcontractors, and Suppliers shall maintain a monthly summary of all costs and shall make all underlying cost records and monthly summary of costs available for review, inspection, and copying by City upon request.
  - 3. Any work performed for which the Contractor intends to seek an adjustment in Contract Price and/or Contract Time shall be recorded on the same day the work is performed and kept separate so as to distinguish it from Contract Work.
- B. In addition to the requirements set forth in Article 5, *Changes to the Contract*, and Article 6, *Time and Price Adjustments*, the Contractor shall be entitled to extra compensation for an event or condition and/or the recovery of damages only to the extent that the Project cost records are kept in full compliance with all Contract requirements and the cost allocations support entitlement to such compensation.

### **3.9 MAINTENANCE AND INSPECTION OF DOCUMENTS**

- A. All Contractor's, Subcontractors', and Suppliers' documents and records relating to the Contract shall be open to inspection, audit, and/or copying by City or its designee:
  - 1. During the Contract Time; and
  - 2. For a period of not less than six years after the date of Final Acceptance of the Contract ("Preservation Period"); or if any Claim, audit or litigation arising out of, in connection with, or related to this Contract is initiated, all documents shall be retained until such Claim, audit or litigation involving the records is resolved or completed, whichever occurs later.
- B. The Contractor shall also guarantee that all Subcontractor and Supplier documents shall be retained and open to similar inspection, audit and/or copying during the Contract Time and also the Preservation Period. The Contractor, Subcontractor, and Supplier shall use its best efforts to cooperate with the inspection, auditing, and/or copying.

- C. Inspection, audit, and/or copying of all documents described herein, may be performed by City or its designee at any time with not less than seven (7) days' Notice. Provided however, if an audit or inspection is to be commenced more than sixty (60) days after the Final Acceptance date of the Contract, the Contractor will be given twenty (20) days' Notice of the date of the audit.
- D. The Contractor, Subcontractors, and Suppliers shall provide adequate facilities, acceptable to City, for inspection, auditing, and/or copying during normal business hours.
- E. If the Contractor is formally dissolved, assigns or otherwise divests itself of its legal capacity under this Contract, then it shall immediately notify City and preserve such records, at its expense, as directed by City.
- F. The Contractor, Subcontractor, and Supplier, shall be subject to audit at any time with respect to this Contract. Failure to maintain and retain sufficient records to allow City to verify all costs or damages or failure to permit City access to the books and records shall constitute a waiver of the rights of the Contractor Subcontractor and Supplier to Claim or be compensated for any damages, additional time or money under this Contract.
- G. At a minimum, the following documents, including the machine readable electronic versions, shall be available for inspection, audits, and/or copying:
  - 1. Daily time sheets and all daily reports, Supervisor's reports, and inspection reports;
  - 2. Collective bargaining agreements;
  - 3. Insurance, welfare, and benefits records;
  - 4. Payroll registers;
  - 5. Earnings records;
  - 6. All tax forms, including payroll taxes;
  - 7. Material invoices and requisitions;
  - 8. Material cost distribution worksheet;
  - 9. Equipment records (list of Contractor's, Subcontractors', and Suppliers' equipment, rates, etc.);
  - 10. Contracts, purchase orders and agreements between the Contractor and each Subcontractor and Supplier;
  - 11. Subcontractors' and Suppliers' payment certificates;
  - 12. Correspondence, including email, with Subcontractors and/or Suppliers;
  - 13. All meeting notes by and between Contractor, Subcontractors, Suppliers and/or any third parties related to the Project;
  - 14. Canceled checks (payroll and vendors);
  - 15. Job cost reports, including monthly totals;
  - 16. Job payroll ledger;
  - 17. Certified payrolls;

18. General ledger;
  19. Cash disbursements journal;
  20. Take off sheets, and calculations used to prepare the bid and/or quotes;
  21. Take off sheets, calculations, quotes, other financial data to support change proposals, request for change order and/or claims;
  22. Financial statements for all years during the Contract Time. In addition, City may require, if it deems appropriate, additional financial statements for 3 years preceding execution of the Contract and 6 years following Final Acceptance of the Contract;
  23. Depreciation records on all Contractor's, Subcontractor's, and Supplier's equipment, whether these records are maintained by the Contractor, Subcontractors, and Suppliers involved, its accountant, or others;
  24. If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents;
  25. All documents which relate to each and every Claim together with all documents which support the amount of damages as to each Claim;
  26. Worksheets or software used to prepare the Claim establishing the cost components for items of the Claim including but not limited to labor, benefits and insurance, materials, equipment, Subcontractors, Suppliers, all documents which establish time periods, individuals involved, the hours for the individuals, and the rates for the individuals;
  27. Worksheets, software, and all other documents used (a) by the Contractor to prepare its bid and schedule(s) and/or (b) to prepare quotes and bids to the Contractor;
  28. All schedule documents, including electronic versions, planned resource codes, or schedules and summaries;
  29. All submittals; and
  30. All other documents, including email, related to the Project, Claims, or Change Orders.
- H. The Contractor shall mark any documentation it considers proprietary or confidential accordingly. Such information will be treated as such by City; however, City cannot ensure that this information will not be subject to release pursuant to a public records request. In the event City receives a request for such information, City will advise the Contractor and will not release the requested information for a period of not less than ten (10) days in order to give the Contractor an opportunity to obtain a court order prohibiting the release of the information in response to the public records request.

### **3.10 MAINTENANCE AND SITE CLEANUP**

- A. The Contractor shall at all times keep the Site, access points, and public rights-of-way free from accumulation of dirt, mud, waste materials or rubbish caused by the Contractor or Subcontractors. At the completion of the Contract Work, the Contractor shall remove and lawfully dispose of all its dirt, mud, waste materials,



rubbish, tools, scaffolding and surplus or partly used materials from the Site and shall leave the Site broom clean unless some stricter standard is specified in the Contract.

- B. The Contractor shall obey all applicable laws and regulations relating to the storage, use, and disposal of Hazardous Materials. The Contractor shall promptly notify City of all Contractor or Subcontractor caused spills or releases of Hazardous Materials, and pay the cost to promptly clean up all such spills or releases and any associated fines or penalties. The Contractor shall maintain documentation of the clean up and disposal all Contractor or Subcontractor caused spills or releases of Hazardous Materials.
- C. If the Contractor fails to adequately maintain or cleanup the Site, City may, after written Notice to the Contractor, sweep surfaces or remove the dirt, mud, waste materials, rubbish, or hazardous materials and charge all reasonable costs of such work to the Contractor.

### **3.11 PROTECTION OF EXISTING STRUCTURES, EQUIPMENT, VEGETATION, UTILITIES, AND IMPROVEMENTS**

- A. Contractor shall protect from damage all existing structures, curbs, gutters, sidewalks, equipment, improvements, utilities, trees, and vegetation not shown in the Contract Documents to be removed or modified at or near the Site. Contractor shall repair, at no cost to City, any such damage resulting from failure to comply with the requirements of the Contract or failure to exercise reasonable care in performing the Work. If Contractor fails or refuses to repair the damage promptly, City may have the necessary work performed and deduct or charge the cost to Contractor or exercise its rights under the Performance and Payment Bond. If there are insufficient funds remaining, excluding retention, the Contractor shall pay City for the costs associated with protection and repairing the damages.

### **3.12 PERMITS, LAWS, REGULATIONS AND TAXES**

- A. Except those permits, easements, and variances specified in the Contract as having been previously obtained by City, all permits, licenses, easements and variances necessary for the execution of the Work shall be secured and paid for by the Contractor. The Contractor shall identify, apply for, and pay for such permits and licenses at the earliest possible time so as to avoid any delay to the Work arising from the permitting and/or licensing process. No actions taken by City to aid the Contractor in securing any permit or license shall relieve the Contractor of any obligations to secure any such permit or license.
- B. The Contractor shall maintain all stamped permit sets of documents at the Site during construction, in good condition and as required by local ordinances.
- C. The Contractor shall perform the Work in full compliance with local, state and federal laws, ordinances, resolutions and regulations, and with permit, license, easement, and variance conditions pertaining to the conduct of the Work. The Contractor shall defend, indemnify, and hold City, its elected officials, officers, agents and employees harmless from any assessment of fines, penalties, or damages arising from violations of the same by the Contractor or Subcontractors. The Contractor shall pay and provide proof of payment for any assessments of fines, penalties or damages. The Contractor shall cooperate with all governmental entities regarding inspection of the Work and compliance with such requirements.

- D. The bid form may include a line item for sales tax on the whole amount, or on items which are not exempt from tax under Washington State Department of Revenue rules, including WAC 458-20-170 and WAC 458-20-171. Unless there are separate line items in the bid form for Washington State sales tax, Contractor shall include all sales tax in its lump sum bid or unit prices. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The City will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability. Except as provided above, the Contractor is required to pay all applicable taxes. No adjustment will be made in the amount to be paid by City under the Contract because of any change in law or regulations covering any applicable taxes, or because of any misunderstanding by the Contractor as to its liability for or the amount of any taxes.

### **3.13 PATENTS AND ROYALTIES**

- A. The Contractor shall assume all costs or fees relating to royalties or claims for any patented invention, article, process or method that may be used upon or in a manner connected with the Work under this Contract or with the use of completed Work by City.

### **3.14 CONTRACTOR'S CERTIFICATION**

#### **A. Conflict of Interest**

The Contractor certifies (and shall require each Subcontractor to certify) that it has no direct or indirect pecuniary or proprietary interest, and that it shall not acquire any such interest, which conflicts in any manner or degree with the work, services or materials required to be performed and/or provided under this Contract and that it shall not employ any person or agent having any such interest. In the event that the Contractor or its agents, employees or representatives acquires such a conflict of interest, the Contractor shall immediately disclose such interest to City and take action immediately to eliminate the conflict or to withdraw from this Contract, as City may require.

#### **B. Contingent Fees and Gratuities**

The Contractor, by entering into this Contract with City to perform or provide work, services or materials, has thereby covenanted:

1. That no person or selling agency except bona fide employees or designated agents or representatives of the Contractor has been or will be employed or retained to solicit or secure this Contract with an agreement or understanding that a commission, percentage, brokerage, or contingent fee may be paid; and
2. That no gratuities, in the form of entertainment, gifts or otherwise, have been or will be offered or given by the Contractor or any of its agents, employees or representatives, to any official member or employee of City or other governmental agency with a view toward securing this Contract or securing favorable treatment with respect to the awarding or amending thereof, or the making of any determination with respect to the performance of this Contract. The Contractor certifies that it has not made any contributions to any person or entity as a condition of doing business with City and it has disclosed to City all attempts by any person to solicit such payments.

**3.15 DEVIATION FROM CONTRACT**

- A. The Contractor shall not make an alteration, variation, addition, deviation, or omission from the requirements of the Contract Documents without the prior written consent of the Engineer.
- B. Any alteration, variation, addition, deviation, or omission by the Contractor shall not result in any extra compensation or extension of time.

**3.16 OPERATIONS, MATERIAL HANDLING, AND STORAGE AREAS**

**A. Temporary Buildings and Utilities**

Temporary buildings (including storage sheds, shops, and offices) and utilities may be erected by Contractor on the Site only with the consent of City and without expense to City. The temporary buildings and utilities shall remain the property of Contractor and shall be removed by the Contractor at its expense upon completion of the Work.

**B. Disposal/Removal of Materials**

The Contractor shall be responsible for compliance with all laws governing the storage and ultimate disposal of all materials and components. The Contractor shall provide City with a copy of all manifests and receipts evidencing proper disposal when required by City or applicable law.

**C. Protection and Care of Contractor's Materials and Equipment**

The Contractor shall be responsible for the proper care and protection of its materials and equipment delivered to the Site. Materials and equipment may be stored on the Site at the Contractor's own risk and with prior written approval from City. When the Contractor uses any portion of the Site as a shop, the Contractor shall be responsible for any repairs, patching, or cleaning arising from such use and for obtaining any necessary permits to establish such shop or temporary storage facilities.

**3.17 CONTRACTOR'S OVERALL RESPONSIBILITY FOR PROTECTION OF WORK, PROPERTY, AND PERSONS**

- A. The Contractor shall be responsible for conditions of the Site, including safety of all persons and property, during performance of the Work. The Contractor shall maintain the Site and perform the Work in a manner which meets all statutory and common law requirements or other specific contractual requirements for the provision of a safe place to work and which adequately protects the safety of all persons and property on or near the Site. This obligation shall apply continuously and shall not be limited to normal working hours. City's inspection of the Work or presence at the Site does not and shall not be construed to include review of the adequacy of the Contractor's safety measures in, on or near the site of the Work.
- B. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs, including adequate safety training, in connection with the Work. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.
- C. The Contractor shall protect and be responsible for any damage or loss to the Work or to the materials and equipment associated with the Work until the date of

Substantial Completion. The Contractor remains responsible for any damage or loss caused directly or indirectly by the acts or omissions of the Contractor, Subcontractors, Suppliers, or third parties authorized or allowed on the Site by the Contractor until Final Acceptance.

- D. The Contractor shall also be solely and completely responsible for damages arising from the Work that affect property adjacent to the Site.
- E. The Contractor shall repair or replace without cost to City any damage or loss that may occur, except damages or loss caused by the acts or omissions of City.
- F. The Contractor shall erect and maintain adequate steel plates, signs, fencing, barricades, lights or security measures and persons to protect the Work until the Engineer authorizes in writing the removal of signs, fencing, barricades, lights or security measures.
- G. The Contractor shall conduct all operations with the least possible obstruction and inconvenience to the public. To disrupt public traffic as little as possible, the Contractor shall permit traffic to pass through the Project Site with the least possible inconvenience or delay. The Contractor shall maintain existing roads, streets, sidewalks and paths within the Project Site, keeping them open and in good, clean, safe condition at all times.

### **3.18 PROTECTION OF PERSONS**

- A. The Contractor shall take all reasonable precautions for the safety of all employees working on this Contract and all other persons who may be affected by such Work. The Contractor shall designate a responsible member of its organization at the Site whose duty shall be to manage and coordinate the safety programs and to prevent accidents of the Contractor and Subcontractors.
- B. Except as otherwise stated in the Contract, if the Contractor encounters, on the Site, material reasonably believed to be Hazardous Material that Contractor shall immediately stop work in the area affected and give Notice of the condition to City. Work in the affected area shall not be resumed without written direction by City.
- C. To protect the lives and health of persons performing work under this Contract, the Contractor shall comply with the Federal Occupational Safety and Health Act of 1970 (OSHA), including all revisions, amendments and regulations issued thereunder, and the provisions of the Washington Industrial Safety Act of 1973 (WISHA), including all revisions, amendments and regulations issued thereunder by the Washington State Department of Labor and Industries including, without limitation, all excavation, tunneling, trenching and ditching operations. In case of conflict between any such requirements, the more stringent regulation or requirement shall apply. There is no acceptable deviation from these safety requirements, regardless of practice in the construction industry. Any violation of OSHA, WISHA or other safety requirements applicable to the Work may be considered a breach of this Contract.

### **3.19 SAFETY PROGRAM**

The Contractor shall prepare and maintain a written site specific "Safety Program" demonstrating the methods by which all applicable safety requirements of this Contract will be met. The Contractor shall ensure its Subcontractors and Suppliers have a written "Safety Program" or formally adopt the Contractor's site specific "Safety Program." The

Contractor shall conduct a weekly safety meeting with all Subcontractors and others on the Site to discuss general and specific safety matters.

### **3.20 ARCHAEOLOGICAL AND HISTORICAL PRESERVATION**

The Contractor shall comply fully with the requirements set forth in Chapter 27.53 RCW entitled Archaeological Sites and Resources. The Contractor shall immediately notify the City if any artifacts, skeletal remains or other archaeological resources (as defined under RCW 27.53.040 now and as hereinafter amended) are unearthed during excavation or otherwise discovered on the Site.

### **3.21 WATER POLLUTION CONTROL REQUIREMENTS**

The Contractor shall comply with and be liable for all penalties, damages and violations under Chapter 90.48 RCW including any regulations issued pursuant thereto in the performance of the Work.

### **3.22 EASEMENTS**

If the Contractor makes arrangements for use of additional public and/or private property, the Contractor, prior to using such property, shall provide the Engineer with written permission of the landowner, or duly authorized agent of such landowner, for such use.

### **3.23 TITLE VI / NONDISCRIMINATION ASSURANCES**

During the performance of this contract, the contractor/consultant, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

#### **1. Compliance with Regulations**

The contractor shall comply with the Regulations relative to non-discrimination in federally assisted programs of United States Department of Transportation (USDOT), Title 49, Code of Federal Regulations, part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

#### **2. Non-discrimination**

The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, sex, or national origin in the selection and retention of sub-contractors, including procurement of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

#### **3. Solicitations for Sub-contracts, Including Procurement of Materials and Equipment**

In all solicitations either by competitive bidding or negotiations made by the contractor for work to be performed under a sub-contract, including procurement of materials or leases of equipment, each potential sub-contractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to non-discrimination on the grounds of race, color, sex, or national origin.

#### **4. Information and Reports**

The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records,

accounts, other sources of information, and its facilities as may be determined by the contracting agency or the appropriate federal agency to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to WSDOT or the USDOT as appropriate, and shall set forth what efforts it has made to obtain the information.

#### **5. Sanctions for Non-compliance**

In the event of the contractor's non-compliance with the non-discrimination provisions of this contract, the contracting agency shall impose such contract sanctions as it or the USDOT may determine to be appropriate, including, but not limited to:

- Withholding of payments to the contractor under the contract until the contractor complies, and/or,
- Cancellation, termination, or suspension of the contract, in whole or in part.

#### **6. Incorporation of Provisions**

The contractor shall include the provisions of paragraphs (1) through (5) in every sub-contract, including procurement of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any sub-contractor or procurement as the contracting agency or USDOT may direct as a means of enforcing such provisions including sanctions for non-compliance.

Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a sub-contractor or supplier as a result of such direction, the contractor may request WSDOT enter into such litigation to protect the interests of the state and, in addition, the contractor may request the USDOT enter into such litigation to protect the interests of the United States.

### **ARTICLE 4: ADMINISTRATION OF THE CONTRACT**

#### **4.1 TIME OF ESSENCE**

All time requirements set forth in the Contract Documents are of the essence.

#### **4.2 WORK PROGRESS**

A. The Contractor shall be required to:

1. Prosecute the Work diligently with adequate forces;
2. Plan, coordinate, and layout the Work in advance so as to avoid delay; and
3. Achieve Substantial Completion of the Work and Final Acceptance in accordance with the requirements of Contract Documents.

#### **4.3 SCHEDULE OF VALUES**

A. Unless otherwise specified, within fourteen (14) days after the date of Contract Execution, the Contractor shall submit to City a detailed Schedule of Values that identifies the various activities of the Work and their values and quantities, including the overhead and profit for each activity. The Contractor warrants that the values identified in its Schedule of Values accurately reflect the value of each work activity. The Schedule of Values shall be used as a basis for calculating all Progress Payments. Payment for Contract Work shall be made only for and in accordance with those activities identified in the Schedule of Values.

- B. The Contractor shall not be entitled to, nor shall City be required to make, payment for any Contract Work until the Schedule of Values has been accepted by City. Such acceptance shall not be unreasonably withheld.
- C. City shall review and accept the Schedule of Values or provide the Contractor with a written explanation of why the Schedule of Values was not acceptable. City shall use reasonable efforts to review the Schedule of Values within thirty (30) days of City's receipt of the Contractor's submittal of its Schedule of Values. City's acceptance of the Schedule of Values shall not relieve the Contractor from its sole responsibility for the accuracy of the Schedule of Values and its compliance with all Contract requirements. The Contractor shall revise the Schedule of Values as necessary to accurately reflect Change Orders.
- D. Each Application for Payment shall include a current status of the Schedule of Values. No Application for Payment will be considered until the current status of the Schedule of Values has been submitted and accepted.
- E. The activities, which the Contractor identifies within its Schedule of Values, shall be specifically referenced within, and conform and be consistent with the activities set forth within the Project Schedule.

#### **4.4 PROJECT SCHEDULE**

- A. Unless otherwise specified, within fourteen (14) days after the date of Contract Execution, the Contractor shall submit to City a Project Schedule. The Project Schedule shall show the sequence in which the Contractor proposes to perform the Work, indicate the Critical Path, identify the dates on which the Contractor proposes to start and finish the scheduled activities of the Contract Work, indicate Substantial Completion within the Contract Time, indicate a date for Final Acceptance, and meet all the requirements as may be set forth in the Contract Documents.
- B. Within thirty (30) days of City's receipt of the Contractor's submittal of its Project Schedule or unless stated elsewhere in the Contract, City shall review the Project Schedule and provide the Contractor with written comments. City will review the Project Schedule only to determine whether the Project Schedule meets the requirements in the Technical Specifications on Project Schedule. To the extent the Project Schedule does not meet such Technical Specifications, the Contractor shall revise the Project Schedule to make it compliant.
- C. By reviewing the Project Schedule and providing written comments, City is not approving or adopting the Contractor's plan, schedule, means, methods, techniques, sequences, or procedures required to perform the Work. Review and comment by City of the Project Schedule shall not relieve the Contractor from the sole responsibility for the accuracy of a Project Schedule, and its compliance with all Contract requirements, and its responsibility to meet all required Contract completion dates. Failure by City to indicate items on the Project Schedule that do not conform with the Contract requirements shall not alter or waive the Contract requirements or relieve the Contractor from complying with all Contract requirements.
- D. The Contractor shall not be entitled to, nor shall City be required to make payment for any Contract Work until the Project Schedule complies with all Contract requirements.
- E. The Contractor shall schedule the Contract Work so that the Contract Work is completed within the Contract Time. Float in the project Schedule shall be defined as the period of time measured by the number of days each non-critical path

activity may be delayed before it and its succeeding activities become part of the Critical Path. Contractor and Owner may both utilize float to offset delays to the Work.

- F. The Contractor shall regularly enter the actual progress of the Work and Contract Time extensions, if any, approved by City on the Project Schedule. Updated Project Schedules shall reflect actual progress and completion within the Contract Time and shall be provided to City with each Application for Payment in format(s) as required by the Contract. Applications for Progress Payments will not be considered by City and the Contractor will not be paid until the Contractor complies with these requirements. The updated Project Schedule shall be used to assist City in verifying the appropriate payment.
- G. If, in the opinion of City, the Contractor falls behind in its progress of the Work due to acts or omissions of the Contractor, Subcontractors, and Suppliers, the Contractor shall take all necessary steps to improve its progress and bring its progress back in-line with the accepted Project Schedule, without additional cost to City. In this circumstance the Contractor shall, as necessary, increase the number of shifts, overtime operations, and/or days of work, both on and off the Site, and submit for acceptance any supplementary schedule or schedules as City deems necessary to demonstrate how the accepted rate of progress will be regained. Failure of the Contractor to comply with the requirements under these provisions shall be grounds for a determination by City that the Contractor is not prosecuting the Work with sufficient diligence to ensure completion within the time specified in the Contract. Upon making this determination, City may pursue any right it has under the law or the Contract, including but not limited to default termination.

#### **4.5 SUBMITTALS**

- A. Submittals include shop drawings, setting and erection drawings, schedules of materials, product data, samples, certificates and other information prepared for the Work by the Contractor or a Subcontractor as set forth in the Technical Specifications ("Submittals"). The Contractor shall perform no portion of the Work requiring Submittals until the Submittals have been reviewed and returned by City with one of the following annotations: (1) no exceptions taken, or (2) note markings.
- B. When submitting information, the Contractor shall identify and state reasons for any alteration, variation, addition, deviation, or omission from the Contract. The Contractor shall not perform work that alters, varies, adds to, deviates from, or omits any requirement of the Contract Documents without prior specific written acceptance by City.
- C. The Contractor shall provide Submittals with reasonable promptness and in such sequence as to facilitate the timely completion of the Contract.
- D. City shall review the Contractor's Submittals and respond in writing with reasonable promptness so as not to unreasonably delay the progress of the Work. Unless otherwise agreed, no delay to the Work shall be attributable to the failure by City to respond to a Submittal until thirty (30) days after the Submittal is received by City, and then only if failure by City to respond is unreasonable and affects the Contract completion date.
- E. If the Contractor is required to resubmit a Submittal, any revisions on resubmittals shall be specifically identified in writing and the resubmitted Submittal shall be sequentially alpha denoted (for example: 22A followed by 22B, etc.) and note revisions in numerical order. The cost of the review of the initial Submittal and the first revised submittal shall be borne by City. The costs of all



additional revised Submittals shall be charged to the Contractor. The cost of review shall include, without limitation, administrative, design, and engineering activities directly related to review of Submittals. City may deduct these costs from any amounts due the Contractor.

- F. City shall review the Contractor's Submittals only for conformance with the design of the Work and compliance with the Contract. Review of the Submittals are not conducted to verify the accuracy of dimensions, quantities, or calculations, the performance of materials, systems, or equipment, or construction means, methods, techniques, sequences, or procedures, all of which remain the Contractor's responsibility. Failure by City to take exception to a Submittal shall not relieve the Contractor from any duty, including its responsibility for errors or omissions in Submittals, its duty to make Submittals and duty to perform the Work according to the requirements of the Contract. City's review of a Submittal shall not alter or waive the requirements of the Contract unless City has issued prior written approval of such change or alteration of the Contract requirements.
- G. The Contractor's failure to identify any error, deviation, or omission and subsequent acceptance of the Submittal by City shall not relieve the Contractor from complying with the Contract requirements.

#### **4.6 REQUESTS FOR INFORMATION**

- A. If the Contractor determines that some portion of the drawings, specifications or other Contract Documents require clarification or interpretation by City because of an apparent error, inconsistency, omission, or lack of clarity in the Contract, the Contractor shall promptly submit a Request For Information ("RFI") and, unless otherwise directed, shall not proceed with the affected work until City has responded to the RFI. The Contractor shall plan its work in an efficient manner so as to allow for timely responses to RFIs.
- B. City shall respond in writing with reasonable promptness to Contractor's RFI.
  - 1. At the request of the Engineer, the Contractor shall prioritize its RFIs, identify a date by which the Contractor prefers the RFI be answered, and reasons for such priority.
  - 2. If the Contractor submits a RFI on an activity less than thirty (30) days prior to the commencement of that activity, the Contractor shall not be entitled to any time extension or adjustment in Contract Price due to the time it takes City to respond to the RFI provided that City responds within fifteen (15) days. No delay to the Work or damages to the Contractor shall be attributable to the failure by City to respond to the RFI until fifteen (15) days after City's receipt of the RFI, and then only if the failure by City to respond is unreasonable and affects the Contract completion date.
- C. City's response to a RFI shall not be considered a change to the Contract requirements unless it is accompanied by a Request for Change Proposal. If the Contractor believes that City's response to the RFI constitutes changed work impacting Contract Price or Contract Time, the Contractor shall submit a Notice of Claim, Supplemental Information and a Request for Change Order to City in accordance with Articles 5, *Changes to the Contract*.

#### **4.7 TESTS, INSPECTIONS, AND ACCESS TO THE WORK**

- A. Contractor shall be responsible for inspection and quality assurance of all the Work including all work performed by any Subcontractor. The Contractor shall document and maintain an adequate testing and inspection program and perform such tests and inspections as are necessary or required to ensure that the Work conforms to the requirements of the Contract. The Contractor shall maintain all documentation related to testing and inspection and make such documentation available to City at its request. Unless otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to City, or with the appropriate public authority. If any governmental, regulatory, or permitting authority requires any portion of the Work to be inspected, tested, or approved, the Contractor shall make all arrangements for and cooperate with such inspections, tests, and approvals so as not to delay completion of the Work. The Contractor shall bear all related costs of tests, inspections, and approvals. The Contractor shall give City at least three (3) days' Notice of: (1) when the work is ready to be tested and inspected and (2) when and where tests and inspections are to be made. Contractor shall maintain complete inspection records and make them available to City upon request.
- B. The Contractor shall cooperate with City in the performance of any tests and inspections of the Work. The Contractor has the duty to coordinate all tests and inspections in a manner, which does not negatively impact Contractor's compliance with the Contract.
- C. If any Work required to be inspected, tested, or approved is covered without such inspection, testing or approval being obtained, it must, if requested by City, be uncovered for observation, and such uncovering shall be at Contractor's expense.
- D. City may, at any reasonable time and at its own cost, conduct inspections and tests as it deems necessary to ensure that the Work is in accordance with the Contract. City shall promptly notify Contractor if an inspection or test reveals that the Work is not in accordance with the Contract. City inspection and tests are for the sole benefit of City and do not:
  - 1. Constitute or imply acceptance;
  - 2. Relieve Contractor of responsibility for providing adequate quality control measures;
  - 3. Relieve Contractor of responsibility for risk of loss or damage to the Work, materials, or equipment;
  - 4. Relieve Contractor of its responsibility to comply with the requirements of the Contract; or
  - 5. Impair City's right to reject defective or nonconforming items, or to avail itself of any other remedy to which it may be entitled.
- E. Neither observations by an inspector retained by City, the presence or absence of such inspector on the Site, nor inspections, tests, or approvals by others, shall relieve Contractor from any requirement of the Contract. Inspectors are not authorized to change any term or condition of the Contract.
- F. Contractor shall promptly furnish, without additional charge, all facilities, labor, material and equipment reasonably needed for performing such safe and convenient inspections and tests as may be required by City. City may charge

Contractor any additional cost of inspection or testing when Work is not ready at the time specified by Contractor for inspection or testing, or when prior rejection makes reinspection or retest necessary. City shall perform its inspections and tests in a manner that will cause no undue delay in the Work.

#### **4.8 CORRECTION OF WORK OR DAMAGED PROPERTY**

- A. If material, equipment, workmanship, or work proposed for, or incorporated into the Work, does not meet the Contract requirements or fails to perform satisfactorily, City shall have the right to reject such work by giving the Contractor written notice and may require the Contractor to promptly repair, replace or correct it at no cost to the City.
- B. If the Contractor does not repair, replace or correct and/or remove defective or non-conforming Work or repair damaged property as required by City, in manner and/or schedule, City or City's designee may repair, replace or correct and/or remove it and deduct the cost of such effort from any payment due the Contractor.
  - 1. If the remaining payments due the Contractor are not sufficient to cover City's cost of remedying the defective or non-conforming Work, the Contractor shall pay the difference to City.
- C. The Contractor shall be liable for all damages and costs incurred by City caused by defective or non-conforming work or workmanship, including but not limited to all special, incidental, or consequential damages incurred by City.

#### **4.9 SUBSTITUTION OF PRODUCTS & PROCESSES**

- A. Substitutions requested by the Contractor will be subject to City's prior written acceptance and at City's sole discretion.
- B. Requests for substitution must specifically identify:
  - 1. Material, equipment, and labor costs included in the Contractor's bid associated with the original item to be substituted;
  - 2. All costs for material, equipment, labor associated with the proposed substitution, including any impact costs;
  - 3. Proposed change to the Contract Price and/or Contract Time; and
  - 4. Compatibility with or modification to other systems, parts, equipment or components of the Project and Contract Work.
- C. Contractor shall provide all documentation supporting its request as requested by City.
- D. All costs of any redesign or modification to other systems, parts, equipment or components of the Project or Contract Work, which result from the substitution, shall be borne by the Contractor.
- E. When City approves a substitution proposed by the Contractor, the Contractor shall guarantee the substituted article or materials to be equal to, or better than, those originally specified and shall be compatible with all other systems, parts, equipment or components of the Project and Contract Work. City has the right to order an unaccepted, substituted article removed and replaced without additional cost to City.

- F. City has a right to a deductive Change Order if the substituted product or process is less costly than the contractually required product or process.
- G. If City does not accept the substitution proposal the Contractor shall proceed, without delay or cost to City, with the Contract Work as originally specified.

#### **4.10 INCREASED OR DECREASED QUANTITIES**

- A. Payment to the Contractor will be made only for the actual quantities of work performed and accepted in conformance with the contract. When the accepted quantity of work performed under a unit item varies from the original proposal quantity, payment will be at the unit contract price for all work unless the total accepted quantity of any contract item, adjusted to exclude added or deleted amounts included in change orders accepted by both parties, increases or decreases by more than 25 percent from the original proposal quantity. In that case, payment for contract work may be adjusted as described herein:
  - 1. The adjusted final quantity shall be determined by starting with the final accepted quantity measured after all work under an item has been completed. From this amount, subtract any quantities included in additive change orders accepted by both parties. Then, to the resulting amount, add any quantities included in deductive change orders accepted by both parties. The final result of this calculation shall become the adjusted final quantity and the basis for comparison to the original proposal quantity.
    - a. Increased Quantities: Either party to the contract will be entitled to renegotiate the price for that portion of the adjusted final quantity in excess of 1.25 times the original proposal quantity. The price for excessive quantities will be determined by agreement of the parties, or, where the parties cannot agree, the price will be determined by the City based upon the actual costs to perform the work, including markup for overhead and profit in accordance with Paragraph 6.3, *Allowable Costs*.
    - b. Decreased Quantities: Either party to the contract will be entitled to an equitable adjustment if the adjusted final quantity of work performed is less than 75 percent of the original bid quantity. The equitable adjustment shall be based upon and limited to three factors:
      - i. Any increase or decrease in unit costs of labor, materials or equipment, utilized for work actually performed, resulting solely from the reduction in quantity;
      - ii. Changes in production rates or methods of performing work actually done to the extent that the nature of the work actually performed differs from the nature of the work included in the original plan; and
      - iii. An adjustment for the anticipated contribution to unavoidable fixed cost and overhead from the units representing the difference between the adjusted final quantity and 75% of the original plan quantity.
- B. The following limitations shall apply to renegotiated prices for increases and/or equitable adjustments for decreases:
  - 1. Labor, materials and equipment rates shall be actual costs but shall not exceed the rates set forth in Paragraph 6.3, *Allowable Costs* nor shall overhead and profit exceed the rates set forth in Paragraph 6.3, *Allowable Costs*.

2. No payment for consequential damages or loss of anticipated profits will be allowed because of any variance in quantities from those originally shown in the proposal form, contract provisions, and contract plans.
  3. The total payment (including the adjustment amount and unit prices for work performed) for any item which experiences an equitable adjustment for decreased quantity shall not exceed 75% of the amount original bid for the item.
- C. If the adjusted final quantity of any item does not vary from the quantity shown in the proposal by more than 25% then the Contractor and the City agree that all work under that item will be performed at the original contract unit price and within the original time for completion.
  - D. When ordered by the Engineer, the Contractor shall proceed with the work pending determination of the cost or time adjustment for the variation in quantities.
  - E. The Contractor and the City agree that there will be no cost adjustment for decreases if the City has entered the amount for the item in the proposal form only to provide a common proposal for bidders.

## **ARTICLE 5: CHANGES TO THE CONTRACT**

### **5.1 GENERAL**

- A. No provisions of the Contract may be amended or modified except by written agreement signed by the City.
- B. All Change Order work shall be performed in accordance with the original Contract requirements unless modified in writing by City.
- C. Any response to a Request For Information, or other directive, direction, instruction, interpretation, or determination (hereinafter referred to as "Direction" for the purposes of Article 5), provided by City is not considered a Change Order, a change to Contract requirements, and shall not constitute, in and of itself, entitlement to an adjustment in Contract Price and/or Contract Time.
- D. The Contractor shall not be entitled to any change in the Contract Price and/or Contract Time under the following conditions or events:
  1. They were reasonably foreseeable at the time the Contractor submitted its bid;
  2. They were caused by the acts of the Contractor, Subcontractor and/or Supplier, including but not limited to the choice of means, methods, techniques, sequences, or procedures for the Work, failure to provide labor, materials or equipment in a timely manner, and failure to take reasonable steps to mitigate delays, disruptions, or conditions encountered.
- E. The Contract requirements for time and price impacts related to Change Orders are set forth in Article 6, *Time and Price Adjustments*.
- F. If there is a bid item for "Minor Changes," payments or credits for changes that cost \$5,000 or less and do not affect time, may, at the discretion of the City, be made under that bid item in lieu of the procedures set forth in Sections 5.1 – 5.6. A Minor Change will be documented by a written Order for a Minor Change or by a notation confirming an oral agreement.

## 5.2 CONTRACTOR'S REQUEST FOR A CHANGE ORDER

- A. Notice of Claim and Supplemental Information. If the Contractor believes that it is entitled to additional compensation and/or time for any reason (other than for a differing site condition under Section 5.2), or if the Contractor disagrees with any written or oral direction, instruction, interpretation or determination from the City, the Contractor shall
- (1) Provide the Engineer with a written Notice of Protest before doing any work or incurring any costs for which it may seek additional compensation or time from the City.
  - (2) Supplement the written Notice of Protest within 14 days with a written statement that includes the following:
    - a. The date, circumstances, and basis of entitlement to additional compensation and/or time;
    - b. The estimated dollar cost of the protested work and a detailed breakdown showing how that estimate was determined;
    - c. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption;
    - d. Substantive basis of the Request;
    - e. If the protest is continuing, the information required above shall be supplemented upon request by the Engineer until the protest is resolved; and
    - f. The Contractor waives all claims for additional compensation and time if it fails to provide both a timely Notice of Claim and Supplemental Information with the information required by this Section.
- B. Request for Change Order.
1. A Request for a Change Order must be submitted in writing to the Engineer no later than thirty-five (35) days after the Contractor submitted its supplemental information pursuant to Paragraph 5.1(A)(2).
  2. The Request for a Change Order shall include:
    - a. Specific dollar amount covering all costs associated calculated in accordance with Article 6, *Time and Price Adjustments*;
    - b. Specific request for time extension (number of days) calculated in accordance with Article 6, *Time and Price Adjustments*;
    - c. A copy of the written Notice of intent, including all attachments;
    - d. All documentation supporting the Request for a Change Order, including but not limited to a cost proposal prepared using the forms provided by City, all cost records, schedule analysis, and the documents identified in §00700, ¶3.10, *Maintenance and Inspection of Documents*, that are in any way relevant to the Contractor's Request for Change Order; and
    - e. The Contractor waives all claims for additional compensation and time if it fails to provide a timely Request for Change Order with the information required by this Section.
- C. City's Response to Contractor's Request for Change Order.

1. City will make a written determination with respect to the Contractor's Request for Change Order within thirty (30) days of receipt of said Request, unless one of the following activities occurs.
    - a. City may request additional information and specify a time period for receipt of the information. The Contractor shall comply with City's request for additional information.
    - b. City may inform the Contractor that additional time is needed to review the Contractor's Request for Change Order and identify a date certain when a decision will be rendered.
  2. If City requests additional information, City will make a written determination within thirty (30) days receipt of Contractor's additional information.
  3. If City does not make a determination within the applicable time period, the Request For Change Order is deemed denied.
- D. Approval of Request for Change Order and Execution of Change Order. If City determines that a Change Order is necessary, the parties may negotiate acceptable terms and conditions and execute a Bilateral Change Order or City may issue a Unilateral Change Order.
- E. Contractor Procedure upon Denial or Deemed Denial of a Request for a Change Order. If the Contractor disagrees with the denial, the Contractor's sole remedy shall be to file a fully documented Claim within thirty (30) days of deemed denial or the Contractor's receipt of the denial in accordance with Article 9, *Claims and Litigation*.
- F. Contractor's Obligation to Continue to Work. Pending resolution of the Contractor's Request for a Change Order, the Contractor shall continue to perform all Work including, at the written request of City that work associated with the pending Request for Change Order. The Contractor shall maintain its progress with the Work.
- G. Waiver. Failure to follow the provisions set forth herein shall constitute a waiver of the Contractor's right to receive any additional time or money as a result of any alleged direction, instruction, interpretation, determination by City and/or the event or impact to the Project.

### 5.3 DIFFERING SITE CONDITIONS

- A. Immediate Written Notice to City. If the Contractor encounters a Differing Site Condition as defined in Article 1.0 the Contractor shall immediately, and before the conditions are disturbed, give written Notice to City of Differing Site Conditions.
- B. Request for Change Order based on Differing Site Condition. Unless otherwise agreed upon in writing by the Engineer, within forty-five (45) days of the Contractor's initial written notification of the Differing Site Condition to City, the Contractor shall provide a Request for Change Order that includes all elements required for such a request, including:
  1. A detailed description of the Differing Site Condition; and
  2. Substantive, contractual, and technical basis supporting the existence of the Differing Site Condition and its impacts.
- C. Waiver.

1. If the Contractor's actions disturb the Site such that City or City's designee cannot adequately and fully investigate the alleged differing site condition, the Contractor waives its right to receive any additional time or money as a result of the Differing Site Condition.
  2. Failure by the Contractor to provide either (a) immediate Notice or (b) Request for Change Order shall constitute a waiver of the Contractor's right to receive any additional time or money as a result of the Differing Site Condition.
  3. The Contractor shall be responsible for any and all costs or damages incurred by City resulting from the Contractor's failure to provide appropriate notice and/or the Detailed Description and Request for Change Order.
- D. City's Response to the Differing Site Condition Request for Change Order. City shall investigate the alleged Differing Site Conditions and respond to the Differing Site Condition in accordance with the Request for Change Order procedures set forth above.
- E. Contractor's Obligation to Continue to Work. The Contractor shall not disturb the condition until receipt of written authorization from the Engineer that work can resume at the location of the alleged Differing Site Condition. The Contractor shall continue with performance of all other Work.

#### **5.4 SUSPENSION OF WORK**

A. City Issues Directive Suspending Work

1. City may order the Contractor, in writing, to suspend all or any part of the Work of this Contract for the period of time that City determines appropriate for the convenience of City. The Contractor shall not suspend the Work without written direction from City specifically authorizing the Suspension of Work.
2. Upon receipt of a written Notice suspending the Work, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize costs attributable to such suspension. Within a period up to 120 days after the suspension notice is received by the Contractor, or within any extension of that period which City requires, City shall either:
  - a. Cancel the written notice suspending the Work; or
  - b. Terminate the Work for either default or convenience.
3. If a written notice suspending the Work is canceled or the period of the Suspension or any extension thereof expires, the Contractor shall resume Work as required by City.
4. If the performance of all or any part of the Work is, for an unreasonable period of time, suspended by the written direction of City, the Contractor may be entitled to an adjustment in the Contract Time, or Contract Price, or both, for increases in the time or cost of performance directly attributable to the suspension and provided that the Contractor sufficiently documents all costs and time impacts attributable to the suspension. No adjustments to Contract Price and/or Contract Time shall be allowed unless the Contractor can demonstrate that the period of suspension caused by City impacted Critical Path and delayed the Contractor from completing the Work on time.



**B. Constructive Suspension of Work**

1. If the Contractor believes that some action or omission on the part of City constitutes constructive suspension of Work, the Contractor shall immediately notify City in writing that the Contractor considers the actions or omission a constructive suspension of Work.
- C. To the extent the Contractor believes it is entitled to any additional money or time as a result of the suspension of Work or constructive suspension, Contractor shall submit a Notice of Protest, Supplemental Information and Request for Change Order to City in accordance with Article 5, *Changes to the Contract*.
- D. Failure to comply with these requirements shall constitute a waiver of Contractor rights to any adjustment in Contract Time and/or Contract Price.
- E. No adjustment shall be made under this provision for any suspension to the extent that Contractor's performance would have been suspended, delayed, or interrupted as a result of actions, omissions, fault or negligence caused, in whole or in part, by the Contractor or any of its Subcontractors.

**5.5 FORCE MAJEURE**

- A. To the extent the Contractor believes it is entitled to any additional time as a result of Force Majeure, Contractor shall submit a Notice of Protest, Supplemental Information and Request for Change Order to City in accordance with Article 5, *Changes to the Contract*.
- B. Contractor shall not be entitled to a change in Contract Price resulting from an act of Force Majeure.
- C. Contractor is not entitled to an adjustment in Contract Time if the act of Force Majeure did not impact progress of the Work on the Critical Path and delay the Contractor from completing the Work within the Contract Time.
- D. When a Contractor experiences concurrent delay caused by either City or Contractor and an act of Force Majeure, the Contractor shall only be entitled to an change in Contract Time. No change to the Contract Price shall be allowed as a result of such concurrent delay.

**5.6 CHANGE ORDERS**

**A. Bilateral Change Orders**

1. If City and Contractor reach agreement on the terms and conditions of any change in the Work, including any adjustment in the Contract Price and Contract Time, such agreement shall be incorporated into a Change Order and signed by both Parties. Such Bilateral Change Orders shall represent full and complete payment and final settlement of all changes, Claims, damages or costs for all (a) time; (b) direct, indirect, and overhead costs; (c) profit; and (d) any and all costs or damages associated with delay, inconvenience, disruption of schedule, impact, ripple effect, loss of efficiency or productivity, acceleration of work, lost profits, stand-by, and any other costs or damages related to any work either covered or affected by the Change Order, or related to the events giving rise to the Bilateral Change Order.

B. Unilateral Change Order

1. City's Right to Issue Unilateral Change Order.

- a. City may unilaterally issue a Change Order at any time, without invalidating the Contract and without notice to the sureties, making changes within the general scope of this Contract.
- b. If any such Change Order causes an increase or decrease in the cost of, or time required for, performance of any part of the Work, City may make an adjustment in the Contract Price, Contract Time, or both, in accordance with Articles 5, *Changes to the Contract*, and 6, *Time and Price Adjustments*.

2. Contractor Disagreement with Unilateral Change Order. If the Contractor disagrees with the adjustment to the Contract Price and/or Time as indicated in the Unilateral Change Order, the Contractor must submit a Notice of Protest, Supplemental Information and Request for Change Order to City in accordance with Article 5, *Changes to the Contract*.

3. Contractor's Obligation to Continue to Work. The Contractor is required to continue with performance of all Work, including work associated with the Unilateral Change Order.

**5.7 CITY REQUEST FOR A CHANGE PROPOSAL**

A. Request. City may request a written Change Proposal from the Contractor for a change in the Work.

B. Contractor's Proposal. Contractor shall submit its written Change Proposal within the time specified in City's request with the costs shown in a form acceptable to the City. The Change Proposal shall represent the Contractor's offer to perform the requested work, and the pricing set forth within the proposal shall represent full, complete, and final compensation for the proposed change and any impacts to any other Work, including any adjustments in the Contract Time.

C. City's Acceptance of Contractor Proposal. If City accepts the Change Proposal as submitted by the Contractor or as negotiated by the parties, City shall notify the Contractor in writing of its acceptance of the Proposal and direct that the change in the Work be performed.

D. Execution of a Bilateral Change Order. After acceptance of the Change Proposal or acceptance of the negotiated Change Proposal, City shall direct the Contractor to perform the work in accordance with the agreed upon terms; thereafter, the Parties shall execute a bilateral Change Order in accordance with the terms of the Change Proposal or negotiated Change Proposal.

E. Execution of Unilateral Change Order. If City does not accept the Change Proposal or the Parties cannot agree upon the appropriate price or terms for the Change Proposal, City may issue a unilateral Change Order.

**ARTICLE 6: TIME AND PRICE ADJUSTMENTS**

**6.1 CHANGE IN THE CONTRACT TIME**

A. The Contract Time shall only be changed by a Change Order.

- B. No change in the Contract Time shall be allowed to the extent the time of performance is changed due to the fault, act, or omission of Contractor, or anyone for whose acts or omissions the Contractor is responsible.
- C. Contractor is not entitled to a change in Contract Time unless the progress of the Work on the Critical Path is delayed and completion of the Contract Work within Contract Time is delayed.
- D. When a Contractor experiences concurrent delays which impact the Critical Path and are caused by (1) City and the Contractor; (2) City and an act of Force Majeure; or, (3) the Contractor and an act of Force Majeure, the Contractor shall only be entitled to a change in Contract Time. No change to the Contract Price shall be allowed as a result of such concurrent delay.
- E. A Request for Change Order that includes a request for an adjustment in the Contract Time shall:
  - 1. Be in writing and delivered to City within the appropriate time period specified in Article 5, *Changes in the Contract*.
  - 2. Include a clear explanation of how the event or conditions specifically impacted the Critical Path and overall Project Schedule and the amount of the adjustment in Contract Time requested.
  - 3. Be limited to the change in the Critical Path of a Contractor's Project Schedule, and any updates, attributable to the event or conditions, which caused the request for adjustment. No extension of time or compensation for damages resulting from delay will be granted unless the delay affects the timely completion of all Work under the Contract or timely completion of a portion of the Work for which time of completion is specific. Contractor shall be responsible for showing clearly on the Project Schedule, and any updates, that the event or conditions:
    - a. Had a specific impact on the Critical Path and was the sole cause of such impact;
    - b. Could not have been avoided by resequencing of the Work or other reasonable alternatives; and
    - c. Will prevent the Contractor from completing the Project within the current Contract completion date.
- F. Contractor shall make all reasonable efforts to prevent and mitigate the effects of any delay, whether occasioned by an act of Force Majeure or otherwise.

## **6.2 CHANGE IN THE CONTRACT PRICE**

- A. The Contract Price shall only be changed by a Change Order.
- B. No change in the Contract Price shall be allowed when:
  - 1. Contractor's changed cost of performance is due to the fault, acts, or omissions of Contractor, or anyone for whose acts or omissions Contractor is responsible, including its subcontractors and suppliers;
  - 2. The change is concurrently caused by Contractor and City; or
  - 3. The change is caused by an act of a third party or Force Majeure.

- C. City shall not be responsible for, and the Contractor shall not be entitled to any compensation for unallowable costs. Unallowable costs include, but are not limited to:
1. Interest or attorney's fees of any type other than those mandated by Washington state statute;
  2. Claim preparation or filing costs;
  3. The cost of preparing or reviewing Change Proposals or Requests for Change Orders;
  4. Lost profits, lost income or earnings;
  5. Costs for idle equipment when such equipment is not at the Site, has not been employed in the Work, or is not scheduled to be used at the Site;
  6. Lost earnings or interest on unpaid retainage;
  7. Claims consulting costs;
  8. The costs of corporate officers or staff visiting the Site or participating in meetings with City;
  9. Loss of other business; and/or
  10. Any other special, consequential, or incidental damages incurred by the Contractor, Subcontractor, or Suppliers.
- D. A Request for Change Order that includes a request for an adjustment in Contract Price shall:
1. Be in writing and delivered to City within the applicable time period specified in Article 5, *Changes to the Contract*.
  2. Identify the following information:
    - a. The event or condition which caused the Contractor to submit its request for an adjustment in the Contract Price;
    - b. The nature of the impacts to Contractor and its Subcontractors, if any; and
    - c. The amount of the adjustment in Contract Price requested calculated in accordance with Paragraph 6.3, *Allowable Costs*, and using forms provided by City.
  3. Any requests by Contractor for an adjustment in the Contract Price and in the Contract Time that arise out of the same event or conditions shall be submitted together.
- E. The adjustments to the Contract Price provided for in this Article represent full, final, and complete compensation for all work done in connection with the request for an adjustment in Contract Price and all costs related to, resulting from, or affected by such change in Work including, but not limited to, all direct and indirect costs, overhead, profit, and all costs or damages associated with delay, inconvenience, disruption of schedule, impact, dilution of supervision, inefficiency, ripple effect, loss of efficiency or productivity, acceleration of work, lost profits, and any other costs or damages related to any work either covered or affected by the change in the Work, or related to the events giving rise to the change.

### **6.3 METHOD TO CALCULATE ADJUSTMENTS TO CONTRACT PRICE**

- A. One of the following methods shall be used to calculate damages and/or adjustments to the Contract Price that result from or relate to Change Proposal, Request for Change Order, and/or Claim.
- B. Determination of the method to be used to calculate adjustments in the Contract Price shall be at the sole discretion of City.
- C. One of the following methods shall be used:
  - 1. Unit Price Method;
  - 2. Firm Fixed Price Method (also known as Lump Sum); or
  - 3. Time and Materials Method.
- D. **Unit Price Method**
  - 1. The City may direct the Contractor to perform extra work on a Unit Price basis. Such authorization shall clearly state the:
    - a. Scope of work to be performed;
    - b. Applicable Unit Price; and
    - c. Not to exceed amount of reimbursement as established by City.
  - 2. The applicable unit price shall include reimbursement for all direct and indirect costs of the work, including Overhead and profit, as limited by paragraph 6.3, *Allowable Costs*.
  - 3. Contractor shall only be paid under this method for the actual quantity of materials incorporated in or removed from the Work and such quantities must be supported by field measurement statements verified by City.
- E. **Firm Fixed Price Method**
  - 1. The Contractor and City may mutually agree on a fixed amount as the total compensation for the performance of changed work.
  - 2. The Contractor shall provide a detailed cost breakdown supporting the Contractor's requested adjustment to Contract Price and any other financial documentation requested by the Engineer, as limited by paragraph 6.3, *Allowable Costs*.
  - 3. Any adjustments to the Contract Price using the Firm Fixed Price Method shall include, when appropriate all reasonable costs for labor, equipment, material, Overhead and profit. Such labor, equipment, material, Overhead and profit shall be calculated in accordance with paragraph 6.3, *Allowable Costs*.
  - 4. Whenever City authorizes Contractor to perform changed work on a Firm Fixed Price Method, City's authorization shall clearly state:
    - a. Scope of work to be performed; and
    - b. Total Fixed Price payment for performing such work.
- F. **Time and Materials Method**
  - 1. Whenever City authorizes the Contractor to perform work on a Time and Material basis, City's authorization shall clearly state:

- a. Scope of work to be performed; and
  - b. A not to exceed amount of reimbursement as established by City.
2. Contractor shall:
- a. Cooperate with City and assist in monitoring the work being performed;
  - b. Substantiate the labor hours, materials and equipment charged to work under the Time and Materials Method by detailed time cards or logs completed on a daily basis before the close of business each working day;
  - c. Present the time card and/or log at the close of business each day to the Engineer so that City may review and initial each time card/log;
  - d. Perform all work in accordance with this provision as efficiently as possible;
  - e. Not exceed any cost limit(s) without City's prior written approval; and
  - f. Maintain all records of the work, including all records of the Subcontractor, Supplier, and Materialmen, and make such records available for inspection as required in paragraphs 3.8, *Record Documents*, 3.9, *Cost Records*, and 3.10, *Maintenance and Inspection of Document*.
3. Contractor shall submit costs and any additional information requested by City to support Contractor's requested price adjustment.
4. The Contractor shall only be entitled to be paid for reasonable costs actually incurred by the Contractor. The Contractor has a duty to control costs. If City determines that the Contractor's costs are excessive or unreasonable, City, at its discretion, shall determine the reasonable amount for payment.

**G. Deductive Changes to the Contract Price**

1. A deductive change to the Contract Price may be determined by taking into account:
- a. Costs incurred and saved by the Contractor as a result of the change, if any;
  - b. The costs of labor, material, equipment, and overhead saved and profit unearned by the deleted work. These costs shall be calculated following as closely as possible with the provisions identified in Article 6, Time and Price Adjustments; and/or,
  - c. At the discretion of City, costs set forth in the documents used by the Contractor to develop its bid.
2. Where City has elected not to correct incomplete or defective Work, the adjustment in the Contract Price shall take into account:
- a. The costs the City would have to expend to correct the Work;
  - b. The decreased value to City resulting from the incomplete or defective Work; and,
  - c. The increased future costs which City may incur by reason of the incomplete or defective Work.

## H. Full Compensation

An adjustment calculated in accordance with the provisions of this Article shall be full and complete payment and final settlement of all changes, claims, damages and costs for all (a) time; (b) direct, indirect, and overhead costs; (c) profit; and (d) any and all costs or damages associated with delay, inconvenience, disruption of schedule, impact, ripple effect, loss of efficiency or productivity, acceleration of work, lost profits, standby, and/or any other costs or damages related to any Work either covered or affected by the changed Work, or related to the events giving rise to the change.

### 6.4 ALLOWABLE COSTS

- A. Any adjustments to the Contract Price shall be based on the following categories and shall incorporate markups for Overhead and profit as provided herein.
1. **Labor.** For all labor, including foreman supervision but excluding superintendents and other project management and consultants, the Contractor shall be reimbursed for labor costs provided herein. The labor cost of an event or condition shall be calculated as the sum of the following:
    - a. **Labor Rate.** The Labor Rate is the actual reasonable wage paid to the individual plus the actual reasonable costs incurred by the Contractor to cover costs associated with Federal Insurance Compensation Act (FICA), Federal Unemployment Tax Act (FUTA), State Unemployment Tax Act (SUCA), industrial insurance, fringe benefits, and benefits paid on behalf of labor by the Contractor. The applicable Labor Rates shall be multiplied by the number of hours reasonably expended in each labor classification because of the event or condition to arrive at a total cost of labor.
    - b. **Travel Allowance and/or Subsistence.** The labor calculation shall include the actual costs of travel and/or subsistence paid to the Contractor's employees engaged upon the Work when said payments are required by a labor agreement.
  2. **Materials.** The cost of materials resulting from an event or condition shall be calculated in one or more of the following methods, at City's election:
    - a. **Invoice Cost.** The Contractor may be paid the actual invoice cost of materials including actual freight and express charges and applicable taxes less all available discounts, rebates, and back-charges,. This method shall be considered only to the extent the Contractor's invoice costs are reasonable and the Contractor provides copies of vendor invoices, freight and express bills, and other evidence of cost accounting and payment satisfactory to City. As to materials furnished from the Contractor's stocks for which an invoice is not available, the Contractor shall furnish an affidavit certifying its actual cost of such materials and such other information as City may reasonably require;
    - b. **Wholesale Price.** The Contractor may be paid the lowest current wholesale price for which the materials are available in the quantities required, including customary costs of delivery and all applicable taxes less all available discounts, rebates, and back-charges; or

- c. **City Furnished Material.** City reserves the right to furnish such materials as it deems advisable, and the Contractor shall have no Claim for any costs, Overhead or profit on such materials. However, should the Contractor be required to pick up, transport and/or unload such materials the Contractor will be reimbursed for reasonable costs thereof.
3. **Equipment.** The additional cost, if any, of machine-power tools and equipment usage shall be calculated in accordance with the following rules:
  - a. **Equipment Rates.** The Contractor's own charge rates may be used if verified and approved by City and based on the Contractor's actual ownership and operating cost experience. Rental rates contained in published rate guides may be used if their cost formulas and rate factors are identifiable, reflect the Contractor's historical acquisition costs, utilization, and useful life, and do not include replacement cost, escalation contingency reserves, general and administrative expense, or profit. Rates shall be based on the Contractor's actual allowable costs incurred or the rates established according to the Rental Rate Blue Book for Construction Equipment, published by Equipment Watch, PRIMEDIA, whichever is less. The Rental Rate Blue Book established hourly equipment rate shall be the monthly rental rate for the equipment plus the monthly rental rate for required attachments, divided by 176 work hours per month, multiplied by the appropriate regional adjustment factor, plus the hourly operating cost. The established equipment rate shall apply for actual equipment usage up to eight hours per day. For all hours in excess of eight hours per day or 176 hours per month, the established equipment rate shall be the monthly rental rate plus the monthly rental rate for required attachments, divided by 352, multiplied by the regional adjustment factor, plus the hourly operating cost.
  - b. **Transportation.** If the necessary equipment is not already at the Site and it is not anticipated that it would be required for the performance of other work under the terms of the Contract, the calculation shall include a reasonable amount for the costs of the necessary transportation of such equipment.
  - c. **Standby.** The Contractor shall only be entitled to standby equipment costs if (a) the equipment is ready, able, and available to do the Work at a moment's notice; (b) Contractor is required to have equipment standby because of an event or condition solely caused by City and (c) the Contractor can demonstrate that it could have and intended to use the equipment on other projects/jobs. The Contractor shall be compensated at 50% of the monthly rental rate for the equipment, divided by 176, and multiplied by the appropriate regional adjustment factor, as identified in the Rental Rate Blue Book for Construction Equipment, published by Machinery Information Division of PRIMEDIA Information Inc. Standby shall not be paid during periods of Contractor-caused delay, concurrent delay, Force Majeure, during any seasonal shutdown, routine maintenance, down-time or broken equipment, late delivery of equipment or supplies, or other anticipated occurrence specified in the Contract Documents. No payment shall be made for standby on any piece of equipment, which has been used on the Project in any 24 hour period. Standby costs shall not be paid for weekends, holidays, and any time the equipment was not intended to be used on the Project as demonstrated by the Project Schedule.



4. **Subcontractor & Supplier.** Direct costs associated with Subcontractors and Suppliers shall exclude Overhead and Profit markups and shall be calculated and itemized in the same manner as prescribed herein for Contractor. Contractor shall provide detailed breakdown of Subcontractor and Supplier invoices.
5. **Overhead and Profit Markup.**
  - a. On a change to the Contract Price or any other claim for money by the Contractor, City will only pay Overhead, including Home Office Overhead, Site or Field Office Overhead, and unabsorbed home office overhead, and Profit pursuant to the Overhead and Profit Markups set forth herein. The Overhead and Profit Markups cover all overhead regardless of how the Contractor chooses to account for various costs in its books of account.
  - b. Overhead and Profit markups shall not be applied to freight, delivery charges, express charges, and sales tax.
  - c. The allowed Overhead and Profit markup shall not exceed the following:
    - i. If the Contractor is self-performing work: 18% combined Overhead and Profit markup on the Contractor's Direct Costs;
    - ii. If a Subcontractor or Supplier is performing work: 18% for the Subcontractor's Direct Cost for performing the work and 7% on the Direct Costs of the Subcontractors' or Suppliers'; provided that the 7% is to be divided among upper tier Subcontractors and the Contractor when a Subcontractor or Supplier is performing the work;
    - iii. If the value of material and equipment is greater than 50% of the total value of the change, the Overhead and Profit Markup shall only be 10% for material and equipment; and
    - iv. In no event shall the total combined Overhead and Profit markup for the Contractor and all Subcontractors and Suppliers of any tier exceed 25% of the Direct Cost to perform the Change Order work.

## **ARTICLE 7: PAYMENT AND COMPLETION**

### **7.1 APPLICATIONS FOR PAYMENT**

- A. On or about the first day of each month, the Contractor shall submit to City an Application for Payment. Each application shall be completed on a form acceptable to City and designated as an "Application for Payment."
- B. The Contractor is not entitled to payment for any work unless the Application for Payment includes all required documentation. City reserves the right to withhold payment pursuant to paragraph 7.2, *Payments Withheld* if it is subsequently determined that all required documentation was not provided by the Contractor or is in error.
- C. The application shall correlate the amount requested with the Schedule of Values and with the state of completion of the Work.
- D. The Contractor shall submit a breakdown of the cost of lump sum items to enable the Engineer to determine the Work performed on a monthly basis. Lump sum breakdowns shall be submitted prior to the first progress payment that includes

payment for the Bid Item. Absent a lump sum breakdown, the Engineer will make a determination based on information available.

## **7.2 PAYMENTS**

- A. City shall comply with RCW 39.76, as amended, and promptly review each Application for Payment and identify in writing any cause for disapproval within 8 working days. In addition to withholding payment for unsatisfactory performance or failure to comply with Contract requirements, if the Contractor's Application for Payment fails to recognize any back-charges, off-sets, credits, change orders, or deductions in payment made in accordance with paragraph 7.2, *Payments Withheld*, City shall have the right to revise or disapprove Contractor's Application For Payment because the Application for Payment is not considered a properly completed invoice.
- B. The City shall withhold retainage from each Application for Payment as required by RCW 60.28, as amended.
- C. If an Application for Payment is accepted by City, it shall be paid within thirty (30) days of City's receipt of the properly prepared invoice (Application for Payment).

## **7.3 PAYMENT WITHHELD**

- A. In addition to retainage withheld pursuant to RCW 60.28 and without waiver of any other available remedies, City has the right to withhold, nullify, or back-charge, in whole or in part, any payment or payments due or that have been paid to the Contractor as may be necessary to cover City's costs or to protect City from loss or damage for reasons including but not limited to:
  - 1. Failure of the Contractor to submit or obtain acceptance of a Progress Schedule, Schedule of Values, and any updated Schedules;
  - 2. Defective or non-conforming Work;
  - 3. Costs incurred by City to correct, repair or replace defective or non-conforming Work, or to complete the Work;
  - 4. A reasonable doubt that the Contract can be completed for the balance then unpaid;
  - 5. A reasonable concern by City that the materials, equipment or component parts are not in proper operating condition;
  - 6. Assessment of Liquidated Damages;
  - 7. Failure to perform in accordance with the Contract;
  - 8. Cost or liability that may occur to City as the result of the Contractor's or Subcontractor's acts, omissions, fault, or negligence;
  - 9. Deduction in the Work;
  - 10. Failure of Contractor to repair damaged materials, equipment, property, or Work;
  - 11. Failure of the Contractor to obtain approval of Submittals pertinent to the work accomplished;
  - 12. Failure to pay Subcontractors, Suppliers, employees or other obligations arising out of the Work;

13. Failure to keep Record Documents up to date;
  14. Failure to comply with all applicable federal, state, and local laws, statutes, regulations, codes, licenses, easements, and permits;
  15. Failure to obtain and maintain applicable permits, insurance, and bonds; and
  16. Failure to provide Statement of intent to Pay Prevailing Wage and/or Affidavits of Wages Paid and, if requested, Certified Payroll Records for the Contractor and for Subcontractors of any tier.
- B. The withholding, nullification, or back-charge of any payment(s) by City shall in no way relieve the Contractor of any of its obligations under this Contract.

#### **7.4 TITLE**

Title to all Work and materials covered by an accepted and paid Application For Payment shall pass to City at the time of such payment, free and clear of all liens, claims, security interest, and encumbrances. Passage of title shall not, however, (1) relieve Contractor from any of its duties and responsibilities for the Work or materials, including protection thereof, (2) waive any rights of City to insist on full compliance by Contractor with the Contract requirements, or (3) constitute acceptance of the Work or materials.

#### **7.5 SUBSTANTIAL COMPLETION**

- A. When the Contractor has achieved Substantial Completion (as defined in Section 1 above), the Contractor shall give written Notice to City.
1. City shall promptly inspect the Work and prepare a Punch List (list of items to be completed or corrected).
    - a. City reserves the right to add to, modify, or change the Punch List.
    - b. Failure by City to include any items on such list does not alter the responsibility of the Contractor to complete or correct the Work in accordance with the Contract.
- B. At the Contractor's request, City may identify those Punch List items that must be completed or corrected in order for the Contractor to achieve Substantial Completion.
1. When City determines that those Punch List items have been completed or corrected by the Contractor, City shall make a determination that the Work is Substantially Complete.
  2. A Certificate of Substantial Completion will be issued by City, which shall establish the date of Substantial Completion.
  3. This Certificate of Substantial Completion shall state the responsibilities of City and the Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance.
- C. City shall assess liquidated damages for the Contractor's failure to Substantially Complete the Work within the Contract Time. The liquidated damage amounts, set forth elsewhere in the Contract Documents, will be assessed for Contractor's failure to achieve Substantial Completion within the Contract Time. These Liquidated Damages are not a penalty, but will be assessed against the Contractor for failure to achieve these Contract requirements. These Liquidated Damage amounts are

fixed and agreed upon by and between the Contractor and City because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages City would in such events sustain. These amounts shall be construed as the actual amount of damages sustained by City, and may be retained by City and deducted from payments to the Contractor. Assessment of Liquidated Damages shall not release the Contractor from any further obligations or duties pursuant to the Work.

- D. As provided in the Contract Documents, City may grant Substantial Completion to specific subsystems or portions of the Work. The dates of Substantial Completion shall be determined, in writing, by City.

## **7.6 FINAL INSPECTION**

- A. The Contractor shall correct all remaining Punch List items and complete all remaining Work within the time period stated in the Certificate of Substantial Completion or within 30 days, whichever is less. When all Punch List items have been successfully corrected and the work is complete the Contractor's shall give written notice to the City that the Work ready for final inspection. After verification by City that such completion was satisfactory, the Contractor shall submit a Final Application for Payment.

## **7.7 REQUIREMENTS FOR FINAL APPLICATION FOR PAYMENT**

- A. In addition to any other requirement identified in the Contract Documents, the Final Application for Payment shall include the following documents:
  - 1. Affidavit of Wages Paid for Contractor and all Subcontractors in accordance with state law;
  - 2. Contractor's release of claims against City, except for Claims specifically described in the release document and submitted in accordance with Article 9, *Claims and Litigation*; and
  - 3. Contractor certification that all Subcontractors and Suppliers have been paid and there are no outstanding liens.

## **7.8 COMPLETION/FINAL ACCEPTANCE**

- A. Completion/Final Acceptance shall be achieved when all the obligations of the Contract have been successfully performed by the Contractor in accordance with the Contract and accepted by City. Should Contractor fail to achieve Final Acceptance within the required time the City may assess actual damages caused by its failure to do so.
- B. Neither Final Acceptance, nor Final Payment, shall release Contractor or its sureties from any obligations under this Contract or the Performance and Payment Bonds, or constitute a waiver of any claims by City arising from or related to Contractor's performance or failure to perform the Work and to meet all Contractual obligations in accordance with the Contract, including but not limited to:
  - 1. Unsettled liens, security interests or encumbrances;
  - 2. Damaged, non-conforming, or defective Work discovered by City;
  - 3. Terms of any warranties or guarantees required by the Contract; and
  - 4. Payments made in error.

- C. Except for any Claims properly submitted in accordance with Article 9, *Claims and Litigation*, acceptance of Payment on the Final Application for Payment by the Contractor shall, on behalf of itself and its Subcontractors or Sureties, forever and unconditionally release and discharge City, its officers, agents, employees, from:
  - 1. Any and all disputes or claims, including but not limited to claims for damages, fines, interest, taxes, attorney fees, or costs, demands, rights, actions or causes of actions, known or unknown, arising out of or in any way related to the parties' performance under the Contract and/or Project; and
  - 2. Any and all known and/or unknown liabilities, obligations, demands, actions, suits, debts, charges, causes of action, requests for money and/or payment under the Contract, outstanding invoices, or claims directly or indirectly arising out of or related to the Contract and/or Project.

## **7.9 WARRANTY AND GUARANTY**

- A. In addition to any special warranties provided elsewhere in the Contract, Contractor warrants that all Work conforms to the requirements of the Contract and is free from any defect in equipment, material, design, or workmanship performed by Contractor or its Subcontractors and Suppliers.
- B. The warranty period shall be for the longer period of: one year from the date of Final Acceptance of the entire Project or the duration of any special extended warranty offered by a supplier or common to the trade.
- C. With respect to all warranties, express or implied, for Work performed or materials furnished according to the Contract, Contractor shall:
  - 1. Obtain all warranties that would be given in normal commercial practice from the supplier and/or manufacturer;
  - 2. Prior to Final Acceptance require all warranties be executed, in writing, for the benefit of City;
  - 3. Enforce all warranties for the benefit of City; and
  - 4. Be responsible to enforce any warranty of a Subcontractor, manufacturer, or Supplier, should they extend beyond the period specified in the Contract.
- D. If, within an applicable warranty period, any part of the Work is found not to conform to the Contract, the Contractor shall correct it promptly after receipt of written Notice from City to do so. In the event City determines that Contractor corrective action is not satisfactory and/or timely performed, then City has the right to either correct the problem itself or procure the necessary services, recommendations, or guidance from third parties. All damages incurred by City and all costs for City's remedy shall be reimbursed by the Contractor.
- E. The warranty provided in this provision shall be in addition to any other rights or remedies provided elsewhere in the Contract or by applicable law.

## **7.10 PRIOR OCCUPATION**

City shall have the right to occupy such part or parts of the Project in or upon which the Work is being done, as it may see fit, and such occupation shall not be construed as acceptance by City of the Work or constitute Substantial Completion of the Work.

## **ARTICLE 8: TERMINATION**

### **8.1 CITY'S RIGHT TO TERMINATE CONTRACT**

#### **A. Termination for Default**

1. City may terminate, without prejudice to any right or remedy of City the Work, or any part of it, for cause upon the occurrence of any one or more of the following events:
  - a. Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Substantial Completion of the Work within the Contract Time;
  - b. Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Final Acceptance of the Work in a timely manner;
  - c. Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or a receiver is appointed on account of its insolvency;
  - d. Contractor fails in a material way to repair, replace or correct Work not in conformance with the Contract;
  - e. Contractor repeatedly fails to supply skilled workers or proper materials or equipment;
  - f. Contractor repeatedly fails to make prompt payment to its employees or Subcontractors;
  - g. Contractor materially disregards or fails to comply with laws, ordinances, rules, regulations, permits, easements or orders of any public authority having jurisdiction;
  - h. Contractor fails to comply with all Contract safety requirements; or
  - i. Contractor is otherwise in material breach of any provision of the Contract, including but not limited to quality control, environmental requirements, administrative requirements, coordination and supervision.
2. If City reasonably believes that one of the aforementioned events has occurred, City will provide the Contractor with written Notice of its intent to terminate the Contractor for default, specifying within such notice the ground(s) for such termination. City, at its option, shall require the Contractor to either promptly correct the deficiencies noted in City's intent to terminate or provide City with a corrective action plan as to how such deficiencies will be remedied or cured in a timely fashion. However, if after receipt of the proposed remedy, City has a reasonable basis for concluding that the Contractor has (a) failed or is unwilling to repair, replace or correct the deficiencies, or (b) failed or is unwilling to provide a reasonable and satisfactory corrective action plan, City shall thereafter have the right to terminate this Contract for default.
3. Upon termination, City may at its option:
  - a. Take possession of the Site and possession of or use of all materials, equipment, tools, and construction equipment and machinery thereon owned by Contractor; and/or

- b. Finish the Work by whatever other reasonable method it deems expedient; or
  - c. Call upon the surety to perform its obligations under the performance and payment bonds, if applicable.
4. The Contractor and its sureties shall be liable for all damages and costs, including but not limited to: (1) compensation for architect and engineering services and expenses made necessary thereby; (2) any other costs or damages incurred by City in completing and/or correcting the Work; and (3) any other special, incidental or consequential damages incurred by City which results or arises from the breach or termination for default.
  5. In the event of termination for default City shall only pay the Contractor for Work successfully completed and accepted by City prior to the date of termination. City shall not be responsible for any other Contractor costs, expenses, or damages including any consequential, special, or incidental damages or lost profits associated with this Contract. In no event shall City reimburse the Contractor for any costs directly or indirectly related to the cause of this termination for default.
  6. If, after termination for default, it is determined that the Contractor was not in default, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of City.
  7. The rights and remedies of City in this provision are in addition to any other rights and remedies provided by law or under this contract.

**B. Termination for Convenience**

1. Upon written Notice City may terminate the Work, or any part of it, without prejudice to any right or remedy of City, for the convenience of City.
2. If City terminates the Work or any portion thereof for convenience, Contractor shall recover as its sole remedy:
  - a. Reasonable costs for all Work completed prior to the effective date of the termination and not previously paid for by City; and
  - b. A reasonable allowance for Overhead and profit for Work actually performed prior to the date of termination and accepted by City, at a rate not to exceed the percentage amount set forth in the Contract and in paragraph 6.3, *Allowable Costs*, subparagraph A.5, *Overhead and Profit*. The Contractor waives all other claims for payment and damages including without limitation, anticipated profit and overhead on work not performed and accepted by City.
3. The Contractor shall not be entitled to any other costs or damages, whatsoever. The total sum payable upon termination shall not exceed the Contract Price reduced by prior payments. Contractor shall be required to make its request for adjustment in accordance with Article 5, *Changes to the Contract*, and Article 6, *Time and Price Adjustments*.
4. If it appears that the Contractor would have sustained a loss on the entire Contract had it been completed, City shall not reimburse Contractor any profit for the Work completed and shall reduce the settlement to reflect the indicated rate of loss.

### **C. Contractor's Obligations During Termination**

Unless City directs otherwise, after receipt of a written Notice of termination for default or termination for convenience, Contractor shall promptly:

1. Stop performing Work on the date and as specified in the Notice of termination;
2. Place no further orders or subcontracts for materials, equipment, services or facilities, except as may be necessary for completion of such portion of the Work not terminated;
3. Cancel all orders and subcontracts, upon terms acceptable to City, to the extent that they relate to the performance of Work terminated;
4. Assign as specifically requested by City all of the rights, title, and interest of Contractor in all orders and subcontracts;
5. Take such action as may be necessary or as directed by City to preserve and protect the Work, Site, and any other property related to this Project in the possession of Contractor in which City has an interest;
6. Continue performance of Work only to the extent not terminated; and
7. Take any other steps required by City with respect to this Project.

### **8.2 CITY'S RIGHT TO STOP THE WORK FOR CAUSE**

- A. If Contractor fails or refuses to perform its obligations in accordance with the Contract, City may order Contractor, in writing, to stop the Work, or any portion thereof, until satisfactory corrective action has been taken.
- B. Contractor shall not be entitled to any adjustment in the Contract Time and/or Contract Price for any increased cost or time of performance attributable to Contractor's failure or refusal to perform its obligations under the Contract.

## **ARTICLE 9: CLAIMS AND LITIGATION**

### **9.1 CONTRACTOR CLAIMS**

#### **A. Condition Precedent to Filing a Claim.**

1. The following actions are a condition precedent to filing a Claim:
  - a. The Contractor submitted a timely Notice of Protest, Supplemental Information and Request for Change Order as required by paragraph 5.1;
  - b. The Request for Change Order has been denied or deemed denied by City;  
or
  - c. A Unilateral Change Order is issued by City.

#### **B. Failure to file a Timely Claim.**

1. At least seven (7) days prior to appropriate time to file a Claim, the Contractor may request an extension of time for filing its Claim. The Contractor shall state the reasons for the request and identify a date certain when the Contractor shall provide a fully documented Claim. Unless otherwise agreed to in writing by the Engineer, a fully documented Claim shall be received by the City within thirty (30) days after:
  - a. Denial or deemed denial of a Request for Change Order; or



- b. Contractor's receipt of an Executed Unilateral Change Order.
- 2. Failure to comply with the time requirements set for filing a Claim shall constitute acceptance by the Contractor, on behalf of itself and its Subcontractors and Suppliers, of the Unilateral Change Order and/or City's denial or deemed denial of a Request for Change Order. Such acceptance shall be considered complete, full, and final settlement of all costs, damages, and Claims related to or arising from the Request for Change Order and/or Unilateral Change Order.
- C. Contractor's Obligation to Continue to Work. Pending final decision of a Claim hereunder, the Contractor shall proceed diligently with the performance of the Contract Work, including that work associated with the Claim, and maintain its progress with the Work.
- D. Information required in a Fully Documented Claim. Every Claim must be submitted by the Contractor, in writing and clearly designated by the Contractor as a fully documented Claim. At a minimum, a fully documented Claim must contain the following information:
  - 1. A detailed factual statement of the Claim providing all necessary details, locations, and items of Contract Work affected;
  - 2. The date on which facts arose that gave rise to the Claim;
  - 3. The name of each person employed or associated with the Contractor, Subcontractor, Supplier, and/or City with knowledge about the event or condition which gave rise to the Claim;
  - 4. Copies of documents and a written description of the substance of any oral communications that concern or relate to the Claim;
  - 5. The specific provisions of the Contract Documents on which the Claim is based;
  - 6. If an adjustment in the Contract Price is sought, the exact amount sought, calculated in accordance with the Contract including paragraph 6.3, *Allowable Cost* and accompanied by (a) all records supporting the Claim and (b) all records meeting the requirements of paragraph 3.10, *Cost Records*;
  - 7. If an adjustment in the Contract Time is sought, the specific days and dates for which it is sought; the specific reason the Contractor believes an adjustment in the Contract Time should be granted; and the Contractor's analyses of its Progress Schedule, any specific Schedule analysis as required by the Contract Documents, and all updates to demonstrate the reason for the adjustment in Contract Time; and
  - 8. A statement certifying, under penalty of perjury, that after the exercise or reasonable diligence and investigation the Claim is made in good faith, that the supporting cost and pricing data are true and accurate to the best of the Contractor's knowledge and belief, that the Claim is fully supported by the accompanying data, and that the amount requested accurately reflects the adjustment in the Contract Price or Contract Time for which the Contractor believes City is liable.
- E. Contractor's Duty to Cooperate. The Contractor shall cooperate with City or its designee in the evaluation of its Claim and provide all information and documentation requested by City, its auditors or its designee.

F. City's Evaluation of the Claim.

1. To assist City in the review of the Contractor's Claim, City or its designee may visit the Site, request additional information and/or documentation in order to fully evaluate the issues raised in the Claim and/or audit the Claim.
2. After the Contractor has submitted a fully documented Claim that complies with this provision, City shall respond, in writing, to the Contractor within sixty (60) days from the date the fully documented Claim is received with either:
  - a. A decision regarding the Claim; or
  - b. Written Notice extending for another thirty (30) days City's time to respond to the Claim.
3. Absent a thirty (30) day extension, the Claim shall be deemed denied upon the sixty-first (61st) day following receipt of the Claim by City. If City had a thirty (30) day extension, the Claim shall be deemed denied upon the ninety-first (91st) day following receipt of the Claim by City.

**9.2 CONTRACTOR'S BURDEN OF PROOF ON CLAIM**

- A. The Contractor shall have the burden of proof to demonstrate entitlement and damages.
- B. If the Contractor, on behalf of itself or its Subcontractors and Suppliers seeks an adjustment in the Contract Price or Contract Time not supported by Project cost records meeting the requirements of ¶3.10, *Cost Records*, the Claim is waived.
- C. Compliance with the record keeping requirements set forth in this Contract is a condition precedent to recovery of any costs or damages related to or arising from performance of the Contract Work. If City establishes non-compliance of the record-keeping requirement set forth in ¶ 3.10, *Cost Records*, no adjustment shall be made to the Contract Price and/or Contract Time with respect to that Claim.

**9.3 LITIGATION**

- A. As a mandatory condition precedent to the initiation of litigation by the Contractor against City, Contractor shall comply with all provisions set forth in this Contract including those stated in Article 5 and Article 9.
- B. Any litigation brought against City shall be filed and served on City within 365 days from either the issuance of the Certificate of Substantial Completion for the entire Contract or Final Acceptance if no Certificate of Substantial Completion of the entire Contract is issued.
- C. Venue and jurisdiction shall vest solely in the King County Superior Court.
- D. Failure to comply with these mandatory condition time requirements shall constitute a waiver of the Contractor's right to pursue judicial relief from or against the City.

**ARTICLE 10: MISCELLANEOUS**

**10.1 COMPENSATION, WAGES, BENEFITS AND TAXES**

City assumes no responsibility for the payment of any compensation, wages, benefits, or taxes owed by the Contractor by reason of this Contract. The Contractor shall indemnify and hold City, its elected officials, officers, agents and employees, harmless

against all liability and costs resulting from the Contractor's failure to pay any compensation, wages, benefits or taxes.

## **10.2 PREVAILING WAGES**

The Contractor shall comply with the minimum wage requirements of RCW 39.12, as amended, including the obligation to pay at least the hourly minimum wage and fringe benefits to workers as required by RCW 39.12. The Contractor shall also post all notices required by the Washington Department of Labor & Industries on forms provided by the Department of Labor & Industries. The Contractor shall timely provide a "Statement of Intent to Pay Prevailing Wages" and timely provide an "Affidavit of Prevailing Wages Paid."

## **10.3 SUCCESSORS AND ASSIGNS**

City and the Contractor each binds itself, its partners, successors, assigns and legal representatives to the other with respect to all covenants, agreements and obligations contained in the Contract. Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to it hereunder, without the previous written consent of City.

## **10.4 THIRD PARTY AGREEMENTS**

Except as otherwise may be provided, the Contract shall not be construed to create a contractual relationship of any kind between: any architect, engineer, construction manager, Subcontractor, Supplier, or any persons other than City and Contractor.

## **10.5 NONWAIVER OF BREACH**

No action or failure to act by City shall constitute a waiver of any right or duty afforded to City under the Contract; nor shall any such action or failure to act by City constitute an approval of or acquiescence in any breach hereunder, except as may be specifically stated by City in writing.

## **10.6 NOTICE TO CITY OF LABOR DISPUTES**

- A. If Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay timely performance in accordance with the Contract, Contractor shall immediately give Notice, including all relevant information, to City.
- B. Contractor agrees to insert a provision in its Subcontracts and to require insertion in all sub-subcontracts, that in the event timely performance of any such contract is delayed or threatened by any actual or potential labor dispute, all Subcontractor or lower-tiered Subcontractor shall immediately notify the next higher tier Subcontractor. Subcontractor or Contractor, as the case may be, of all relevant information concerning the dispute.

## **10.7 HEADINGS**

The headings used in the Contract are for convenience only and shall not be considered a part of or affect the construction or interpretation of any contractual provision therein.

## **10.8 CHOICE OF LAW**

In the event that either party shall bring a lawsuit or action related to or arising out of this Contract, such lawsuit or action shall be brought in the Superior Court, King County,

Washington. This Contract shall be governed by, and construed and enforced in accordance with the laws of the State of Washington.

**10.9 SEVERABILITY**

The provisions of this Contract shall be effective in all cases unless otherwise prohibited by Washington State Law or applicable Federal Law. The provisions of this Contract are separate and severable. The invalidity of any sentence, paragraph, provision, section, Article, or portion of this Contract shall not affect the validity of the remainder of this Contract.

SECTION 01 11 00  
SUMMARY OF WORK

**PART 1 GENERAL**

**1.01 SUMMARY**

A. Project Location:

1. The Work is located in the City of Mercer Island, Washington at the following locations as identified on the Contract drawings:
  - a. First Hill Pump Station
  - b. SPU Station 171
  - c. South Fire Station
  - d. North Fire Station
  - e. Reservoir Pump Station

B. Project Overview:

1. The project consists of providing a control system upgrade at the City's water distribution facility sites identified above. The Work comprises replacement of the programmable logic controllers (PLC) panels at the five (5) sites.

C. Work Summary:

1. Panel Work

- a. Replace PLC back panels at two (2) water distribution sites (First Hill Pump Station and SPU Station 171) with new programmable logic controllers (PLCs) custom fabricated as new back panels for efficient cutover between the existing PLC to the new PLC. Replace operator interface terminal (OIT) at each site. Field verify and document the input/output (I/O) connections to the existing PLC panels, disconnect, and re-terminate power, I/O, and cellular communications to the new PLC back panel.
- b. Provide new PLC panels (custom fabricated back panel and enclosure) at two (2) water distribution sites (North Fire Station and Reservoir Pump Station), where the existing PLC panel size is insufficient for the new control system equipment. Field verify and document the input/output (I/O) connections to the existing PLC panels, disconnect, and re-terminate power and I/O at the existing panel to serve as a terminal junction box. New wiring from existing PLC panel to new PLC panel location. New data cabling from PLC panel location to City IT cabinet for tie-in to existing City fiber network. Installation of panel PC display on the new panel enclosure at one of the sites (Reservoir Pump Station).
- c. Provide new PLC panel (custom fabricated back panel and enclosure) at one (1) water distribution site (South Fire Station), where the existing PLC panel size is insufficient for the new control system equipment. Install new PLC panel in the existing PLC panel's location. Field verify and document the input/output (I/O) connections to the existing PLC panel, disconnect, and re-terminate power, and I/O at the new PLC panel. New data cabling from PLC panel location to City IT cabinet for tie-in to existing City fiber network.
- d. Provide specified PLC/OIT/Panel PC hardware based on the manufacturer/platform(s) the Owner has standardized on.

2. Temporary Power
    - a. As part of cutover activities, provision of temporary (between a few minutes to 48 hours) control power feed during transition of I/O from existing system to the new system.
  3. Demolition
    - a. Demolition of existing control system equipment to be replaced and demolition of obsolete equipment/wiring.
    - b. Demolition/modification to existing local control station wiring in metering vault at SPU Station 171.
  4. Testing
    - a. Provide a process control system integrated factory acceptance test for the custom PLC panels, including testing of the PLC, OIT, and SCADA application programming in coordination with the Project Programmer.
    - b. Field testing and commissioning in accordance with Sections 01 75 00 and 40 61 21.
  5. Training
    - a. Provide a comprehensive training program for City staff on the design, operation, configuration, and maintenance of the PLC/OIT hardware.
  6. Other Electrical Upgrades
    - a. Trace existing electrical circuits interconnected to the existing PLC panels to document to/from locations.
    - b. Install a new power panel board at one of the PLC panel locations (SPU Station 171).
    - c. Install and route conduit at select PLC panel locations.
    - d. Pull and terminate power, control, signal, and data cable at select PLC locations.
- D. Background:
1. The City of Mercer Island (City) water distribution system comprises two storage reservoirs, two booster pump stations, and pressure-reducing valves (PRVs) throughout the distribution system. The City receives its potable water supply from Seattle Public Utilities (SPU) through three separate metered connections. Five of the City's water distribution sites have existing PLCs for local control/monitoring and communicate remotely to a centralized SCADA/human machine interface (HMI) system. The City is replacing the existing SCADA/HMI system under a separate contract as part of the overall upgrade. PLC, OIT, and SCADA/HMI application programming is being performed under a separate contract.
  2. The City has recently upgraded the remote communications system to cellular communications as part of the overall system upgrade. The Reservoir Pump Station communicates over an existing fiber link to the centralized SCADA system location. The North Fire Station and South Fire Station will tie-in to an existing fiber link for communication to the centralized SCADA system location.

## **1.02 PERMITS AND LICENSES**

- A. Contractor shall obtain, at Contractor's expense, all permits and licenses necessary for the construction of the Work in accordance with the General Terms and Conditions Section 3.12.

- B. Permits to be obtained by the Contractor include, but are not limited to, the following:
  - 1. City of Mercer Island electrical permits.

### **1.03 AMBIENT CONDITIONS**

- A. Site elevation: 338 feet (peak)
- B. Outside temperature: 5 deg F to 100 deg F.
- C. Inside temperature: 45 deg F to 90 deg F.

### **PART 2 NOT USED**

### **PART 3 EXECUTION**

#### **3.01 ATTACHMENTS**

- A. 01 11 00 Attachment A: Reference Materials
  - 1. The following documents from previous construction contracts were used as reference material in the design of work included in this contract. These documents from previous construction contracts are provided in Attachment A of this Section for the convenience of bidders and the Contractor. Because these documents do not necessarily reflect changes made during or after construction, they may not indicate existing conditions accurately. The information contained in these documents, therefore, cannot be guaranteed as to accuracy or completeness, and bidders and the Contractor are solely responsible for verifying any information shown on these documents.
    - a. Schematic First Hill Pump Station, Job No. 12683 – S&B System Specialists, 2011.
    - b. Schematic Seattle Inlet #2 (SPU Station 171), Job No. 12683 - S&B System Specialists, 2017.
    - c. Seattle Inlet #2 (Boat Ramp) Water Quality Additions, Job No. 12683 - S&B System Specialists, 2016.
    - d. Schematic South End Pressure Station (South Fire Station), Job No. 12683 – S&B System Specialists, 2016.
    - e. Schematic Main Reservoir Pump Station Control Panel, Job No. 12683 – S&B System Specialists, 2015.

**END OF SECTION**

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**SECTION 01 11 00\_SUMMARY OF WORK**

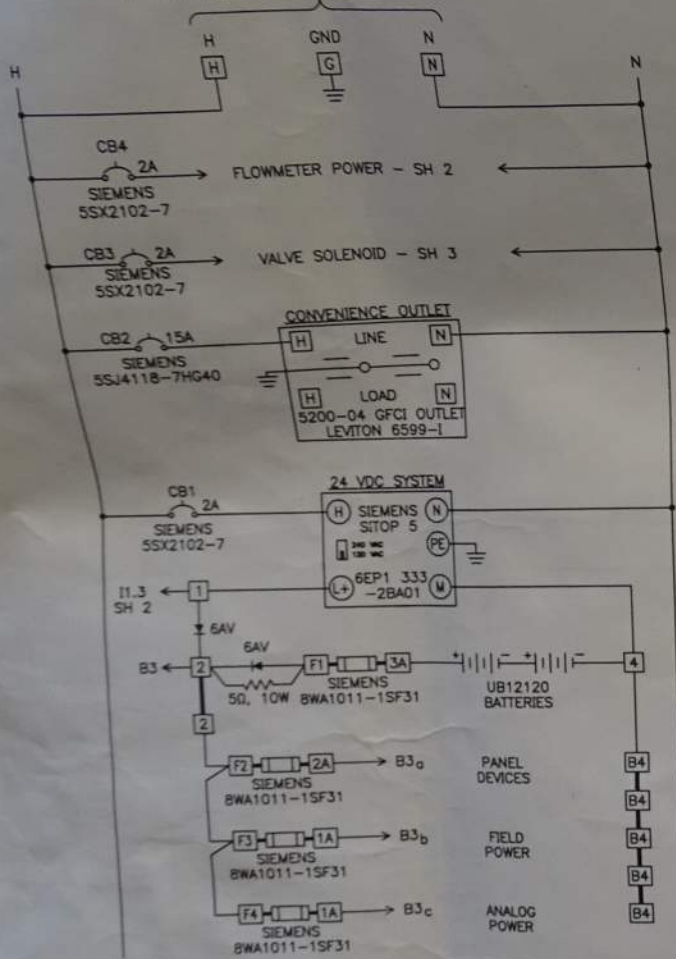
**ATTACHMENT A**

**REFERENCE MATERIALS**

- a. Schematic First Hill Pump Station, Job No. 12683 – S&B System Specialists, 2011.
- b. Schematic Seattle Inlet #2 (SPU Station 171), Job No. 12683 - S&B System Specialists, 2017.
- c. Seattle Inlet #2 (Boat Ramp) Water Quality Additions, Job No. 12683 - S&B System Specialists, 2016.
- d. Schematic South End Pressure Station (South Fire Station), Job No. 12683 – S&B System Specialists, 2016.
- e. Schematic Main Reservoir Pump Station Control Panel, Job No. 12683 – S&B System Specialists, 2015

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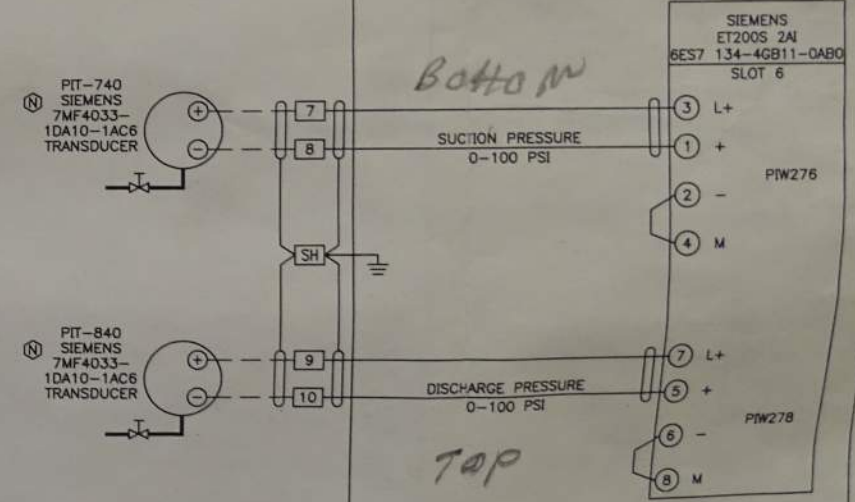
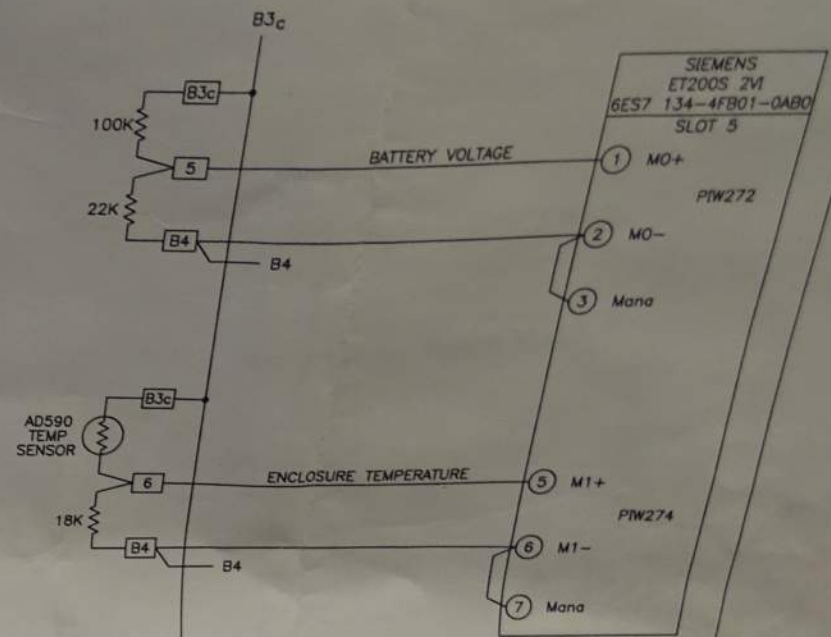
120 VAC 60 HZ 20A MAX  
BRANCH CIRCUIT PROTECTION BY PNL LP CKT B



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AC POWER WIRES	12 GAUGE
DC POWER WIRES	18 GAUGE
CONTROL WIRING	18 GAUGE
WIRE INSULATION	600 VOLTS
TERMINAL SCREW TORQUE	7 IN-LB
MAX VOLTAGE	120V 1ø 60 HZ
FULL LOAD AMPS	2
UL 508A LABEL # BY-BOB485	

SAGINAW SCE-60EL2412LP TYPE 12 ENCLOSURE  
SAGINAW SCE-60P24 BACK PANEL

Ⓧ EXISTING  
Ⓝ NEW



REVISION DESCRIPTION		DGT	DATE
B	REPLACED PER S.O. 22587	DGT	4/11

REV.	DRWN.	ENGR.	DGT	DATE	SCALE
JRB	4-4-11	ASMB	DGT	4/11	NONE

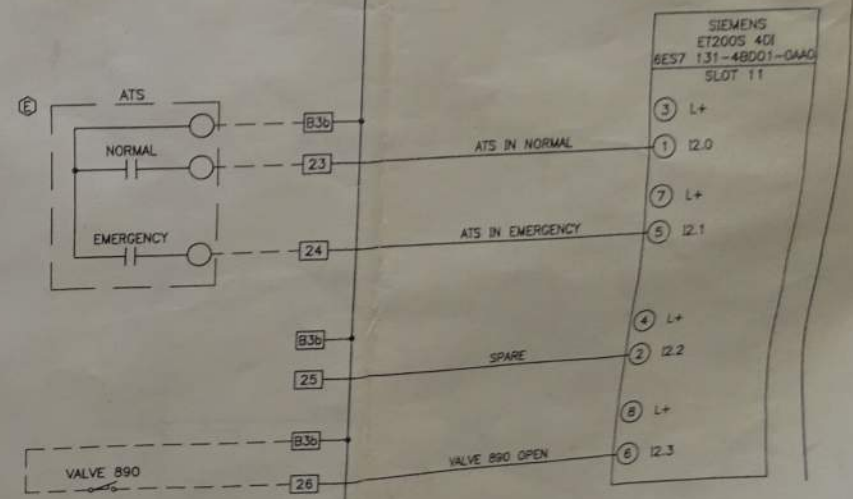
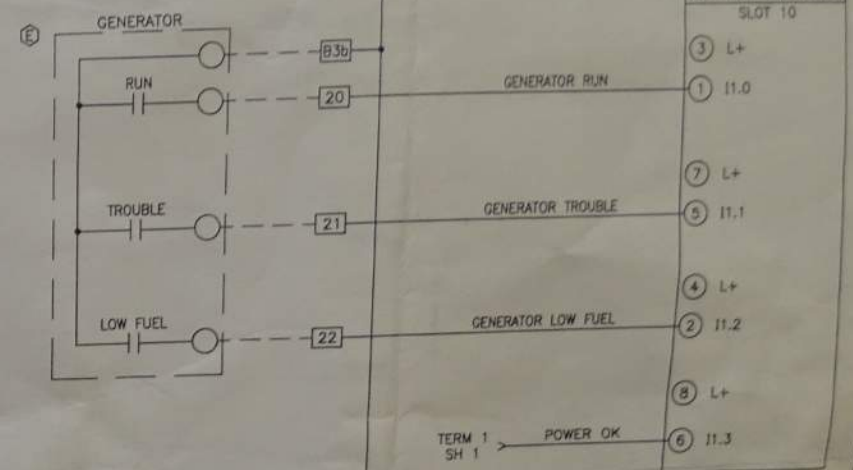
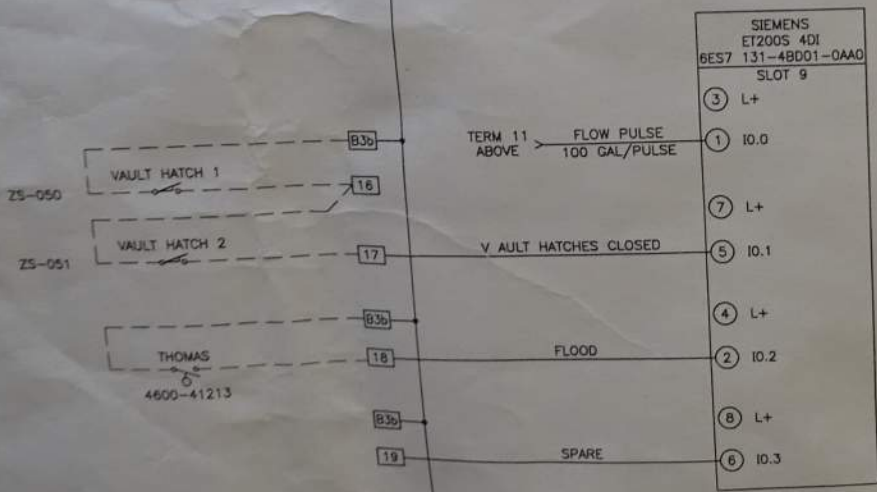
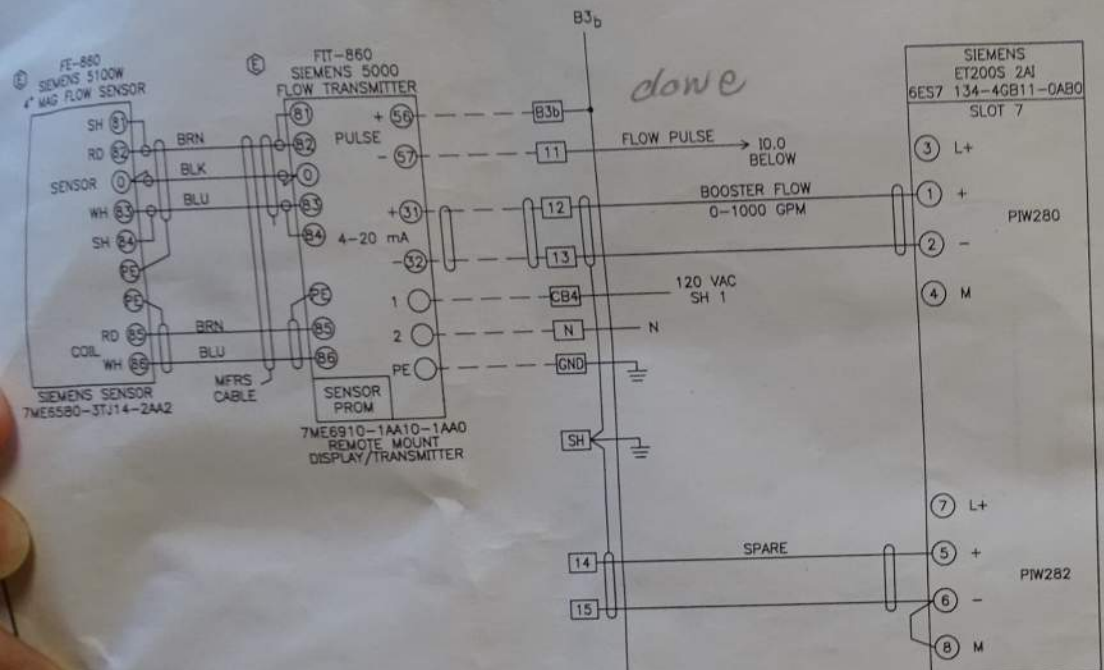
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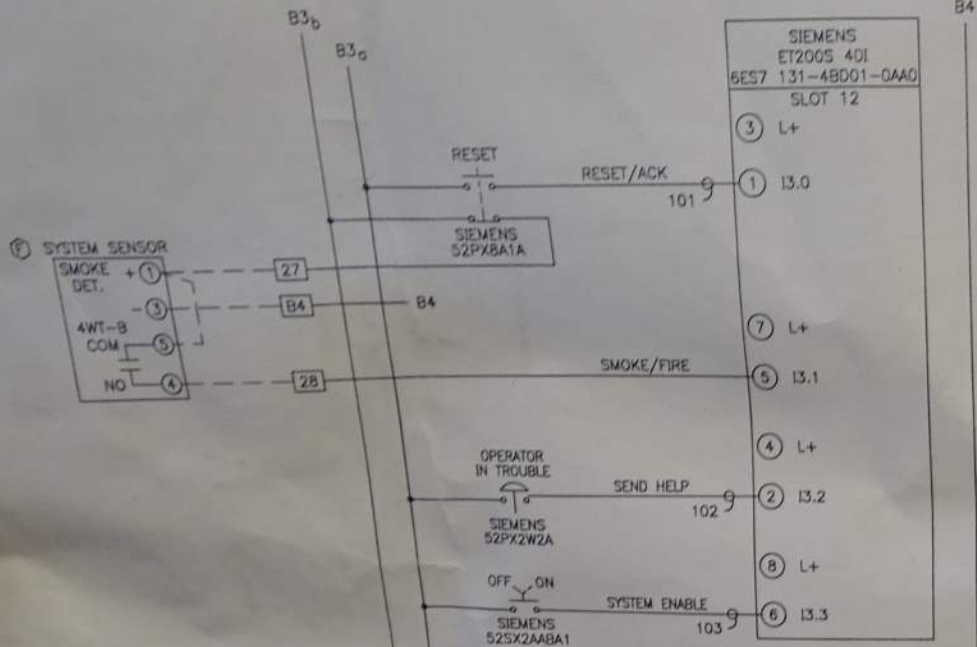
  

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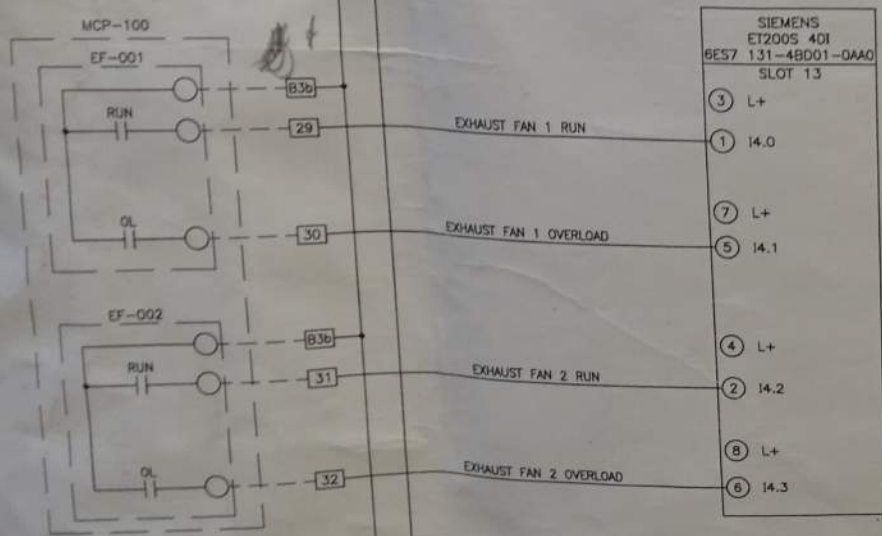


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SAB System Specialists 1220 S.E. 30th St. Miami, Fla. 33133 SAB Inc. (305) 844-1700 Fax (305) 748-8212		PROJECT		CITY OF MERCER ISLAND, WA	
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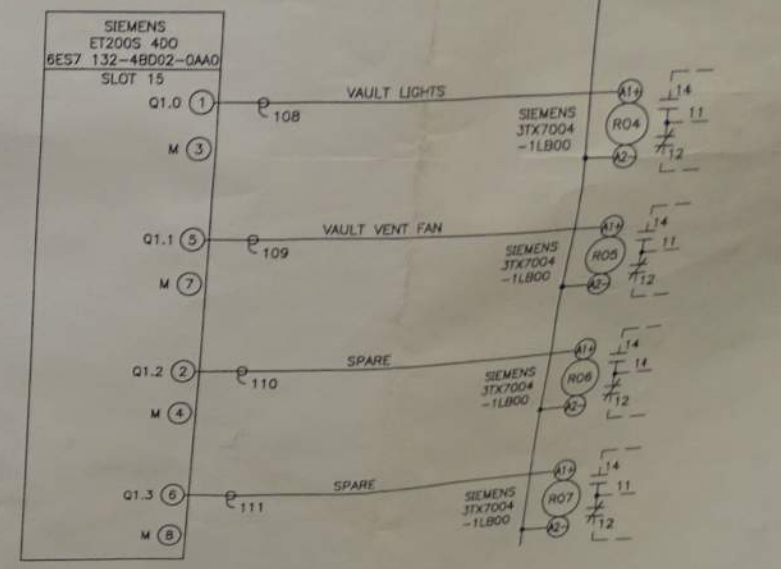
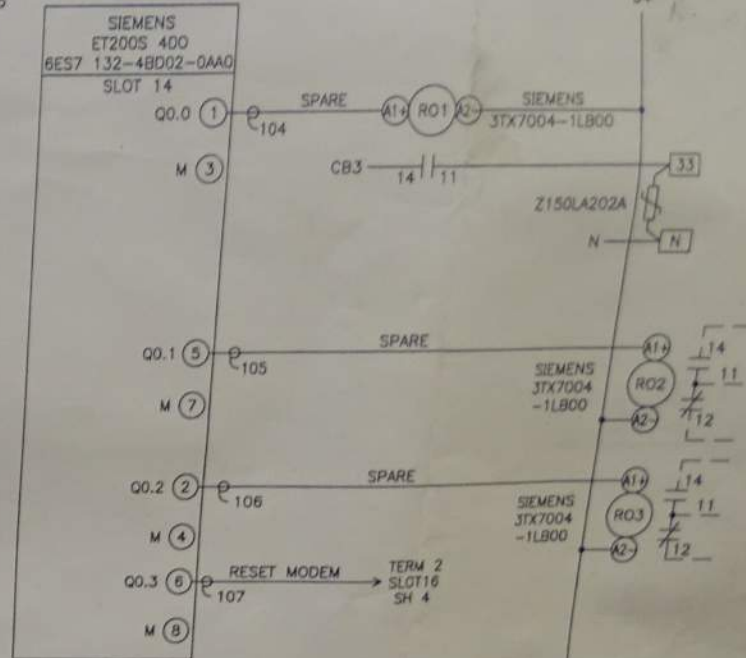




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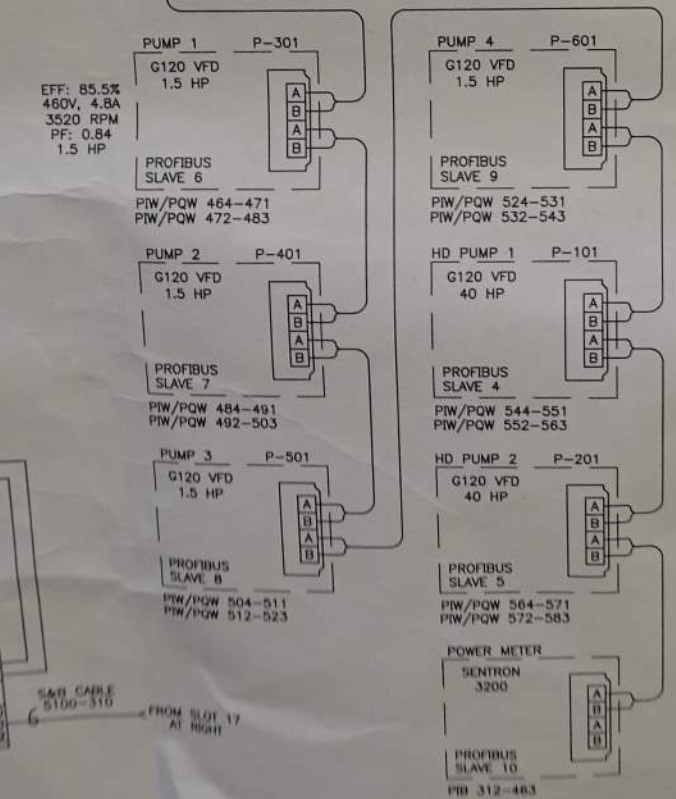
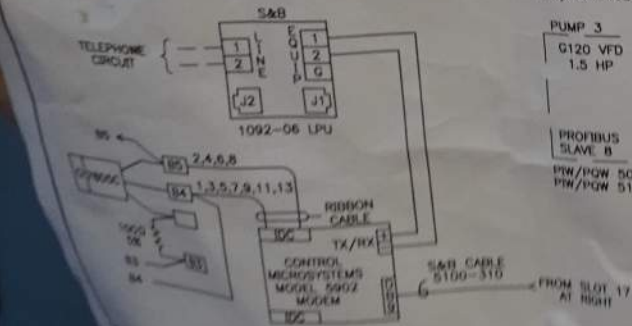
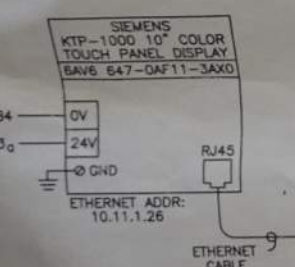
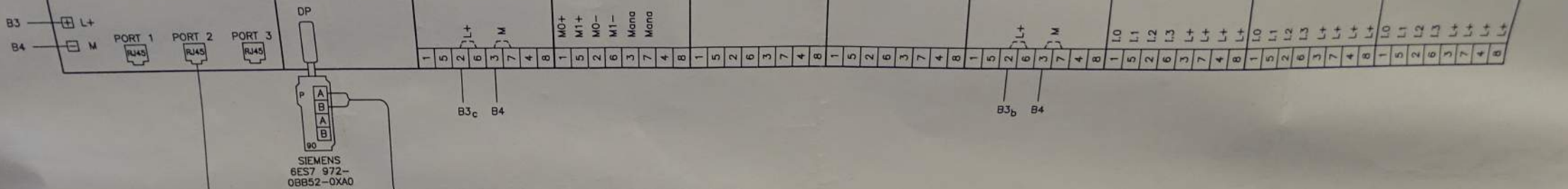
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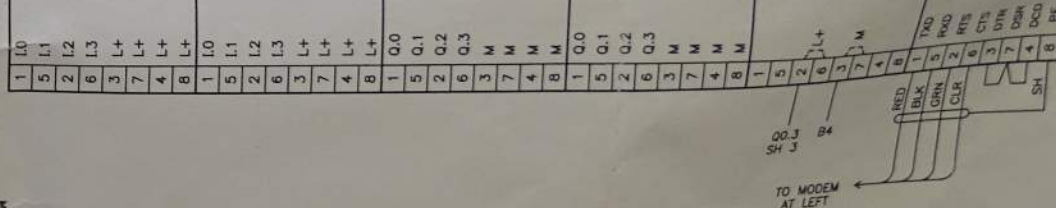
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STANDARD DIN MOUNTING RAIL

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IP ADDR: 10.11.1.25	SLOT 2	SLOT 4	SLOT 5 ADDR: 272	SLOT 6 ADDR: 276	SLOT 7 ADDR: 280	SLOT: 8	SLOT 9 ADDR: 0	SLOT: 10 ADDR: 1	SLOT: 11 ADDR: 2



SIEMENS 4 DIG INPUT	SIEMENS 4 DIG INPUT	SIEMENS 4 DIG OUTPUT	SIEMENS 4 DIG OUTPUT	SIEMENS TM-PM-E24VDC	SIEMENS TM-E MODBUS
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DETAIL  
MODULE TERMINAL  
LAYOUT

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S&B System Specialists  
1200 S. 100th St.  
Delton, Michigan 49620  
S&B Inc. (248) 422-1700 Fax (248) 422-4212

TITLE: SCHEMATIC  
FIRST HILL PUMP STATION

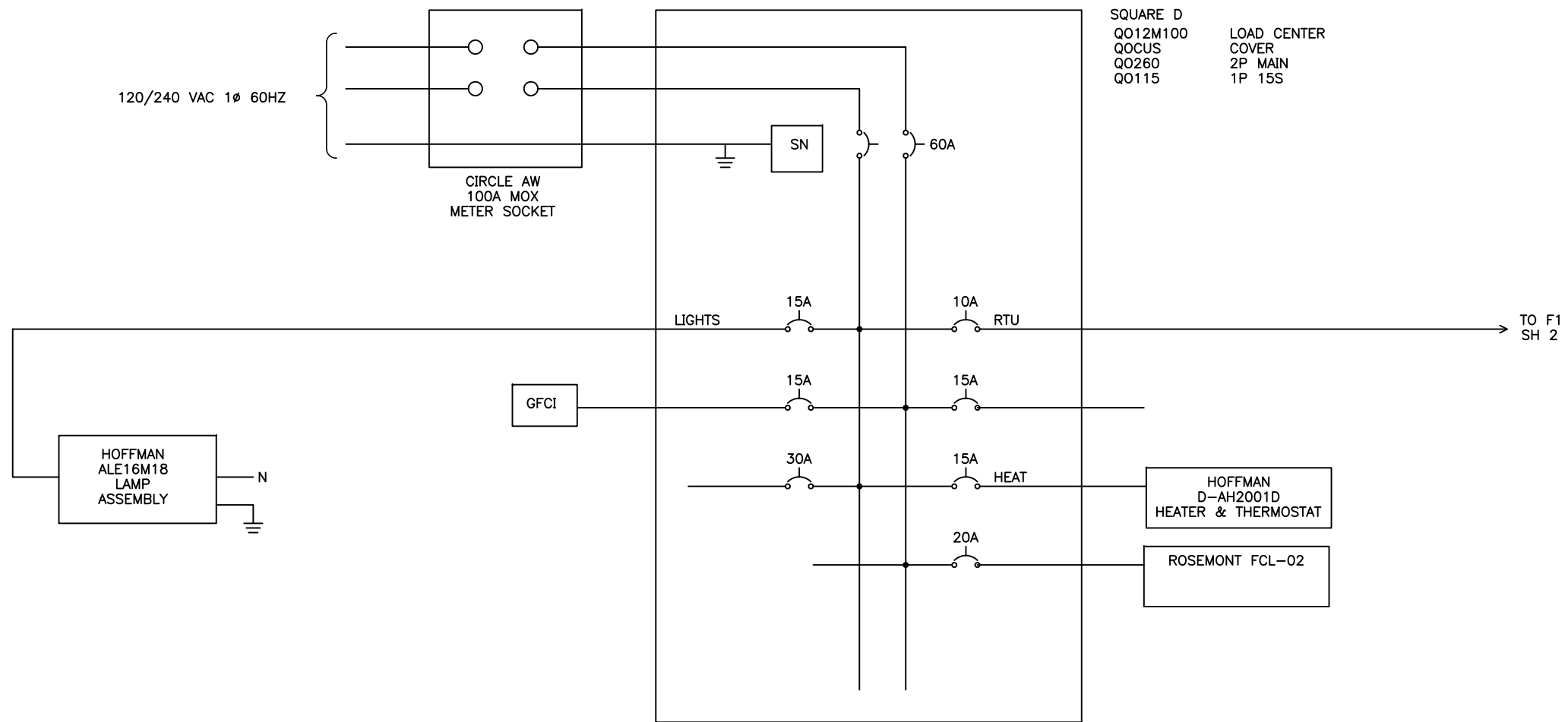
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REVISION DESCRIPTION

DATE

BY

CITY OF MERRIMACK, NH



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DC POWER WIRES	16 GAUGE
CONTROL WIRING	18 GAUGE
WIRE INSULATION	600 VOLTS
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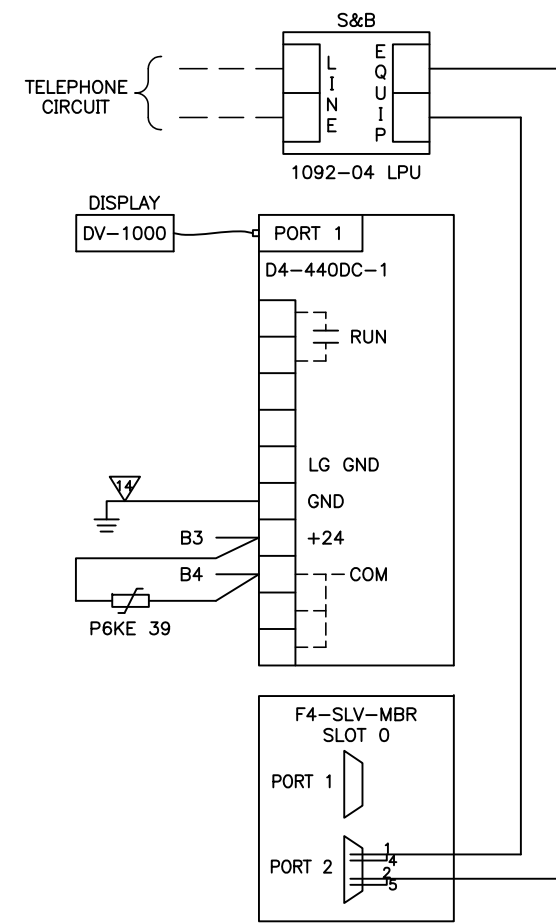
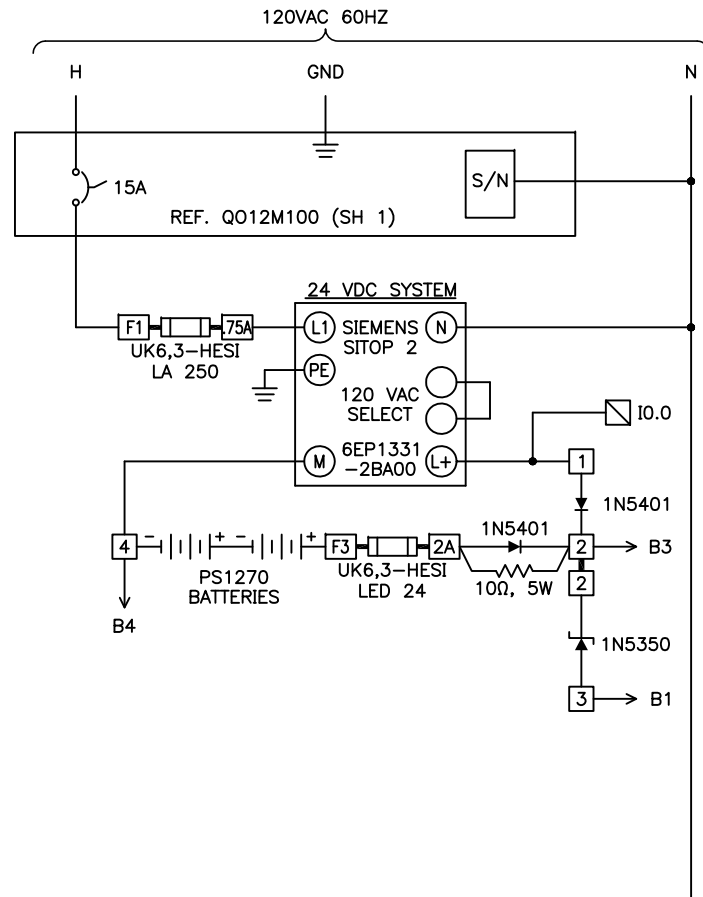
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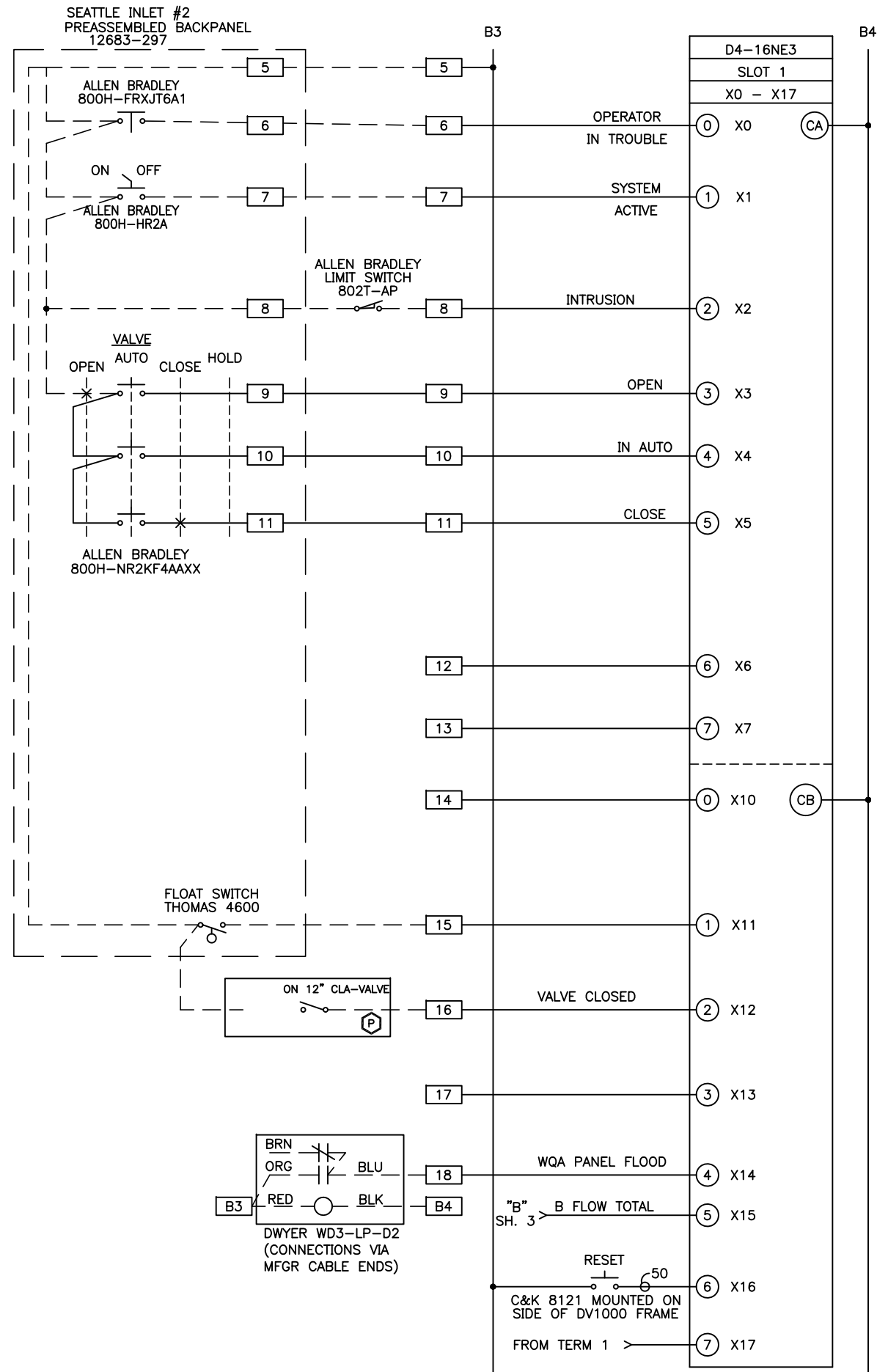
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72x24x18 NEMA 4X STAINLESS STEEL



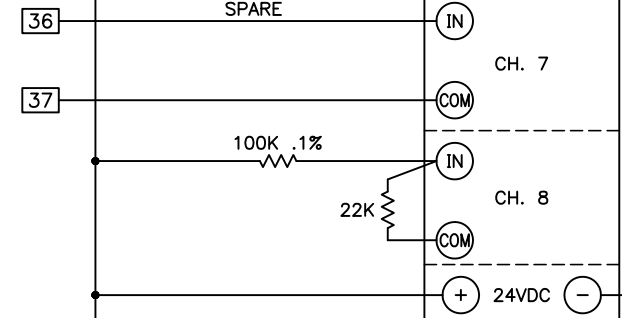
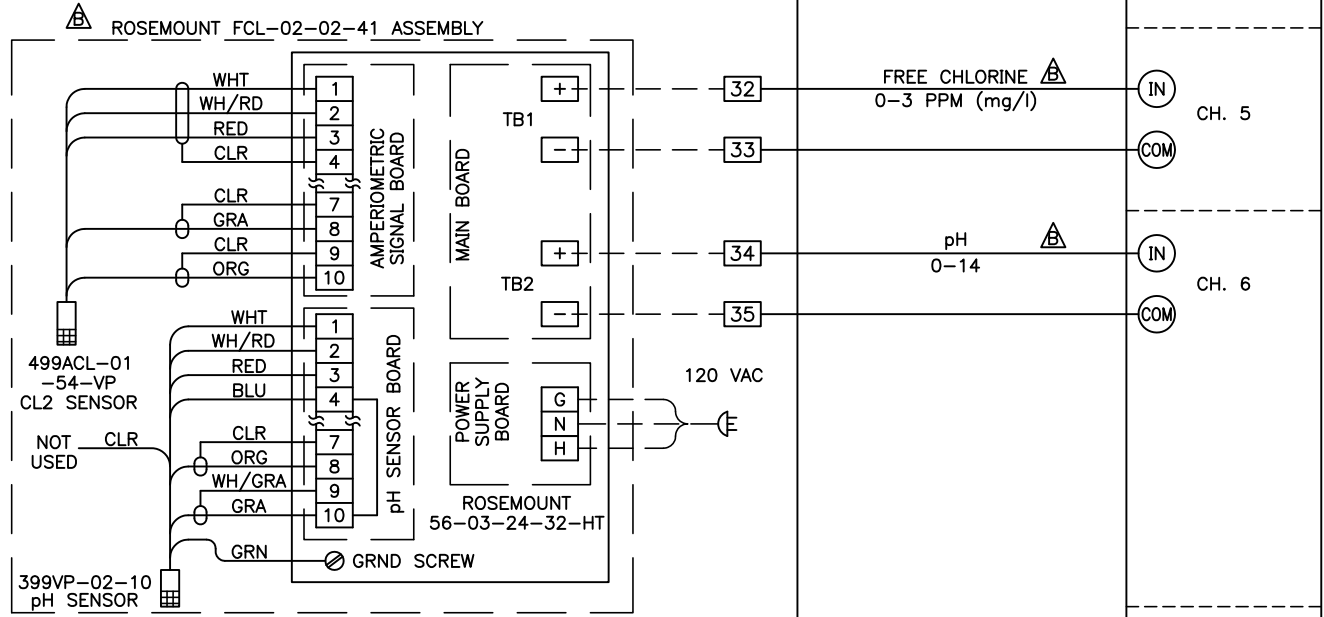
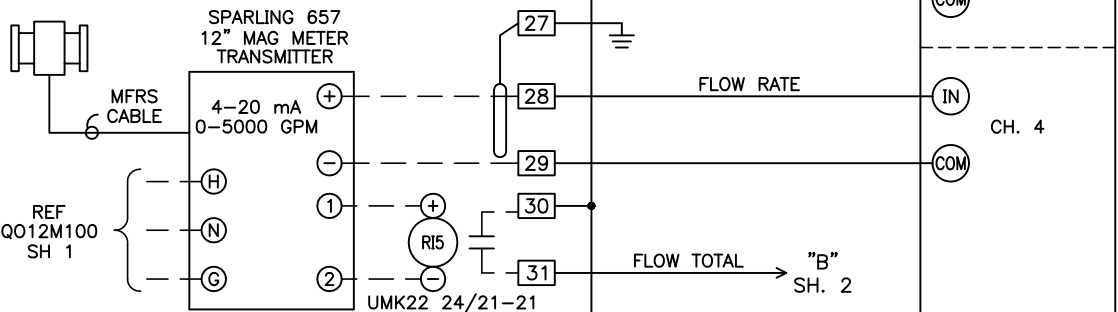
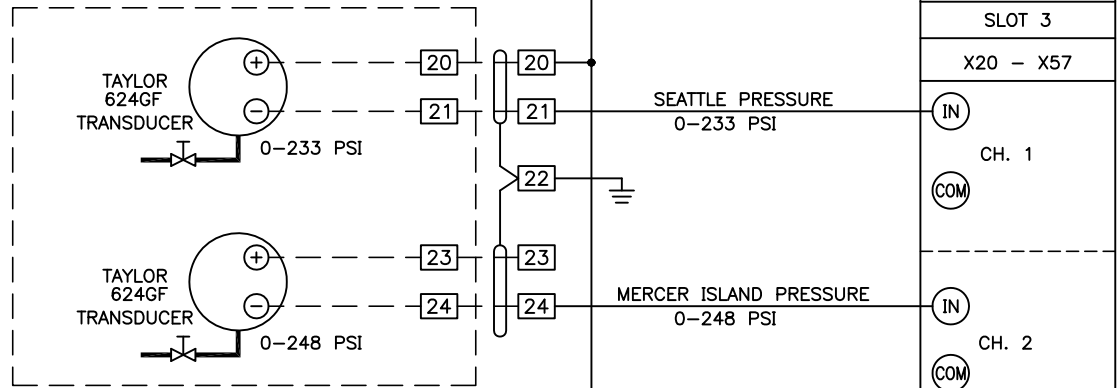
NOTES: ALL FIELD WIRING ROUTES THROUGH J-BOX IN PRV VAULT

PROVIDED BY OTHERS

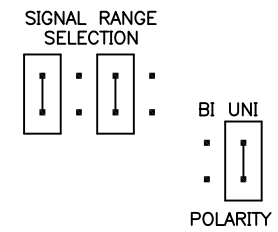
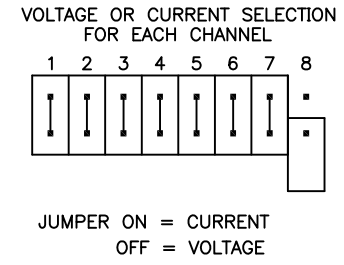
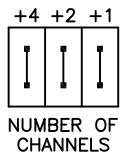
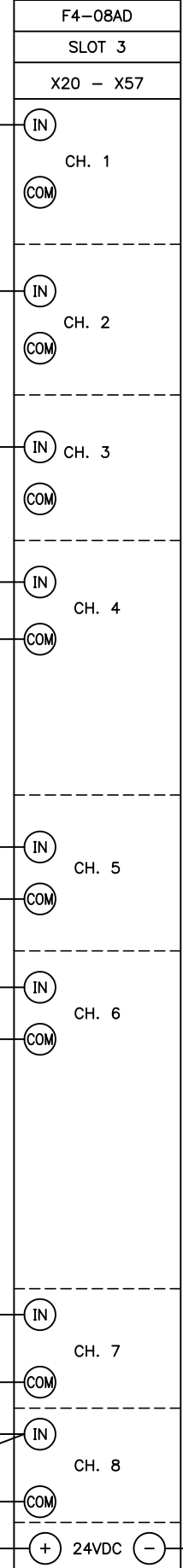
REUSE OF DOCUMENT This document contains information, ideas and designs proprietary to S&B inc. This may not be reproduced in any form without written consent of S&B inc. Copyright 2017 S&B inc.	REV. A	ADDED PER S.O. 24559	RTS	6/17
		ADDED PER S.O. 17425		7/99
DRWN JRB	7-1-99	ASMB	ENGR RTS	6-19-17
S&B System Specialists 13200 S.E. 30th St. Bellevue, Washington 98005 (425)644-1700 Fax: (425)746-9312		PROJECT CITY OF MERCER ISLAND, WA		
FILE: 12683-228-02 LAST 06/19/17 MODIFIED: 1:39 PM		DRAWING NUMBER D 12683 228 2 OF 3 B		
TITLE SCHEMATIC SEATTLE INLET#2		SIZE JOB NUMBER KEY SHEET REV		



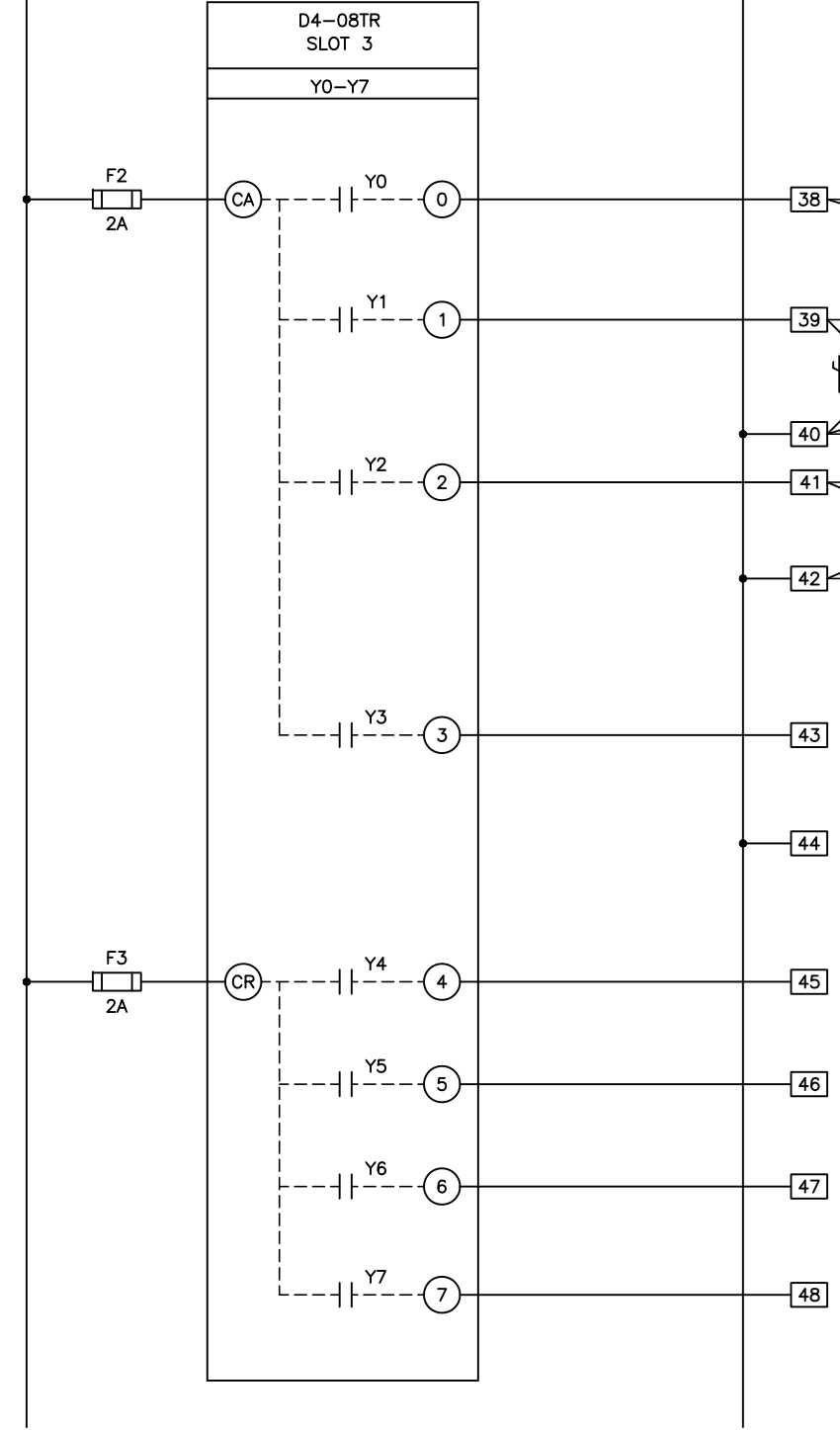
SEATTLE INLET #2  
PREASSEMBLED PANEL 12683-297



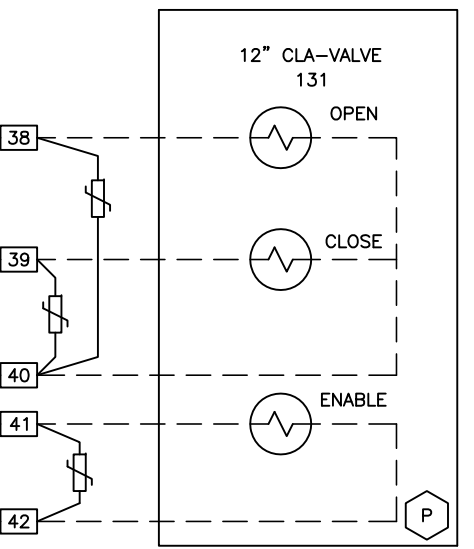
B4



LIF



L2



SPARE  
120 VAC  
OUTPUTS

ALL FIELD WIRING ROUTES NOT THROUGH J-BOX IN PRV VAULT

REV.	ADDED PER S.O. 24545	RTS	6/17
A	ADDED PER S.O. 17425		7/99
DRWN	JRB	ASMB	SCALE
		PROJECT CITY OF MERCER ISLAND, WA	
DRAWING NUMBER			
D	12683	228	3 OF 3
SIZE	JOB NUMBER	KEY	SHEET
			REV

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FILE: 12683-228-03  
LAST 06/19/17  
MODIFIED: 1:18 PM

TITLE  
SCHEMATIC  
SEATTLE INLET#2

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<p><b>Customer</b></p> <p>Customer      City of Mercer Island - Water Utility</p> <p>Street          9611 SE 36th St.</p> <p>City, State, Zip   Mercer Island, WA 98040</p> <p>Phone          (206) 275-7608</p> <p>Website</p>	<p><b>End Customer</b></p> <p>Customer      City of Mercer Island - Water Utility</p> <p>Street          9611 SE 36th St.</p> <p>City, State, Zip   Mercer Island, WA 98040</p> <p>Phone          (206) 275-7608</p> <p>Website</p>	<p><b>General Panel Description</b></p> <p>REPORPOSE OF SPU EMPTY ENCLOSURE FOR WQA PANEL. THE WQA WILL MONITOR THE INCOMING WATER TO THE CITY FROM THE EAST INLETS AT THE I-90 BRIDGE.</p> <p><b>Revisions</b></p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:10%;">Rev.</th> <th style="width:70%;">Revision Comment</th> <th style="width:20%;">Date</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	Rev.	Revision Comment	Date																																																															
Rev.	Revision Comment	Date																																																																		
<p><b>Project Site</b></p> <p>Site Name      SEATTLE INLET 2 (BOAT RAMP)</p> <p>Description    WATER QUALITY ADDITIONS</p> <p>Street</p> <p>City, State, Zip</p>	<p><b>Project Engineer</b></p> <p>Name</p> <p>Street</p> <p>City, State, Zip</p> <p>Phone</p> <p>Website</p>																																																																			
<p><b>Project Dates</b></p> <p>Drawing Approval      03/23/10</p> <p>Fabrication As Builts</p> <p>Installation As Builts</p> <p>Commission            ### COMMISSIONING ###</p> <p>Warranty End Date</p>	<p><b>Panel Information</b></p> <p>Panel Constr. Stds.</p> <p>Panel Weight</p> <p>Heat Dissipation</p> <p>Enclosure              ### ENCLOSURES ###</p> <p>Working Temp Limits 35-104°F, 95% max humidity non condensing</p>																																																																			



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# S&B STANDARDS

## CABLE SPECIFICATION

Part No.	Manufacturer	Description
2412C	ALPHA	2-C, 20AWG, SHIELDED, PVC, 300V JACKET
5420/3	ALPHA	2-C, 20AWG, SHIELDED, PVC, 600V JACKET
6XV18300EH10	SIEMENS	PROFIBUS, TWINAXIAL SHIELDED, PVC 300V JACKET
6XV18402AH10	SIEMENS	PROFNET, TYPE A 4-WIRE, SHIELDED, CAT 5, PVC 600V JACKET
6XV1870-2B	SIEMENS	PROFNET, TYPE B 4-WIRE, SHIELDED, CAT 5, PVC 300V JACKET

## CONTROL PANEL INTERNAL CONSTRUCTION DETAILS, WIRED IN ACCORDANCE WITH UL508A

### COLOR CODES FOR DC WIRING

MTW/TFFN 600V WIRE, 18-12AWG, STRANDED

1. Brown	11. White-Brown
2. Red	12. White-Red
3. Orange	13. White-Orange
4. Yellow	14. White-Yellow
5. White-Red-Green	15. White-Black-Green
6. Blue	16. White-Blue
7. Violet	17. White-Violet
8. Gray	18. White-Gray
9. White-Black	19. White-Black-Orange
10. White-Black-Brown	20. White-Black-Red

Wire coloring repeats every 20 wires starting at 21

### COLOR CODES FOR AC WIRING

L1 or H1	Black - 12 Ga. -120VAC
CONTROL	Red - 14 Ga.
N	White - 14 Ga. -120VAC
G	Green

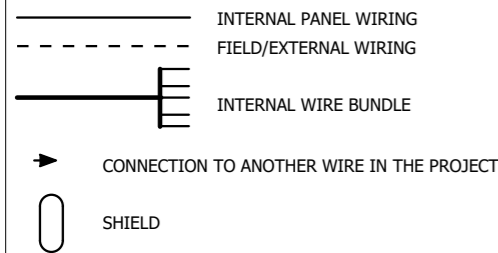
### CABLE FOR 4-20mA LOOPS #20 AWG TSP

RED	+
BLACK	-

### LAMP COLORS

R	Red
G	Green
A	Amber
W	White
B	Blue
Y	Yellow

### LINE TYPES



### WIRING ABBREVIATIONS

PS+	Yellow - 16. Ga. - 24VDC+
B1	Red - 16 Ga. - 12VDC +
B2	Brown - 16 Ga. - 12VDC -
T1	Green - Telephone Circuit
T2	White-Green - Telephone Circuit
B3	Violet - 16 Ga. - 24VDC +
B4	Blue - 24VDC -
B5	Red - 16 Ga. - 5VDC+
B6	Brown - 16Ga. - 5VDC-
L, H	115 VAC H
N	115 VAC N
G, GND	CABINET GROUND
SH	SHIELD OR DRAIN WIRE
CBXXX	UP TO 15 AMPS 14 AWG
CBXXX	UP TO 20 AMPS 12 AWG

### DEVICE ABBREVIATIONS

CB	CIRCUIT BREAKER
CR	CONTROL RELAY
F	FUSE
HH	HAND HOLES
HTR	HEATER
HV	HOLDING VAULT
IM	INTERFACE MODULES
JBOX	JUNCTION BOX
MOV	METAL OXIDE VARISTOR
OUTL	OUTLET
PBCONN	PROFIBUS CONNECTION
PS	POWER SUPPLY
TB	TERMINAL BLOCK
UB	UNIVERSAL BATTERY
UPS	UNINTERRUPTIBLE POWER SUPPLY

### DRAWING SYMBOLS

(XXXX)	LOCATION CROSS REFERENCE
(B)	PROVIDED BY OTHERS
(F)	FOR FUTURE USE
(E)	EXISTING
(N)	NEW
(O)	OPTIONAL, AS APPLICABLE

### NUMBERING

**LOCATION**  
 XXXY XX: PAGE NUMBER  
 YY: ROW NUMBER

**DEVICE**  
 For 1-3 Panels  
 XXXXY XX: DEVICE ABBREVIATION  
 (UP TO 4 CHARACTERS)  
 YY: DEVICE NUMBER  
 (UP TO 2 CHARACTERS)

For 4+ Panels  
 XXXXY.ZZ XX: DEVICE ABBREVIATION  
 (UP TO 4 CHARACTERS)  
 YY: PANEL NUMBER  
 (UP TO 2 CHARACTERS)  
 ZZ: DEVICE NUMBER  
 (UP TO 2 CHARACTERS)

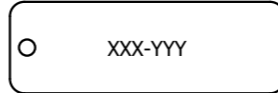
**WIRE**  
 YYY SAME AS TERMINAL NUMBER  
 XXX IF NO TERMINAL IS ATTACHED,  
 STARTING VALUE IS AT 401  
 AND INCREASES BY 1

**CABLE**  
 XXX COUNTER STARTING AT 1,  
 INCREASES BY 1

### FIELD DEVICE TAG REQUIREMENTS

1" x 3" STAINLESS STEEL TAGS  
 WITH 1/8" IN LETTERING

TAGS AFFIXED WITH WIRE TO EACH END OF CONDUITS  
 AND TO INSTRUMENTS, BEARING THE DEVICE TAG ID SHOWN  
 ON THE DRAWINGS.



### INSTALLATION INSTRUCTIONS

- USE HUBS OR FITTINGS WITH THE SAME ENVIRONMENTAL RATING AS THE ENCLOSURE
- DO NOT PENETRATE TOP OF ENCLOSURE OR ROUTE CONDUCTORS THAT WILL ALLOW FOR MOISTURE TO PASS OVER CONTROL COMPONENTS.
- SEE WIRING DIAGRAMS FOR MINIMUM ACCEPTABLE FIELD WIRING CONDUCTOR SIZE

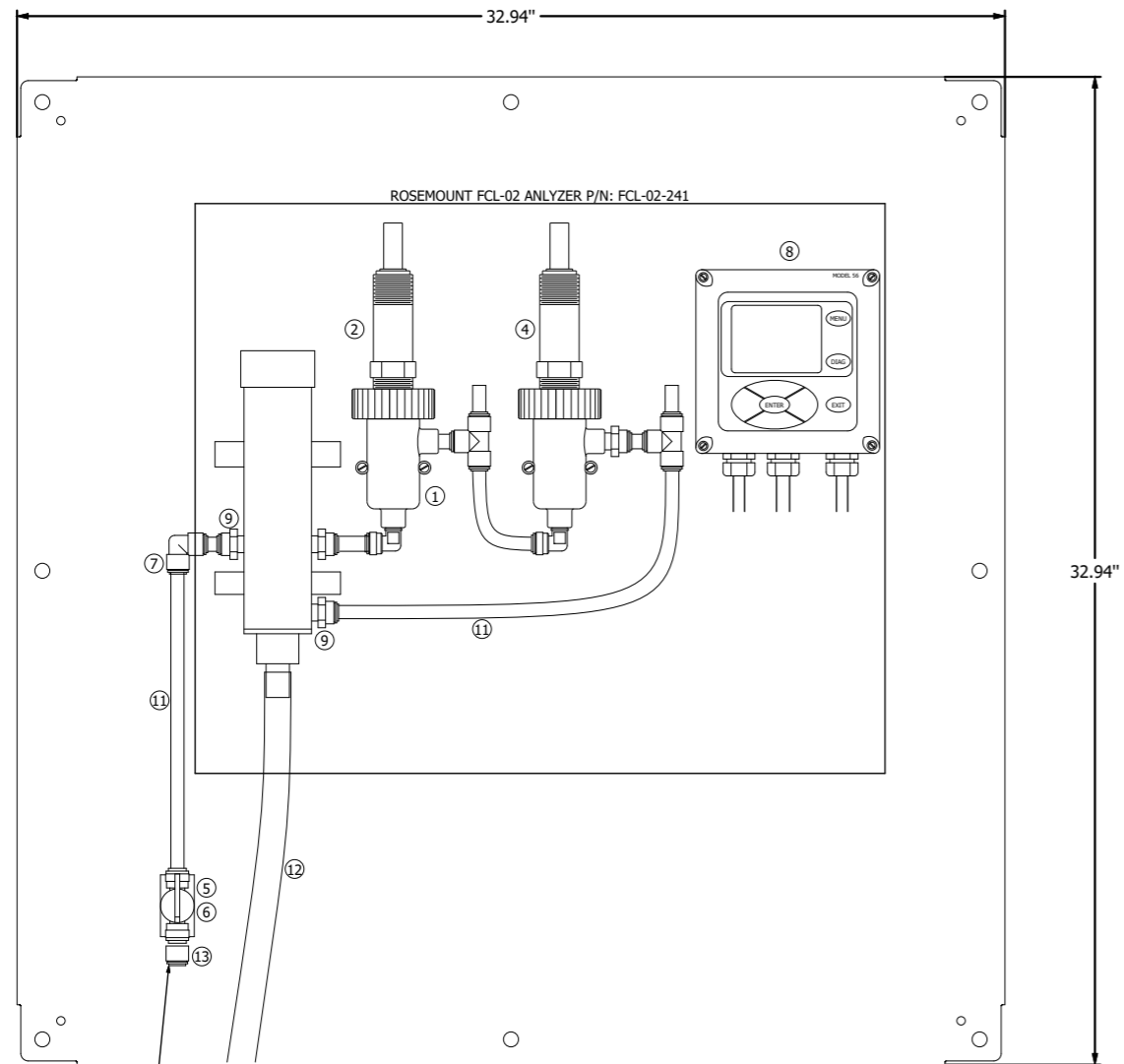
## ELECTRICAL CONSTRUCTION DETAILS FOR INTERCONNECT AND WIRING EXTERNAL FROM CONTROL PANEL

### AC WIRING

	120/240 VOLTS	120/208 VOLTS	480/277 VAC
A PHASE	BLACK	BLACK	BROWN
B PHASE	RED	RED	ORANGE
C PHASE		BLUE	YELLOW
NEUTRAL	WHITE	WHITE	GRAY
GROUND	GREEN	GREEN	GREEN

SEE CIRCUIT SCHEDULE FOR CONDUCTOR SIZING

EAST SIDE OF WQA



S&B SUPPLIED THROTTLE VALVE, 90° ELBOW, AND POLY TUBING TO THE INLET OF THE FCL-02 ANALYZER.

ID	QTY.	MFR / PART NUMBER	DESCRIPTION
①	1	ROSEMOUNT 24091-01	LOW FLOW CELL WITH 1/4" NOZZLE FOR 5-8 GAL/HR
②	1	ROSEMOUNT 499ACL-01-54-VP	CHLORINE SENEOR
③	1	ROSEMOUNT 24091-00	LOW FLOW CELL WITH 1/4" NOZZLE FOR <3 GAL/HR
④	1	ROSEMOUNT 3900VP-02-10	PH SENSOR
⑤	4	RYAN HERCO 5314-103	3/8" SHUTOFF VALVE
⑥	4	RYAN HERCO 5314.900	SHUT-OFF VALVE MOUNTING BRACKET
⑦	3	RYAN HERCO 1208-055	3/8" UNION ELBOW
⑧	3	ROSEMOUNT 56-03-24-32HT	WATER QUALITY ANALYZER XMFR
⑨	4	RYAN HERCO 1202-053	3/8" TO 1/4" REDUCER
⑩	2	RYAN HERCO 1210.053	3/8" TO 1/4" ELBOW REDUCER
⑪	1	BUD INDUSTRIES, INC. NF-6612	FIBERGLASS JUNCTION BOX
⑫	53"	RYAN HERCO 0543.024	LLDPE TUBING 1/4 ID X 3/8 OD
⑬	60"	RYAN HERCO 0317.120	PFA 7/16" ID X 1/2" OD CLEAR TUBING
⑭	1	JOHN GUEST PI061208S	3/8" TO 1/4" STEM TO TUBE FITTING

DSGN		Date		Customer No.	Job No.	Sheet	File:12683-403_Seattle Inlet 2 WQA	Project:
DRWN	esidenquist	Date	12/20/16	12683		3of5	Last Modified: 9:54 AM 06/30/17 Scale: 1:3	SEATTLE INLET 2 (BOAT RAMP)
APPR		Date	03/23/10	Type		Rev.	Project Site: SEATTLE INLET 2 (BOAT RAMP)	WATER QUALITY ADDITIONS
STR		Date		Panel layout	A		Utility: City of Mercer Island - Water Utility	

Project: SEATTLE INLET 2 (BOAT RAMP)  
WATER QUALITY ADDITIONS

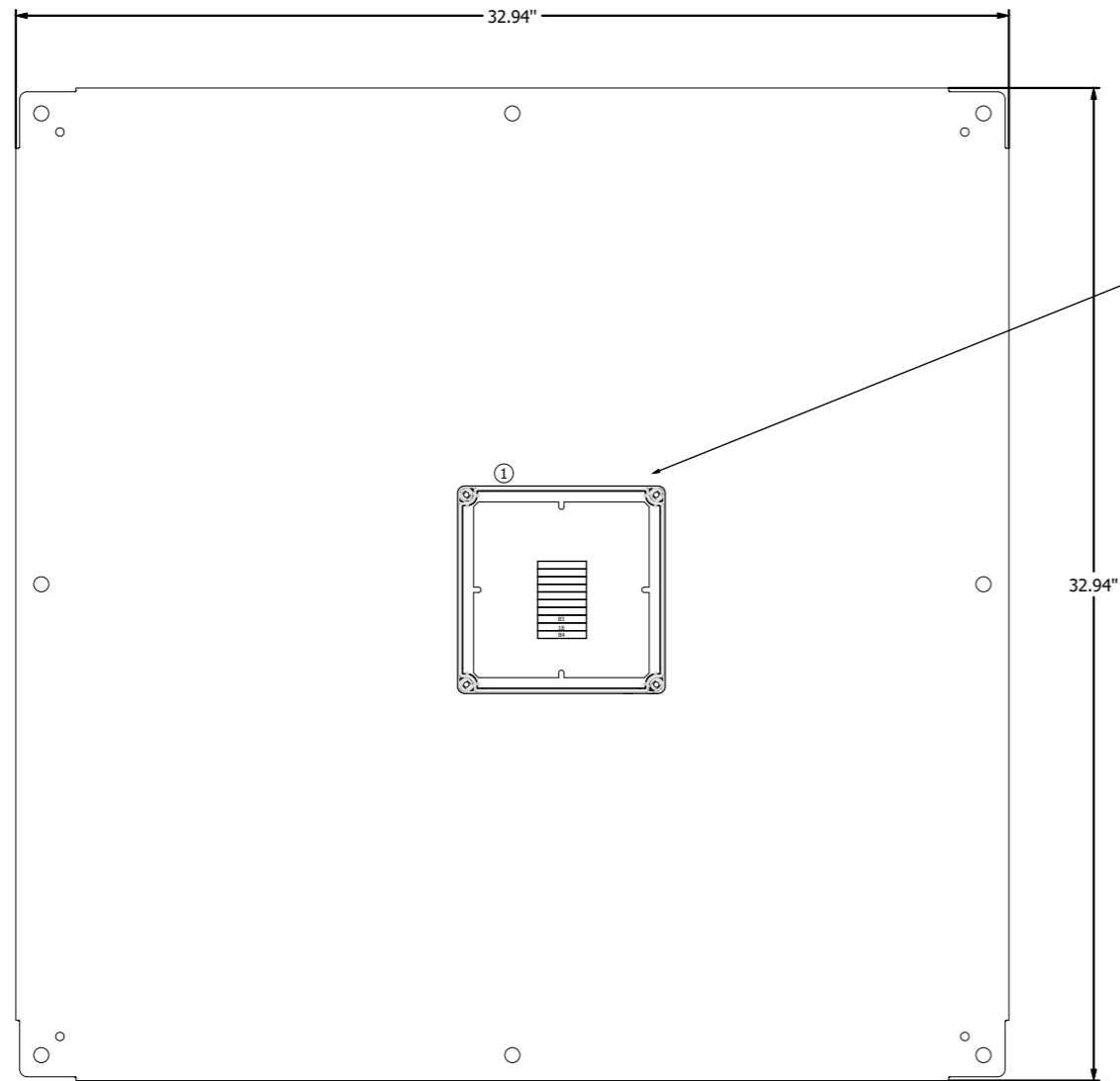
Title: EAST SIDE WATER QUALITY PANEL

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WEST SIDE OF WQA  
(DOOR FACES THE BACK OF THE BOAT RAMP RTU)



J-BOX FOR LANDING ANALOG SIGNAL WIRES BEFORE THE  
CABLE RUNS GO TO THE EXISTING BOAT RAMP RTU

ID	QTY.	MER. / PART NUMBER	DESCRIPTION
①	1	HOFFMAN Q-18188PCECC	POLY JUCTION BOX

DSGN		Date		Customer No.	Job No.	Sheet	File: 12683-403_Seattle Inlet 2 WQA	Project:
DRWN	esidenquist	Date	12/20/16	12683		4 of 5	Last Modified: 9:59 AM 06/30/17 Scale: 1:3	SEATTLE INLET 2 (BOAT RAMP) WATER QUALITY ADDITIONS
APPR		Date	03/23/10	Type	Rev.	Size	Project Site: SEATTLE INLET 2 (BOAT RAMP)	
STR		Date		Panel layout	A		Utility: City of Mercer Island - Water Utility	

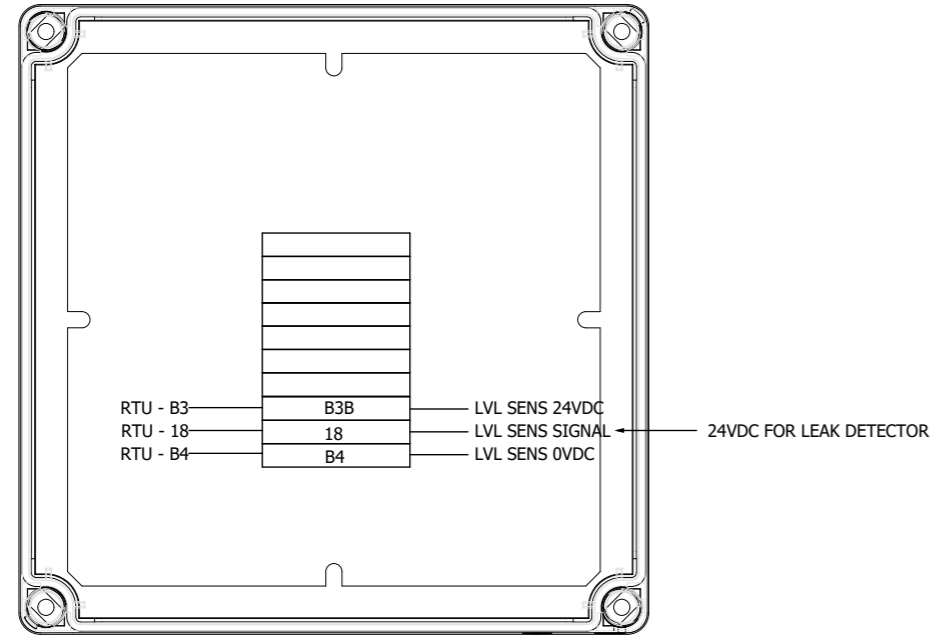
Project: SEATTLE INLET 2 (BOAT RAMP)  
WATER QUALITY ADDITIONS

Title: WEST SIDE BACK PANEL

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DSGN		Date		Customer No.	Job No.	Sheet	File: 12683-403_Seattle Inlet 2 WQA
DRWN	esidenquist	Date	12/20/16	12683		5 of 5	Last Modified: 9:57 AM 06/30/17 Scale: 1:1
APPR		Date	03/23/10	Type		Rev.	Size
STR		Date		Panel layout		A	Project Site: SEATTLE INLET 2 (BOAT RAMP) Utility: City of Mercer Island - Water Utility

Project: **SEATTLE INLET 2 (BOAT RAMP)**  
**WATER QUALITY ADDITIONS**

Title: **J-BOX WIRING**

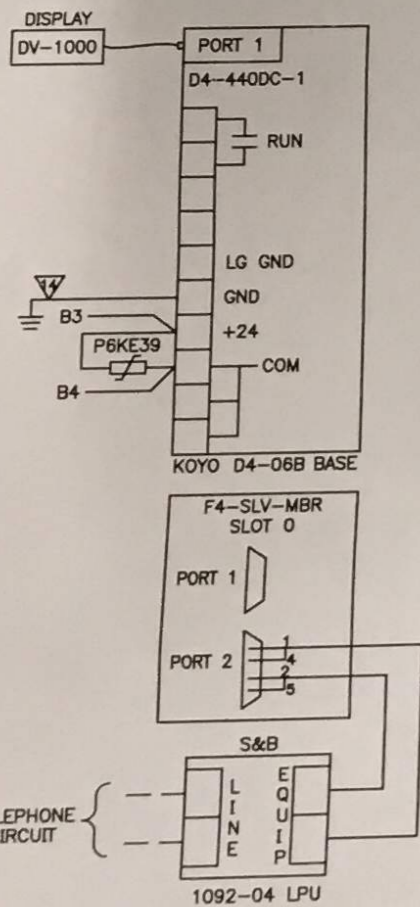
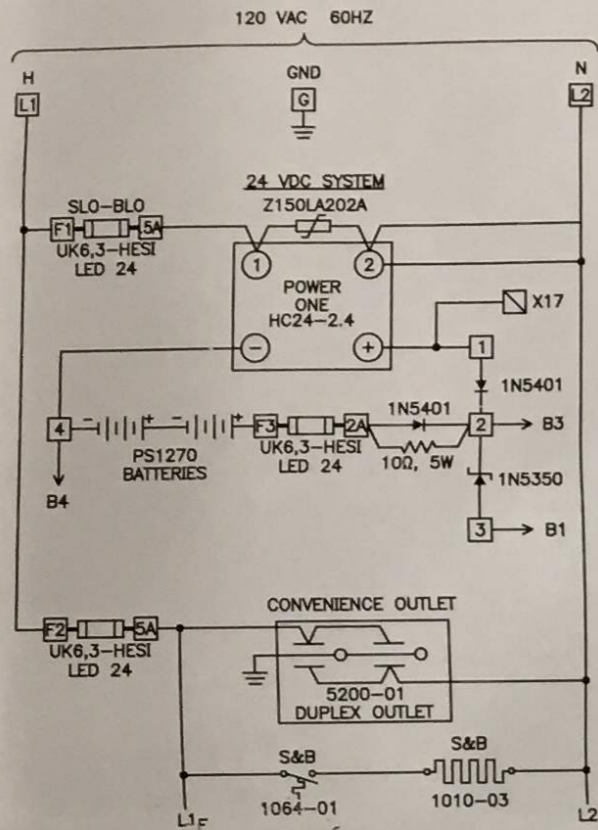
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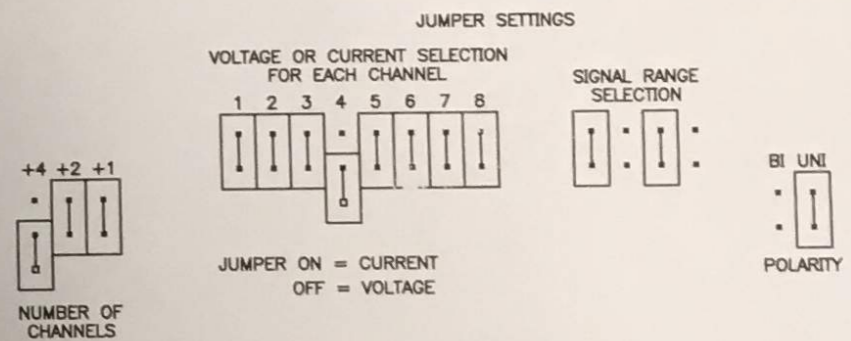
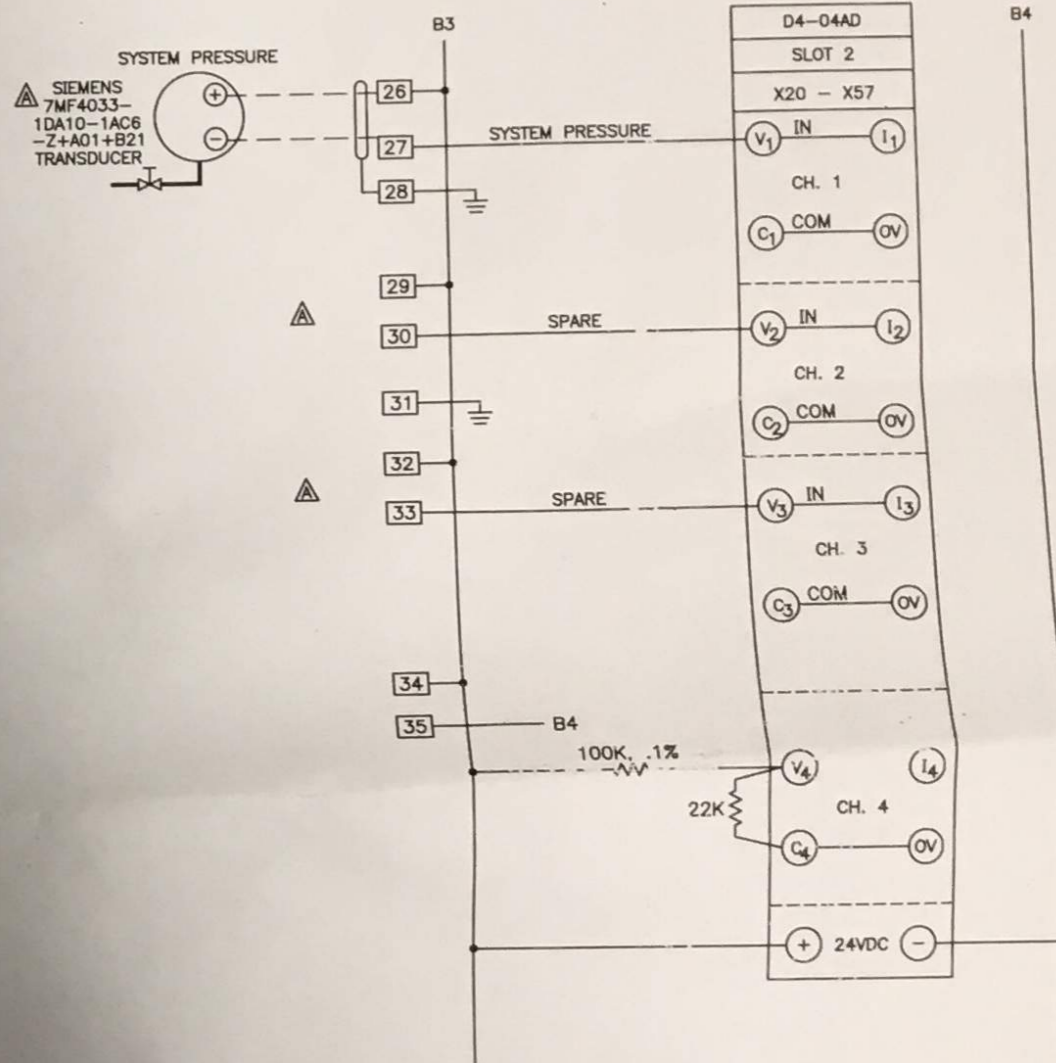
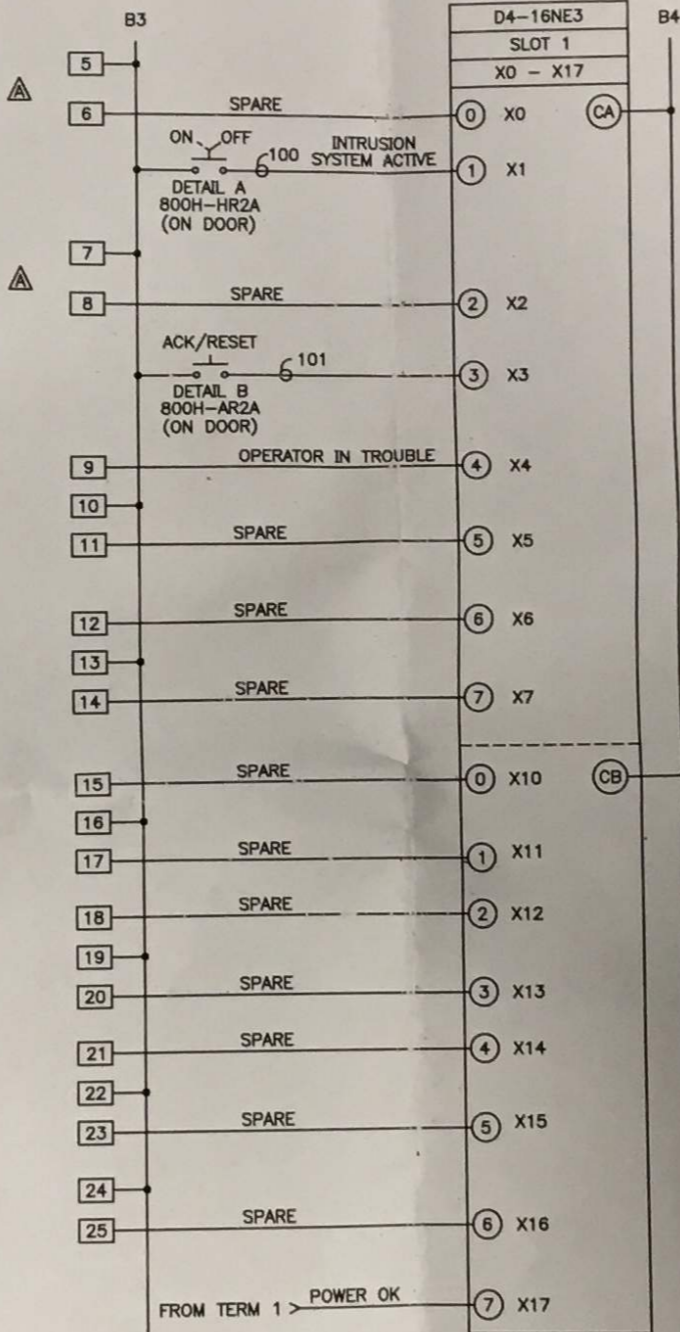


PANEL INFORMATION	
ENCLOSURE RATING	NEMA 12
AC POWER WIRES	14 GAUGE
DC POWER WIRES	16 GAUGE
CONTROL WIRING	18 GAUGE
WIRE INSULATION	600 VOLTS
TERMINAL SCREW TORQUE	14.1 IN-LB
MAX VOLTAGE	120V 1ϕ 60 HZ
FULL LOAD AMPS	1.0
UL 508 LABEL #	AB-914001

HOFFMAN A-201610LP NEMA 12 ENCLOSURE  
HOFFMAN A-20P16 BACK PANEL

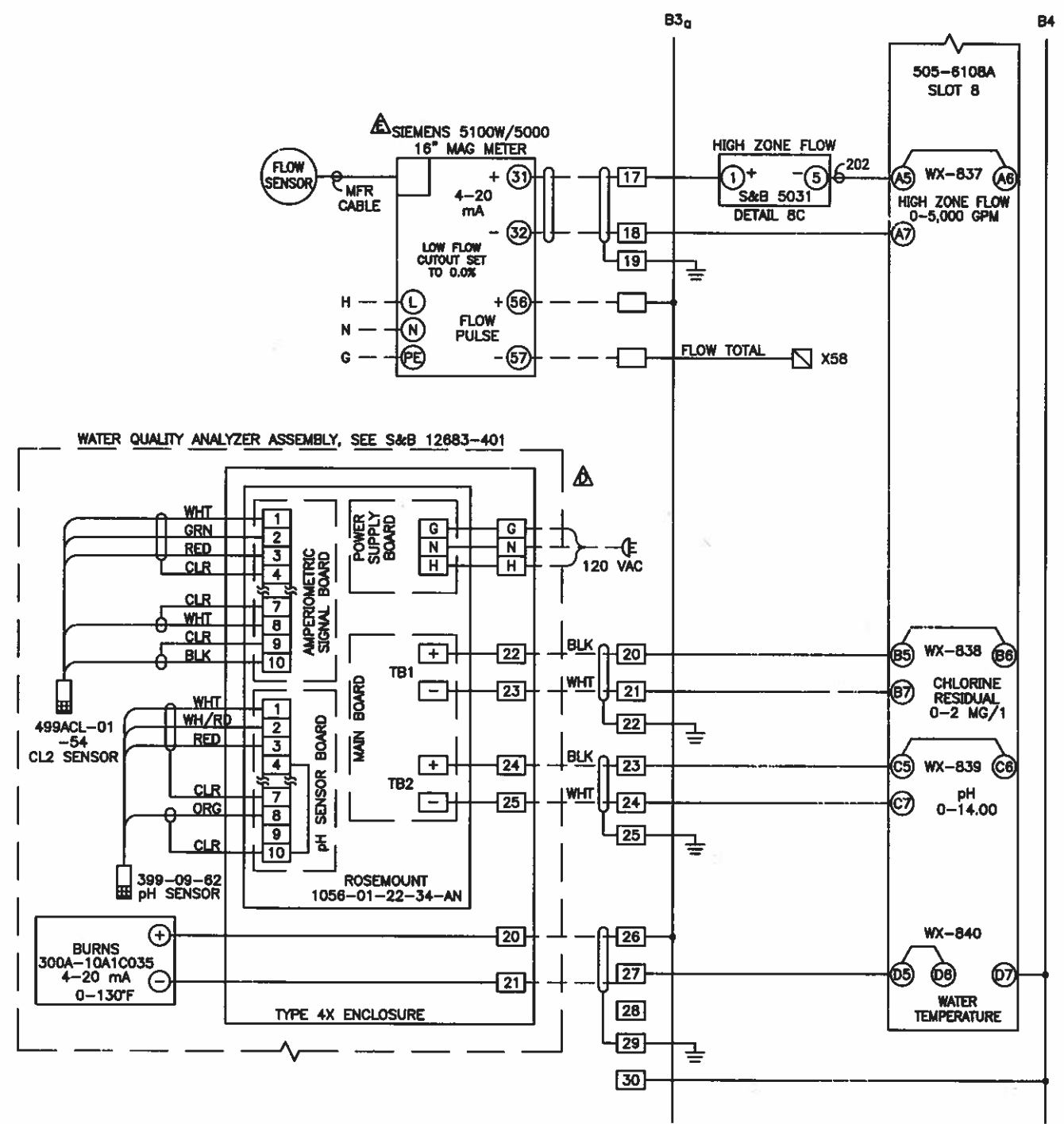
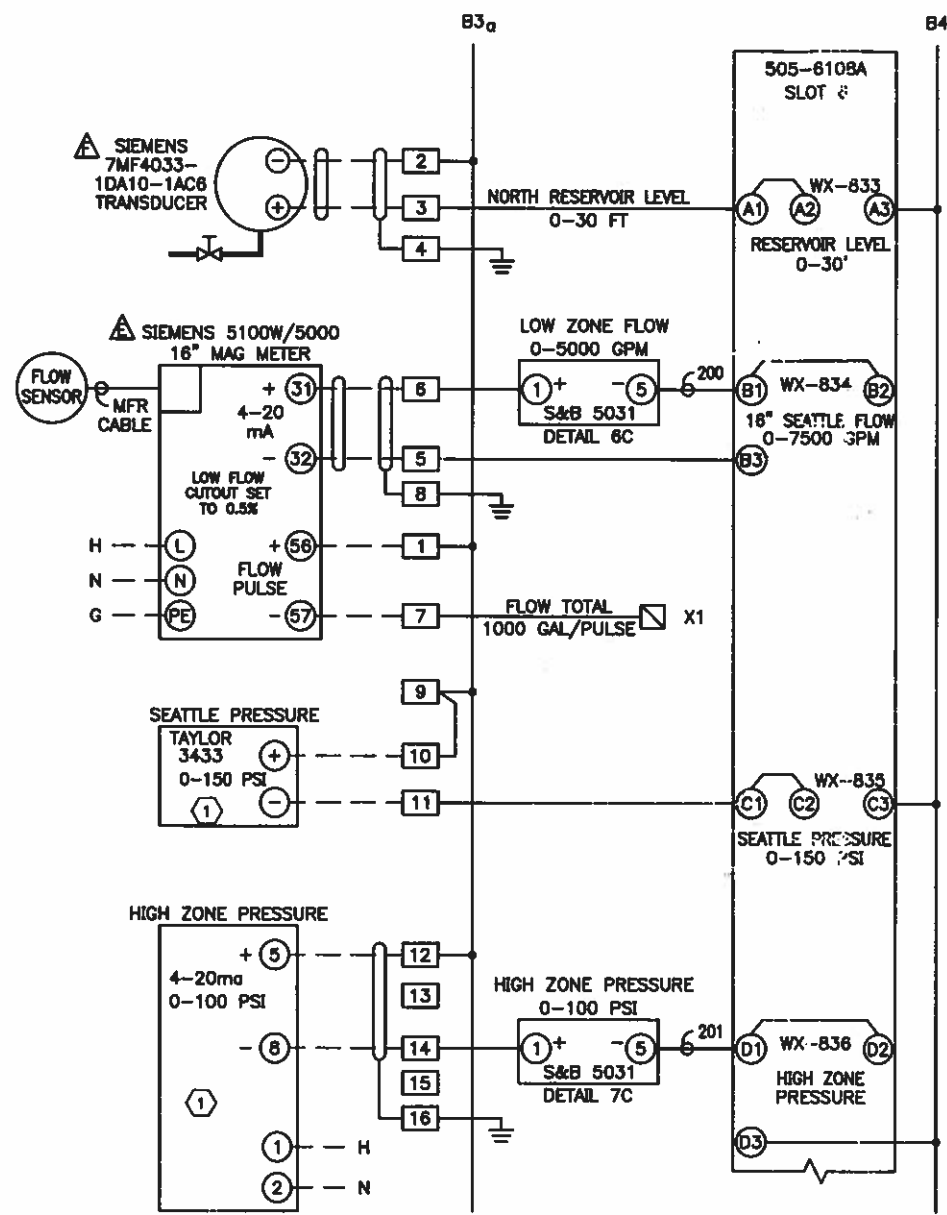
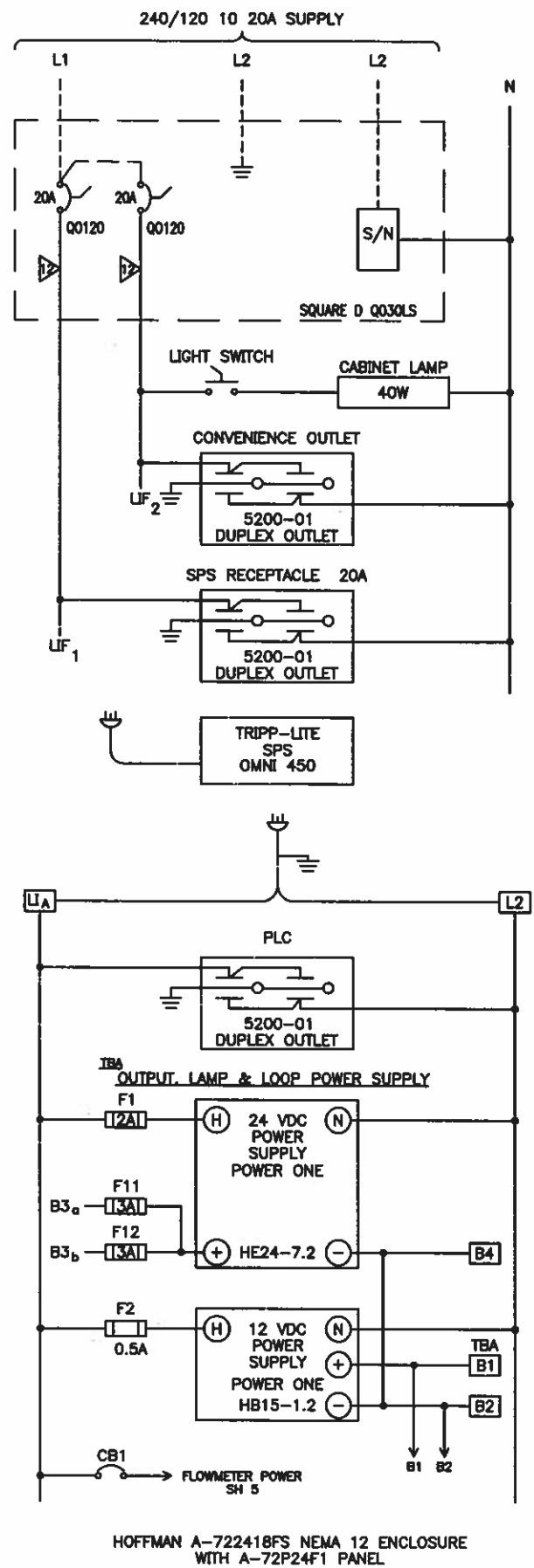
**NOTES:**

- ① FIELD EQUIPMENT, SUPPLIED BY S&B
- ② FUTURE USE, NOT INCLUDED



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DRWN JRB		ENGR		SCALE		APP DATE	
S&B System Specialists 13200 S.E. 30th St. Bellevue, Washington 98005 S&B inc. (425)844-1700 Fax: (425)748-9312		PROJECT		CITY OF MERCER ISLAND, WA		DRAWING NUMBER	
FILE: 12683-226-01		TITLE		SCHEMATIC		D 12683 226 1 OF 1 A	
LAST MODIFIED: 01/07/16 1:23 PM		SOUTH END PRESSURE STATION		SIZE		JOB NUMBER KEY SHEET REV	

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PANEL INFORMATION	
ENCLOSURE RATING	NEMA 12
AC POWER WIRES	14 GAUGE
DC POWER WIRES	16 GAUGE
CONTROL WIRING	18 GAUGE
WIRE INSULATION	600 VOLTS
TERMINAL SCREW TORQUE	14.1 in/lb
MAX VOLTAGE	120V 1 $\phi$ 60 HZ
FULL LOAD AMPS	1.0
UL 508 LABEL	#AB-913992

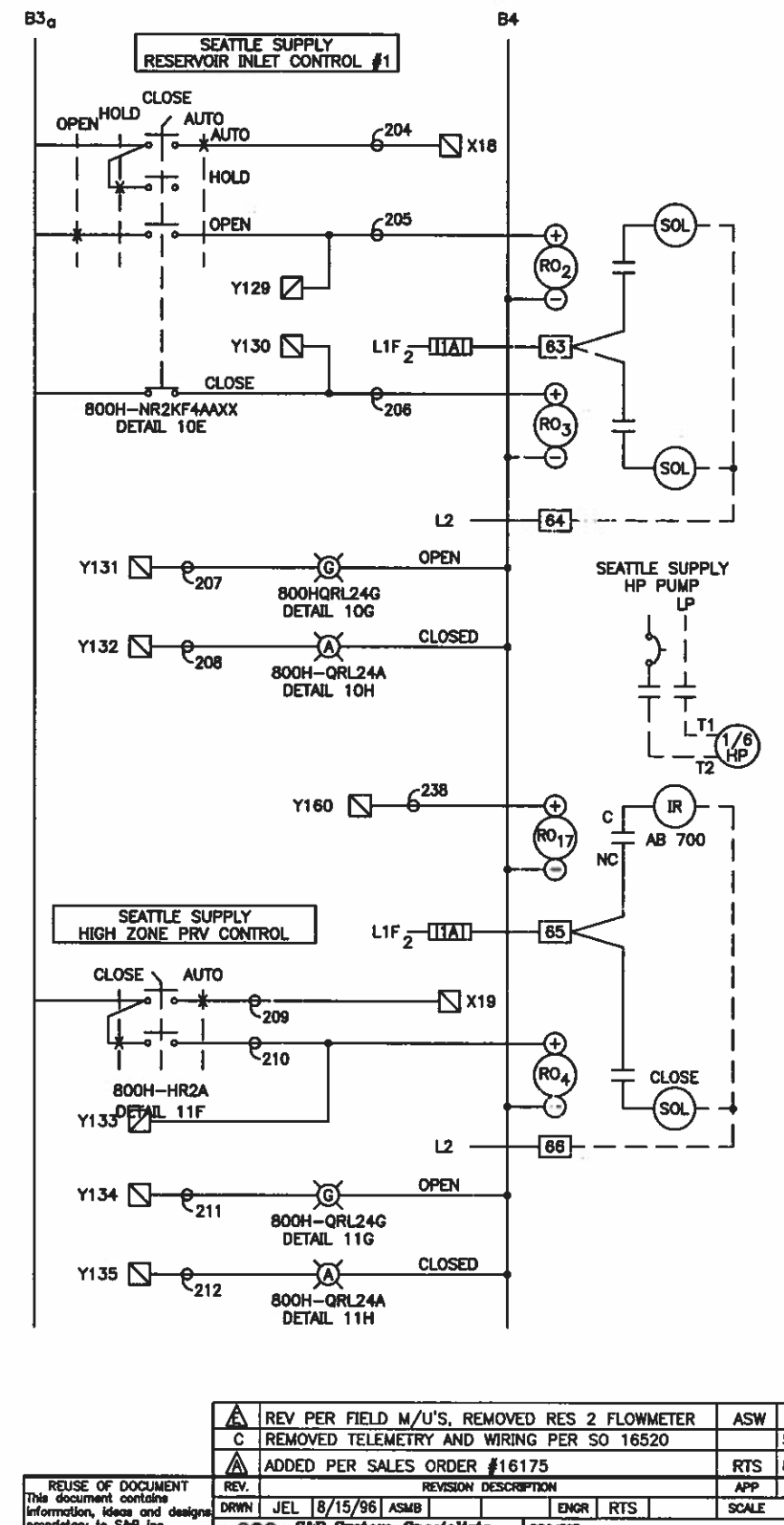
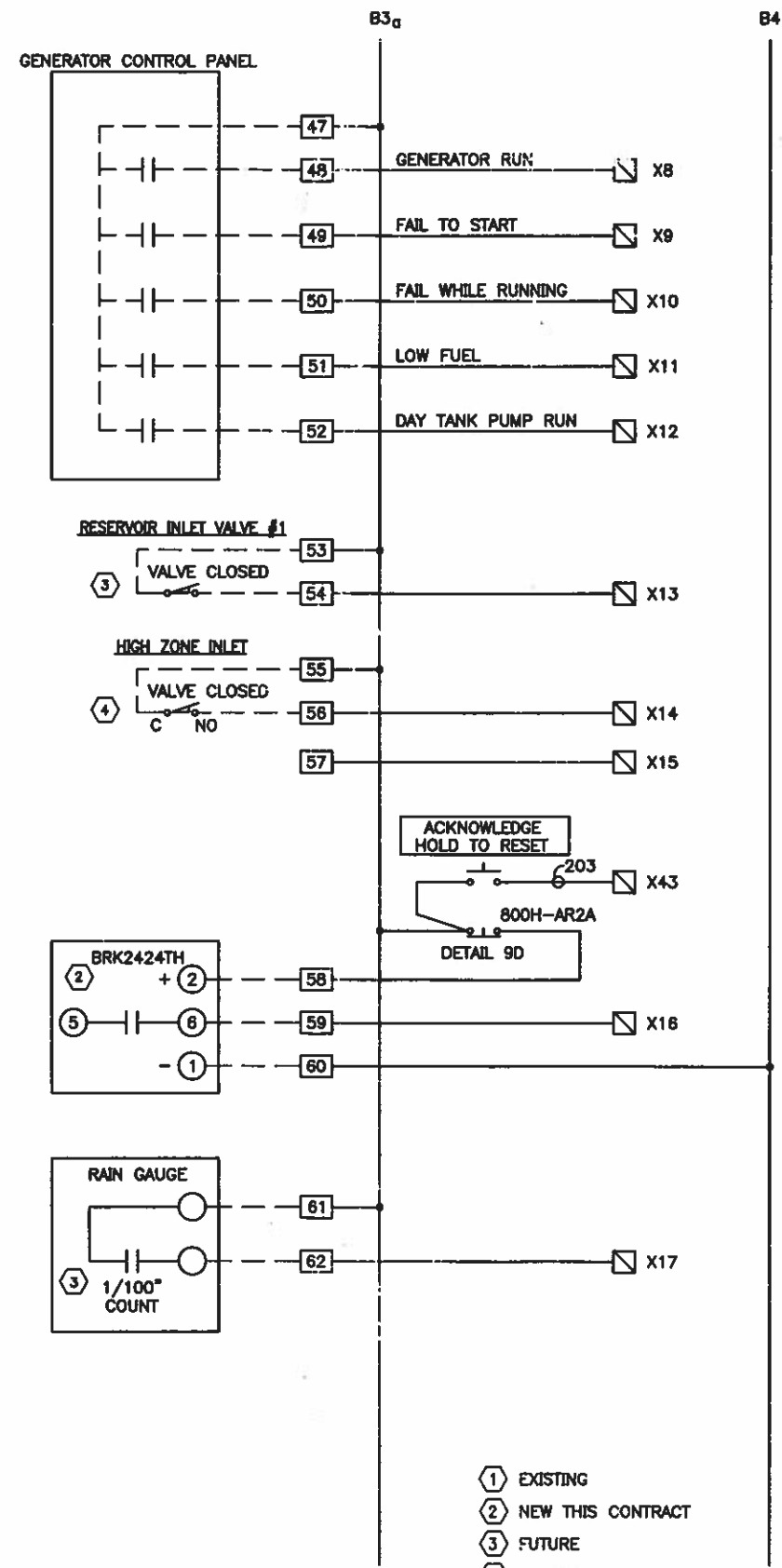
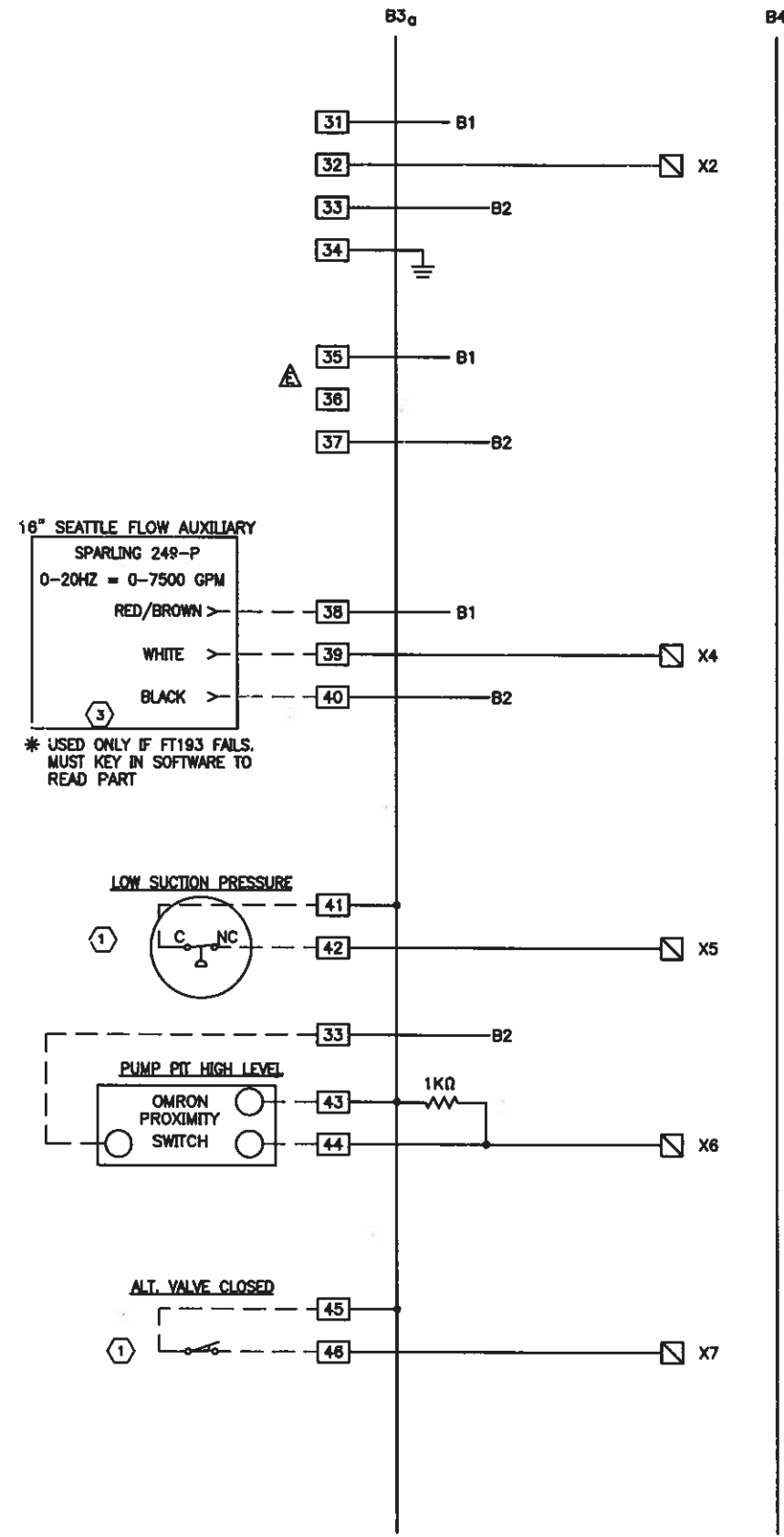
- ① EXISTING
- ② NEW THIS CONTRACT
- ③ FUTURE
- ④ PROVIDED BY CITY
- ⑤ ADDED POST CONTRACT

REV.	REVISION DESCRIPTION	APP	DATE
△	ADDED PRESSURE TRANSDUCER PER FIELD MARK-UPS	EHD	9/12
△	REVISED PER FIELD MARK-UPS, NEW FLOWMETERS	ASW	5/11
△	NEW WATER QUALITY PANEL PER S.O. 21276	RTS	3/08
C	REMOVED TELEMETRY AND WIRING PER SO 16520		5/97
△	UPGRADED RESERVOIR TO 422TB PER SO #	DAR	3/97
△	ADDED PER SALES ORDER #16175	RTS	8/96

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FILE: 12683-211-01  
 LAST 04/19/13  
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DRWN	JEL	8/15/96	ASMB	ENGR	RTS	SCALE
PROJECT: CITY OF MERCER ISLAND, WA WATER SYSTEM DRAWING NUMBER: D 12683 211 1 OF 8 F SIZE: JOB NUMBER KEY SHEET REV						



- ① EXISTING
- ② NEW THIS CONTRACT
- ③ FUTURE
- ④ PROVIDED BY CITY
- ⑤ ADDED POST CONTRACT

REV.	REVISION DESCRIPTION	APP.	DATE
△	REV PER FIELD M/U'S, REMOVED RES 2 FLOWMETER	ASW	5/11
C	REMOVED TELEMETRY AND WIRING PER SO 16520		5/97
△	ADDED PER SALES ORDER #16175	RTS	8/96

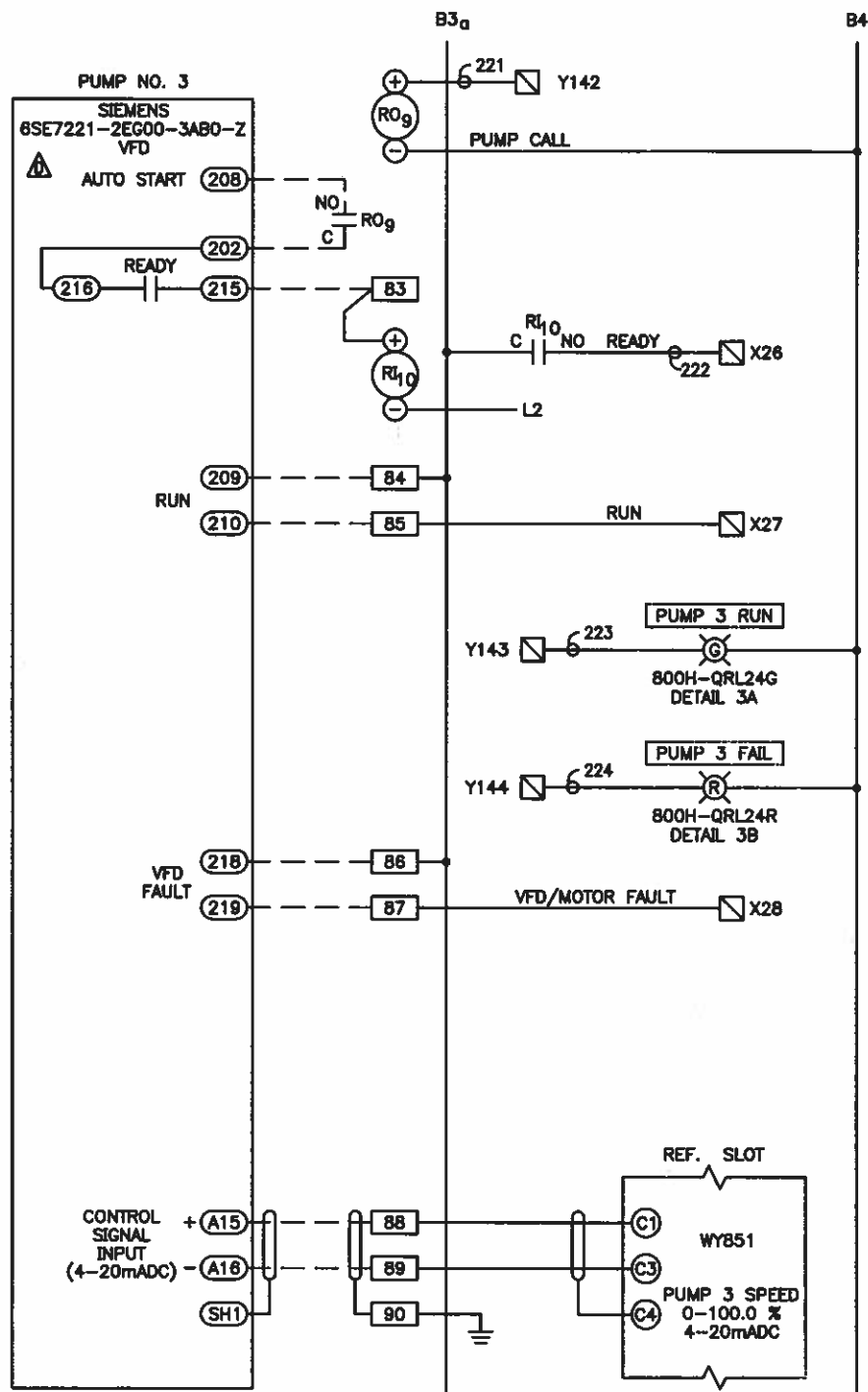
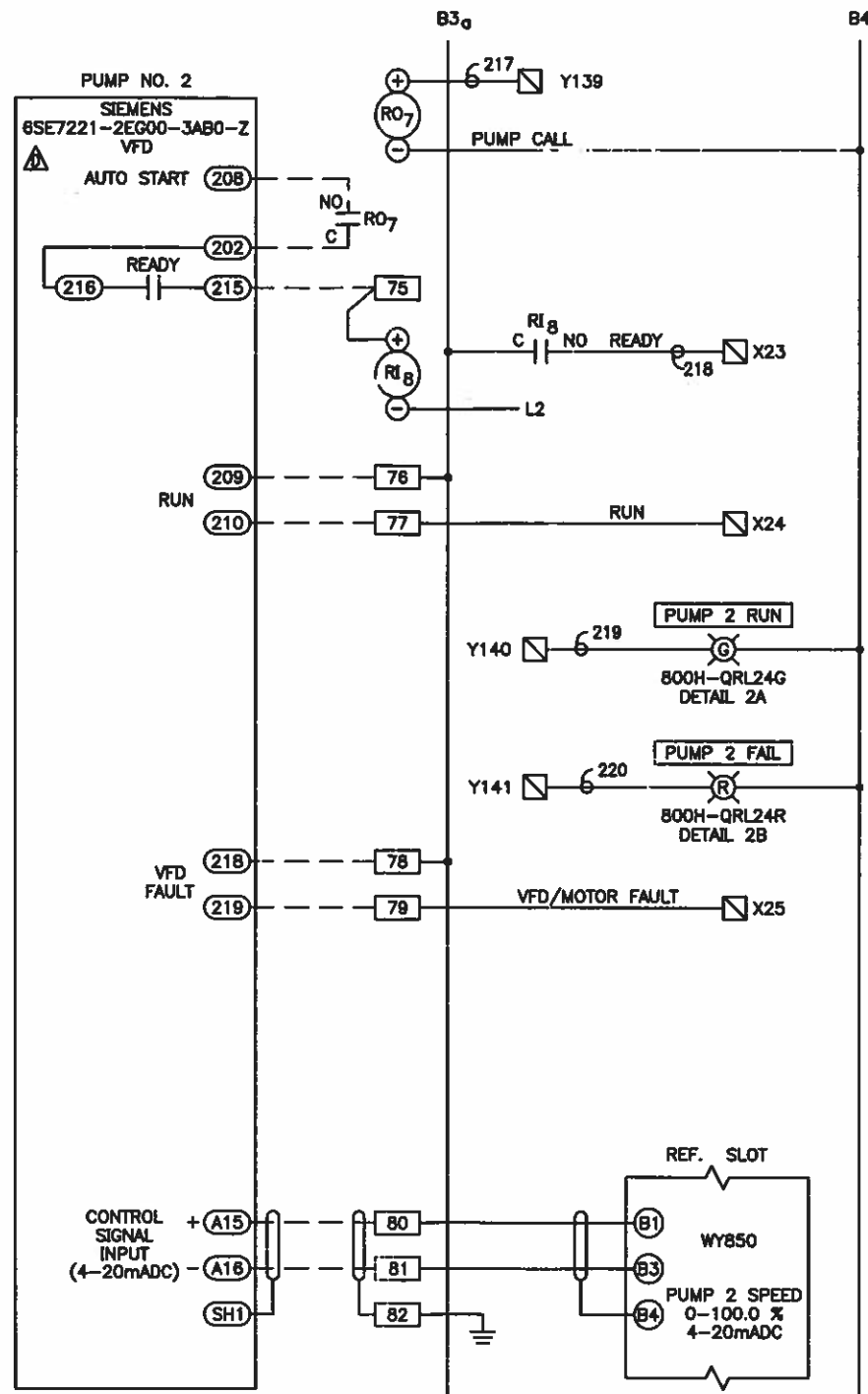
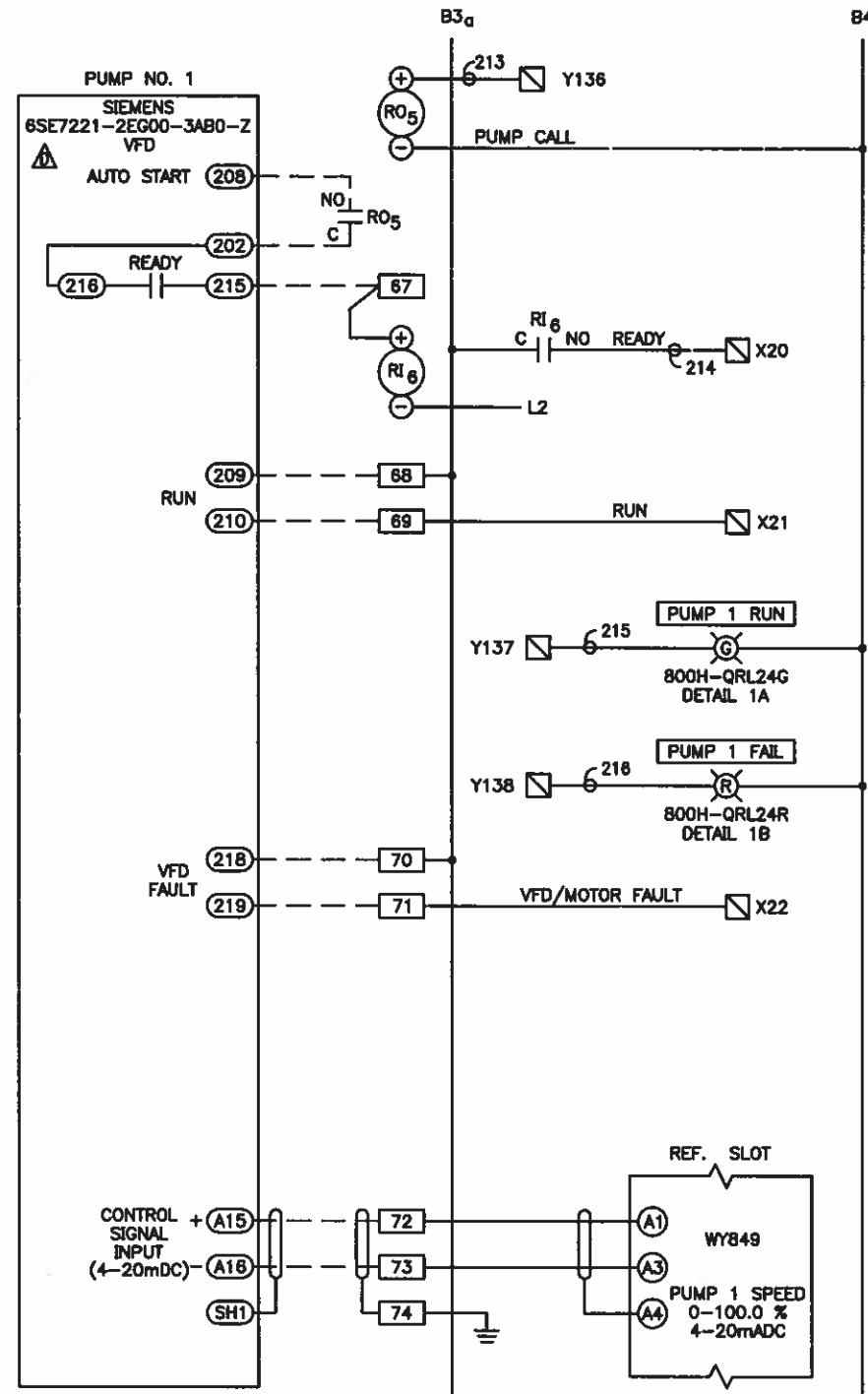
  

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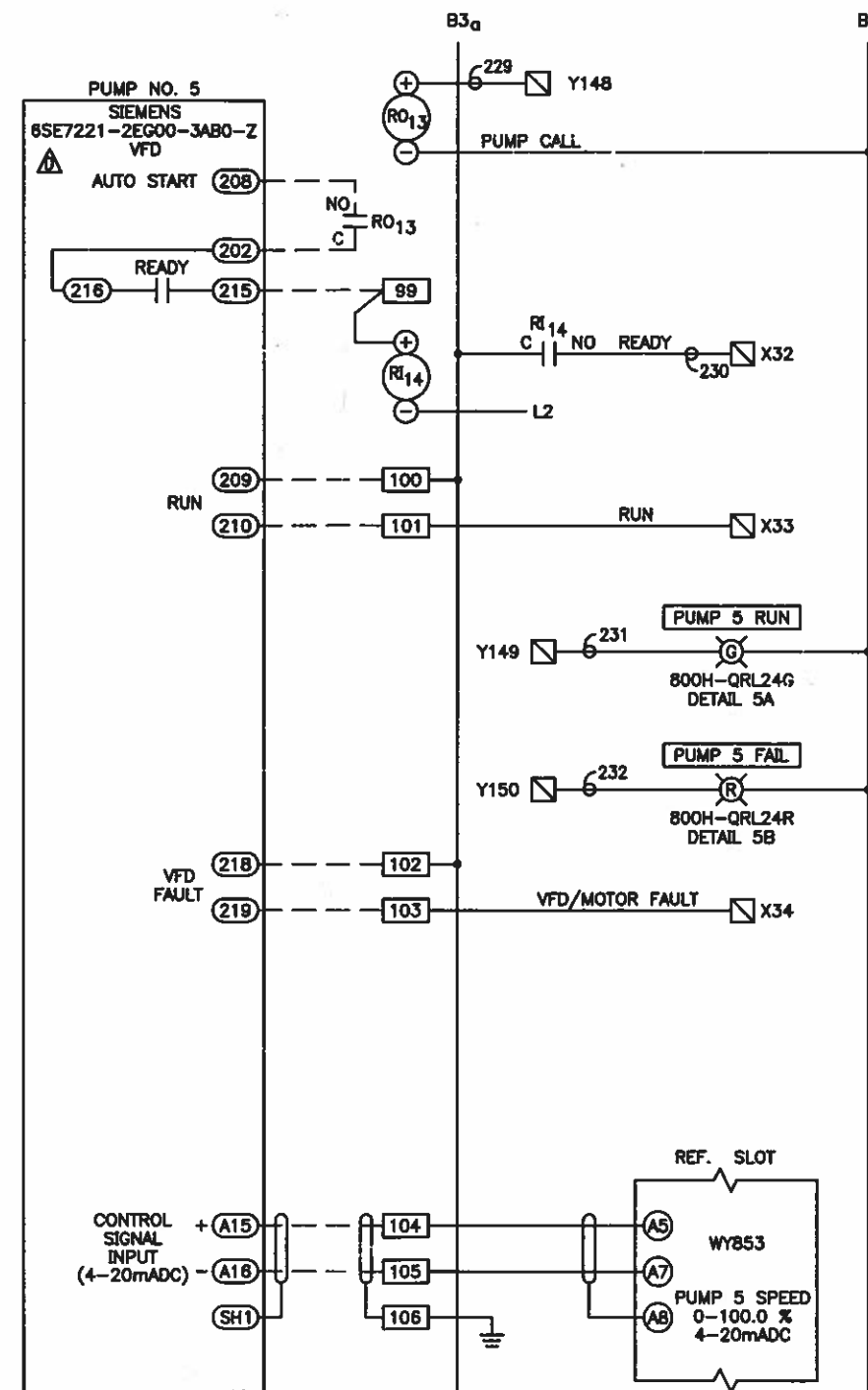
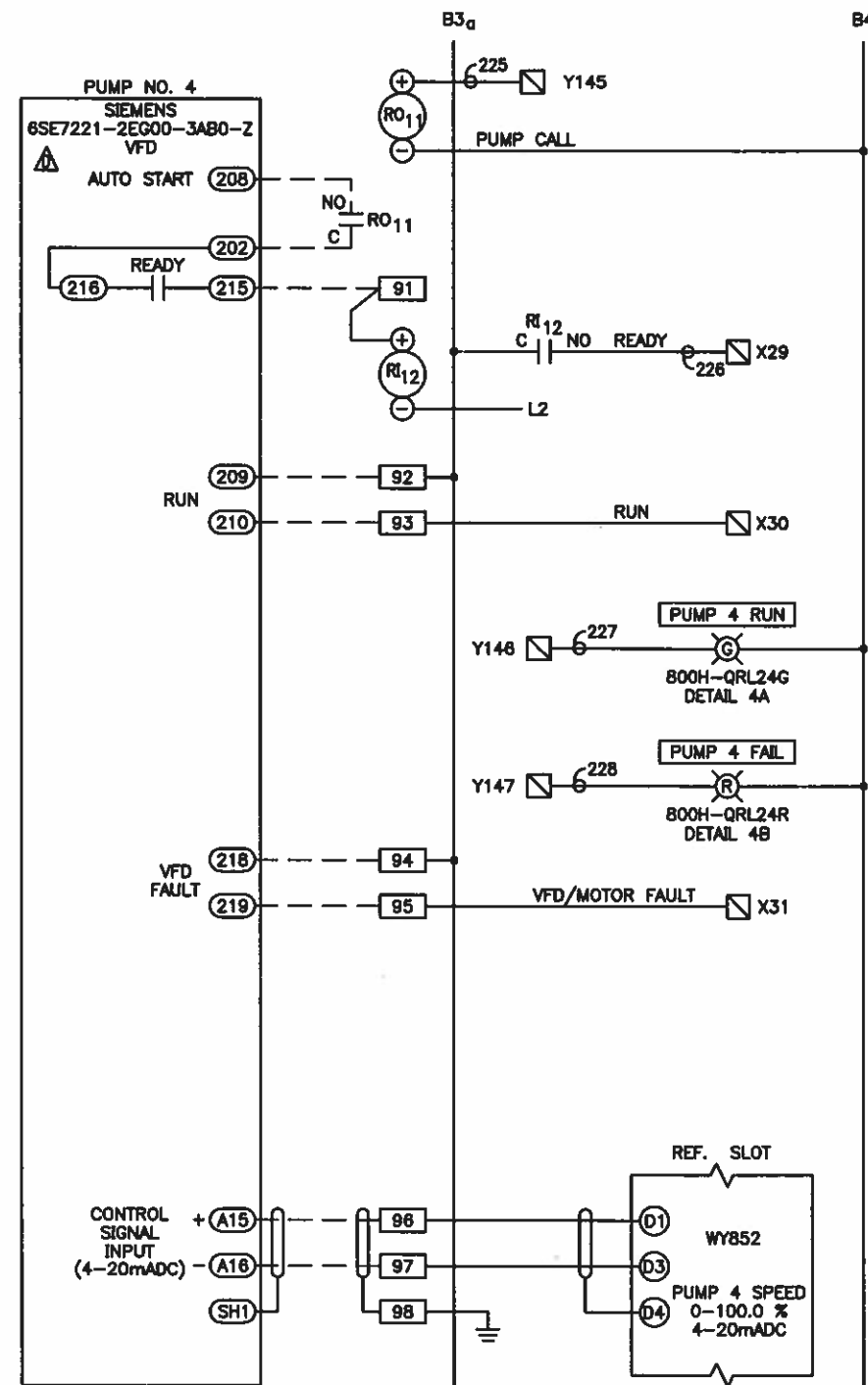
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- ① EXISTING
- ② NEW THIS CONTRACT
- ③ FUTURE
- ④ PROVIDED BY CITY
- ⑤ ADDED POST CONTRACT

REVISION		DATE
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REMOVED TELEMETRY AND WIRING PER SO 16520		5/97
ADDED PER SALES ORDER #16175	RTS	8/96
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PROJECT CITY OF MERCER ISLAND, WA WATER SYSTEM		
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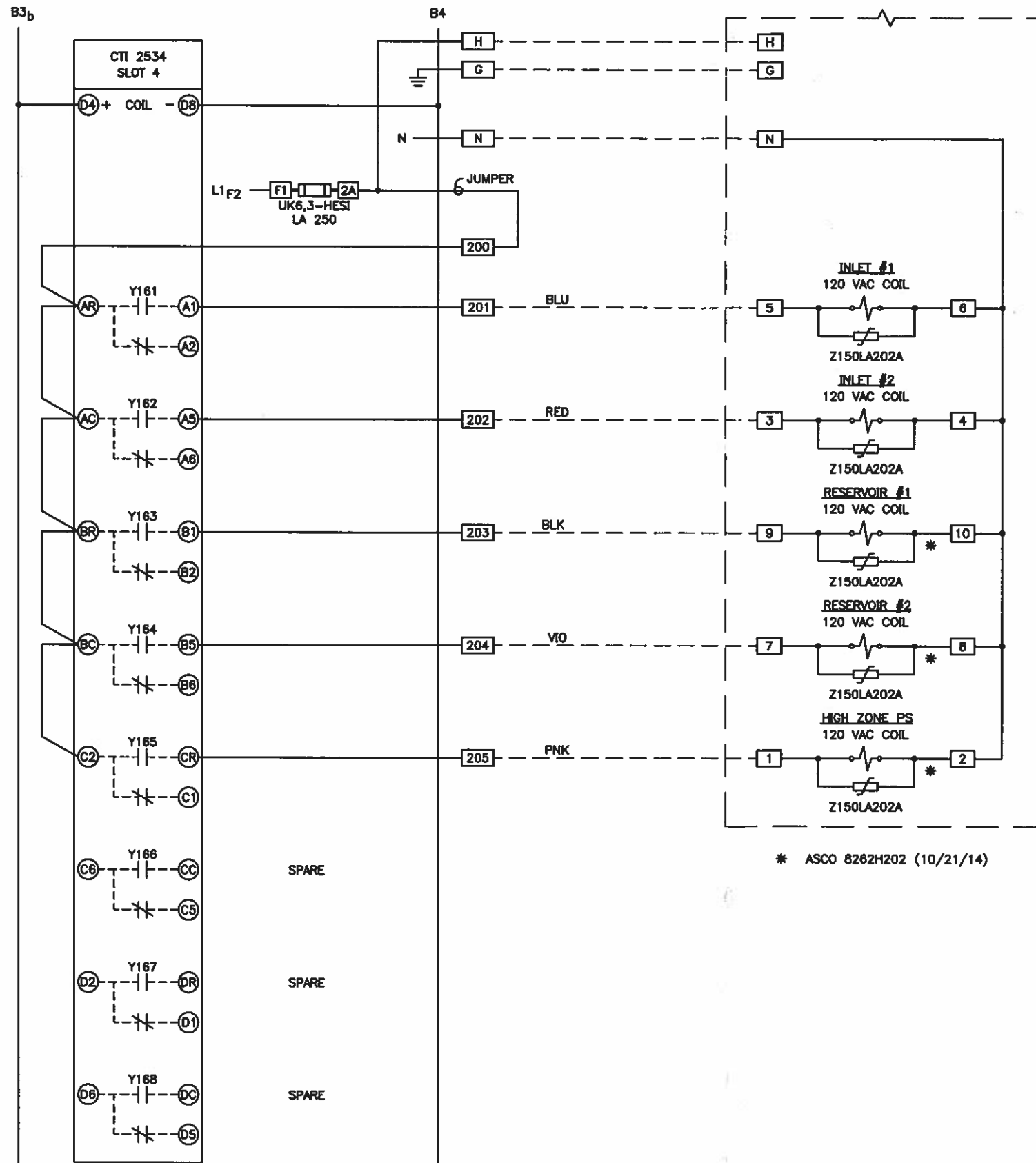
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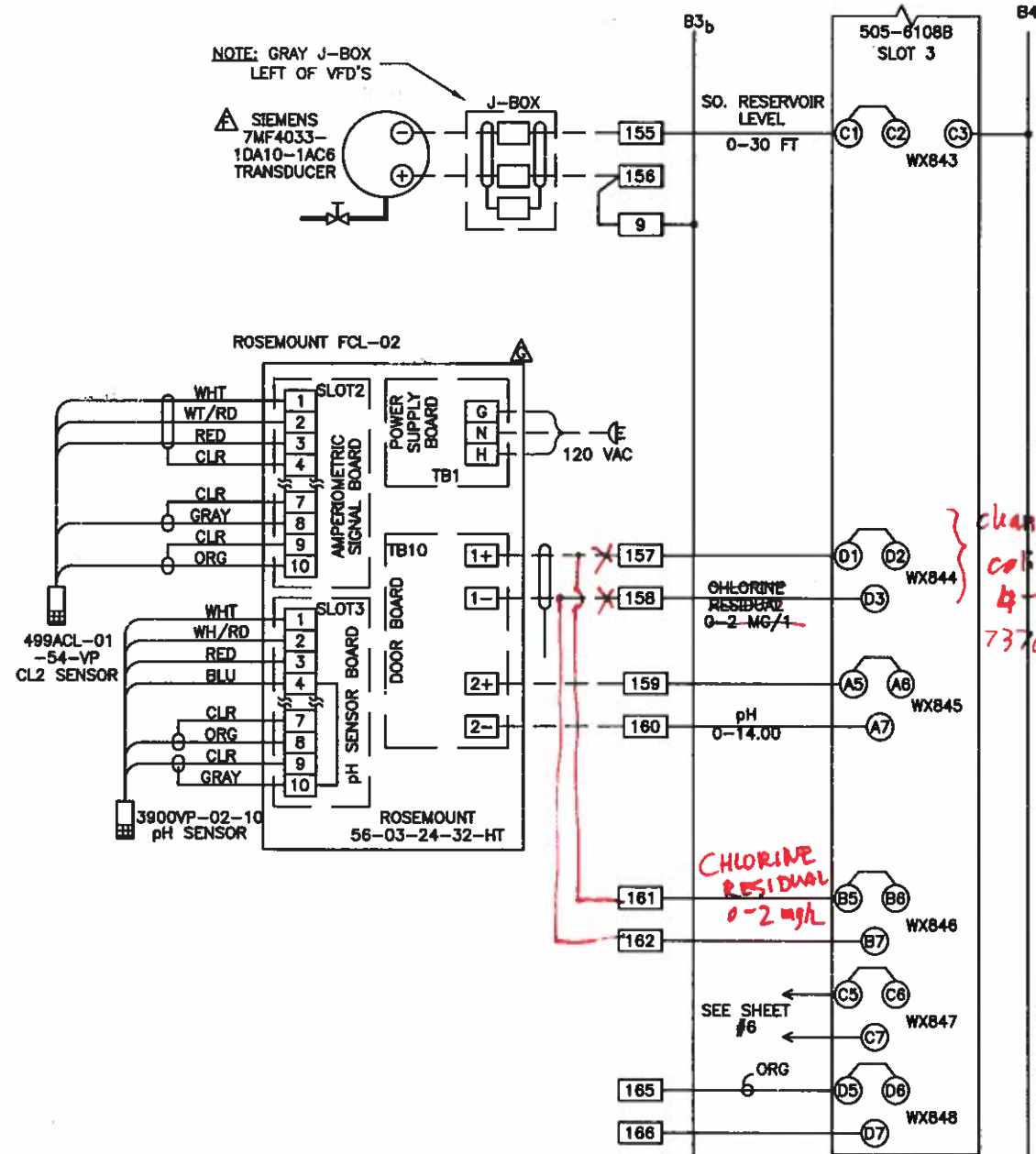
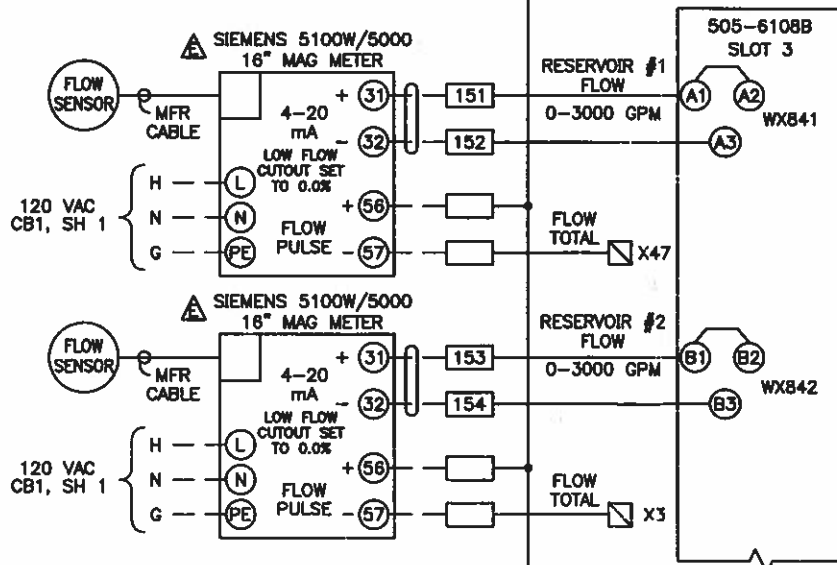
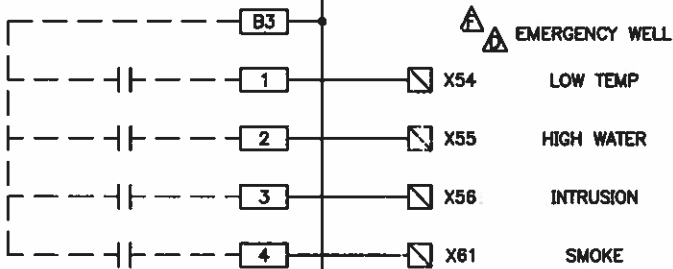
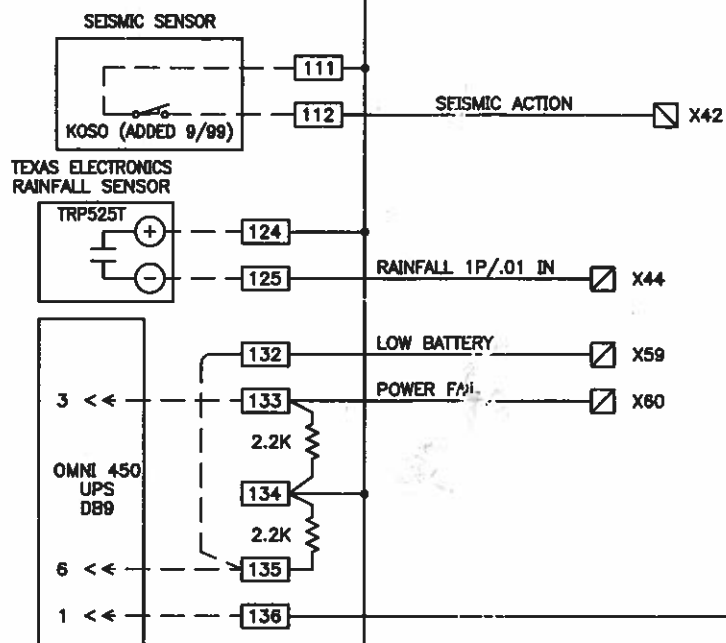
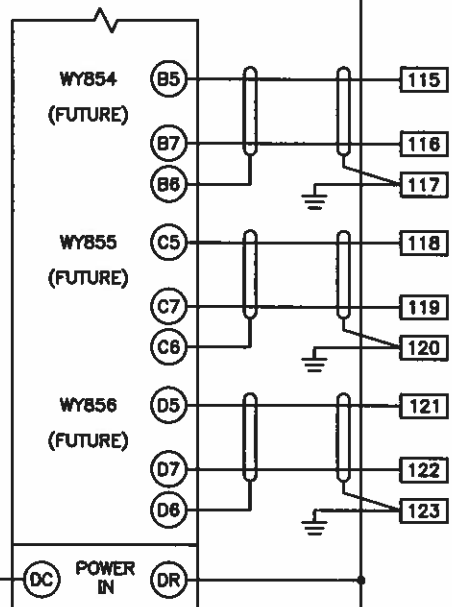
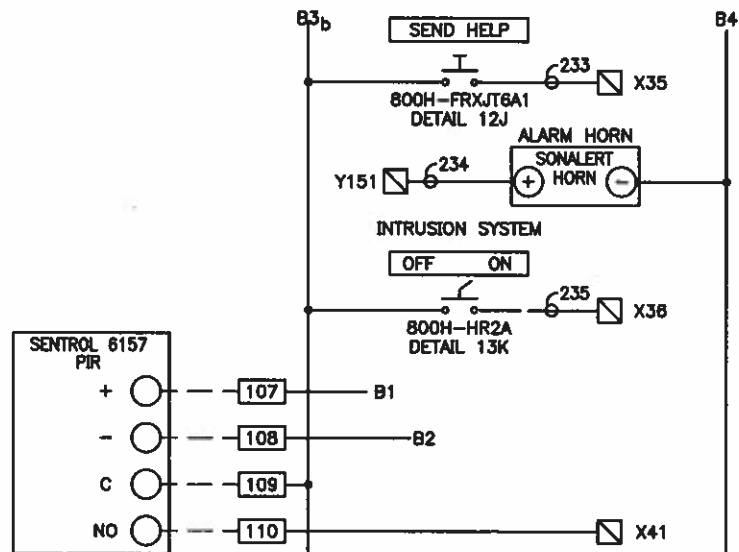
  

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<small>           DRWN JEL 8/15/96 ASMB            O.S. S&amp;B System Specialists            13200 S.E. 30th St.            Bellevue, Washington 98005            S&amp;B Inc. (425)844-1700 Fax (425)746-6312         </small>	<small>           TITLE            SCHEMATIC            MAIN RESERVOIR PUMP STATION            CONTROL PANEL         </small>		
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WATER QUALITY ANALYZER ASSEMBLY  
SEE S&B DWG 12683-401



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	<p>DRWN JEL 8/16/96 ASMB</p> <p>ENGR RTS</p> <p>SCALE</p>	
<p>S&amp;B System Specialists 13200 S.E. 30th St. Bellevue, Washington 98005 S&amp;B inc. (425)844-1700 Fax: (425)748-9312</p>	<p>PROJECT CITY OF MERCER ISLAND, WA WATER SYSTEM</p>	
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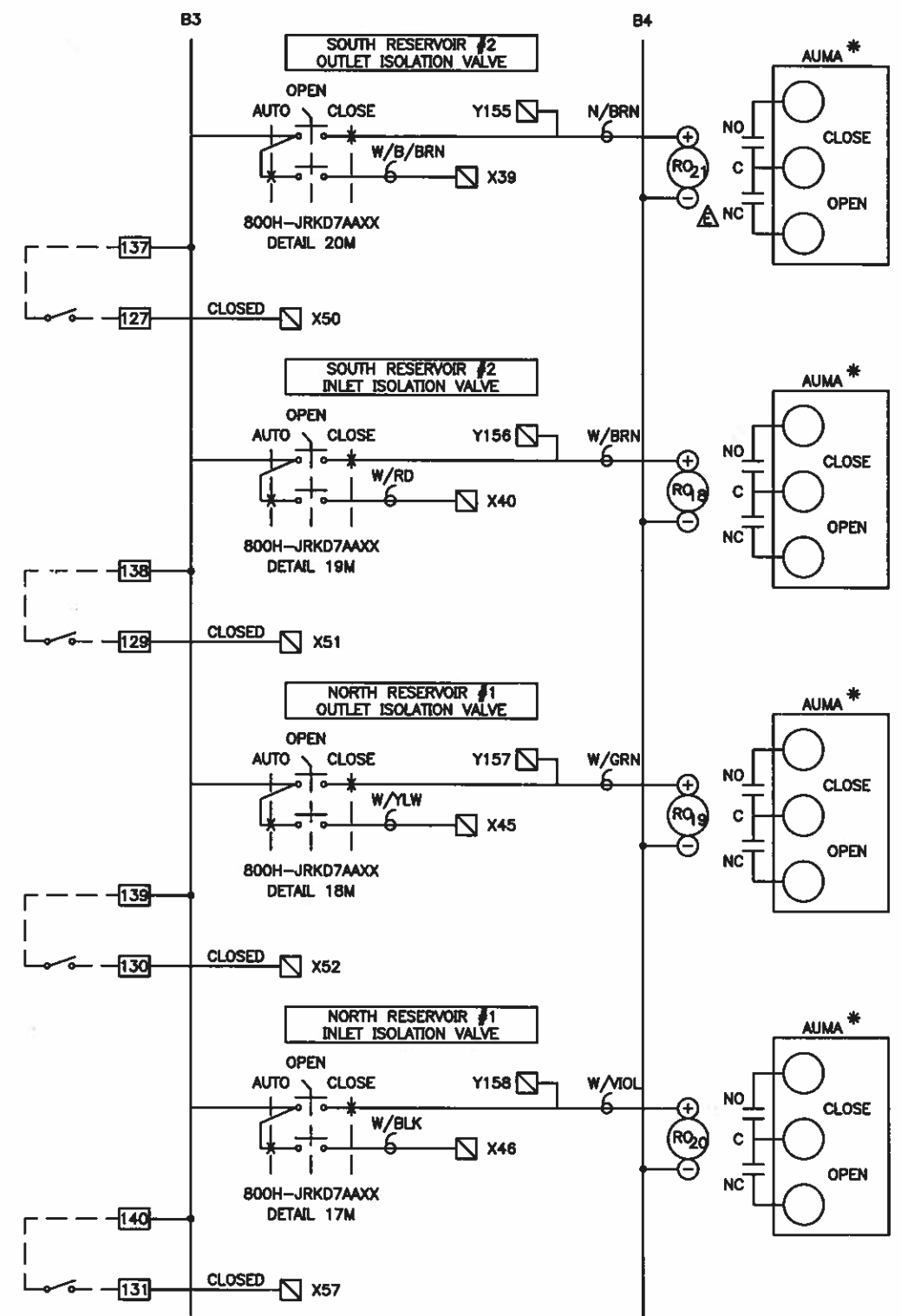
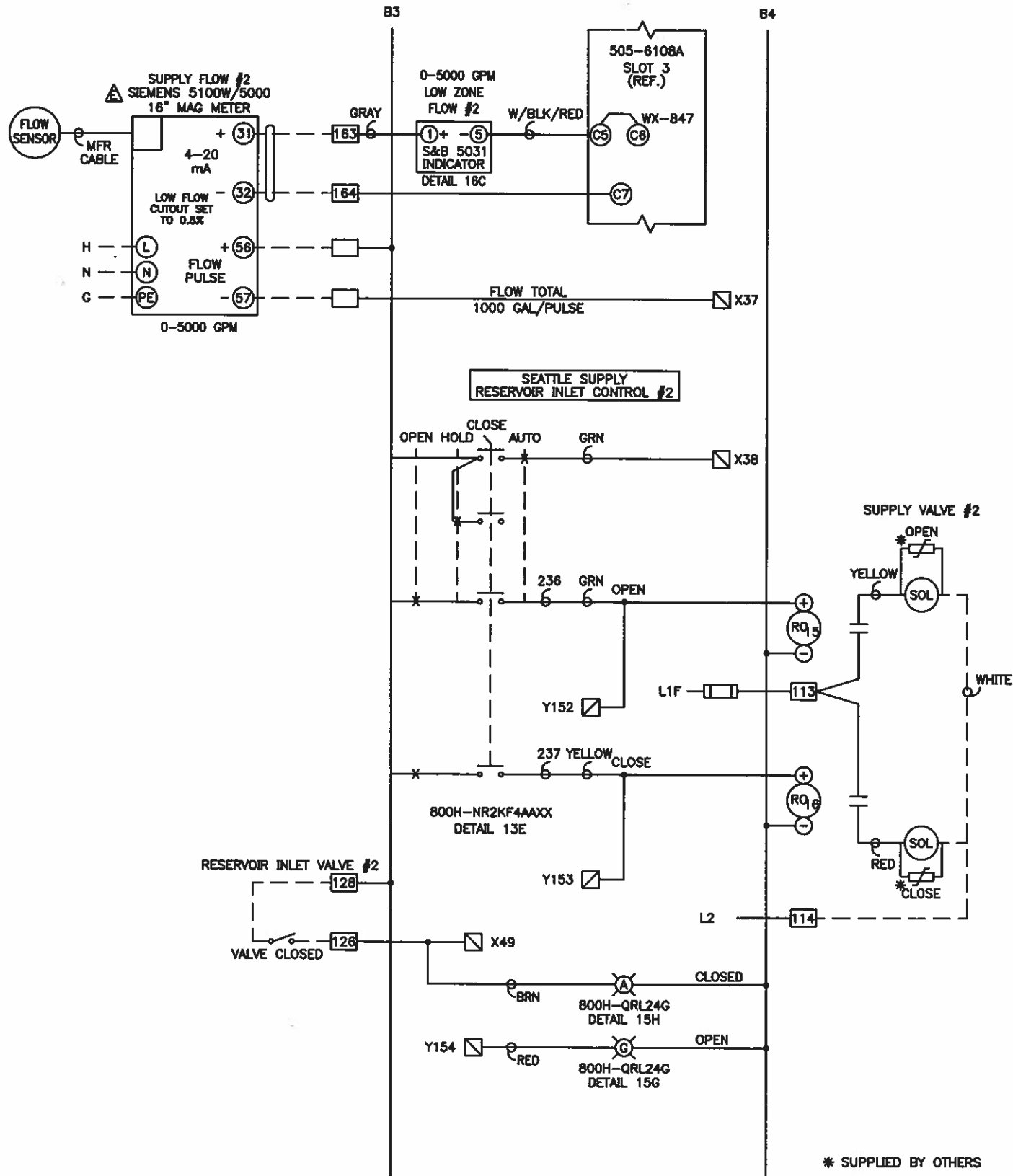
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- ① EXISTING
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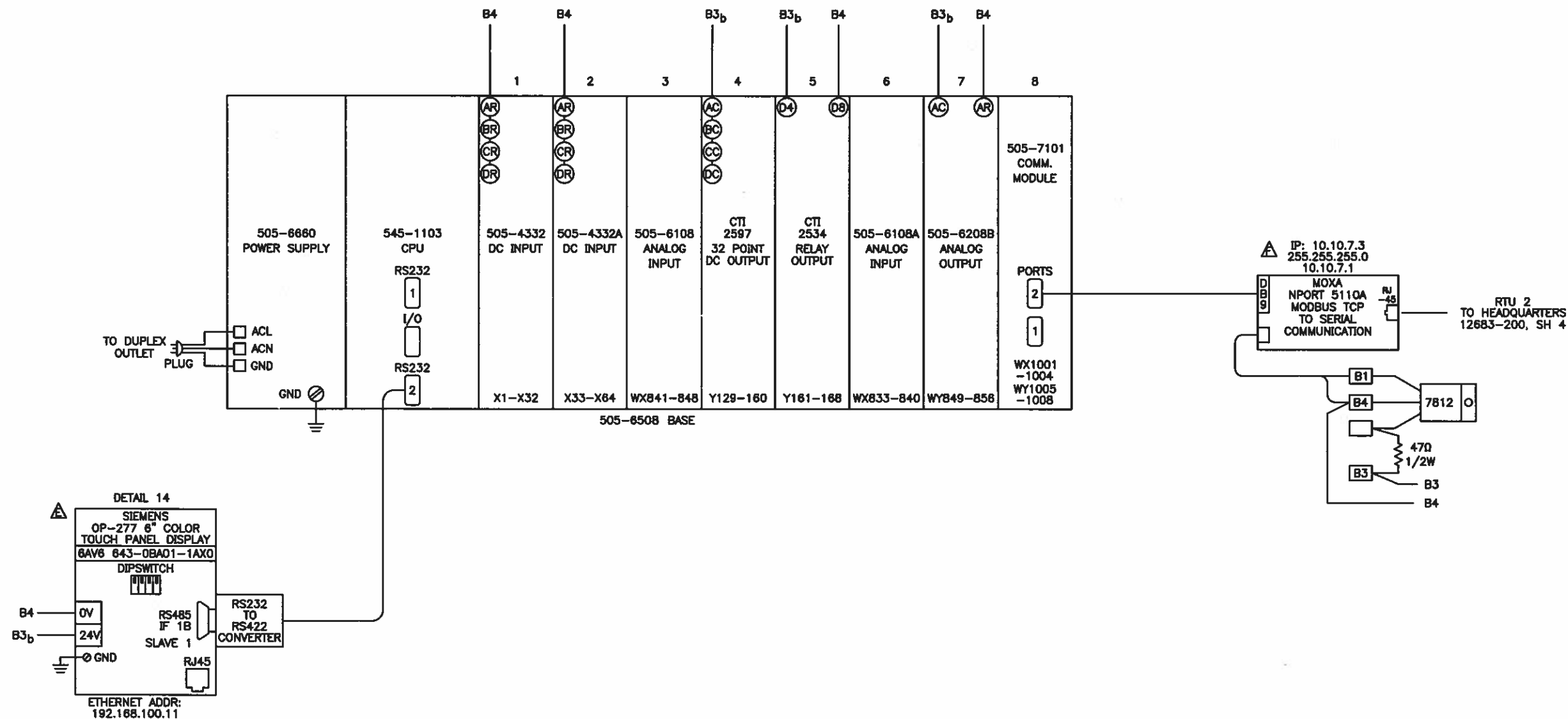
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②	ADDED PRESS, MOVED INPUTS PER FIELD MARK-UPS	EHD	9/12
③	ADDED RES 1&2 FLOWMETERS PER FIELD MARK-UPS	ASW	5/11
④	ADDED EMERGENCY WELL PER S.O. 22149	RTS	2/10
⑤	REMOVED TELEMETRY AND WIRING PER SO 16520	RTS	5/97
⑥	ADDED PER SALES ORDER #16175	RTS	8/96

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FILE: 12683-211-06 LAST 04/19/13 MODIFIED: 6:12 PM	TITLE SCHEMATIC MAIN RESERVOIR PUMP STATION CONTROL PANEL	PROJECT CITY OF MERCER ISLAND, WA WATER SYSTEM	DRAWING NUMBER D 12683 211 6 OF 8 E
		SCALE	APP DATE
		ENGR RTS	SCALE
		SIZE JOB NUMBER	KEY SHEET REV



△	REPLACED CMS5902 MODEM WITH MOXA 5110A	EHD	12/12
△	OP277 WAS COROS 27	EHD	12/09
D	UPGRADED FROM ICL TO CM5902 MODEM	RTS	2/05
C	REMOVED TELEMETRY AND WIRING PER SO 16520		5/97
△	ADDED PER SALES ORDER #16175	RTS	8/96

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S&B System Specialists 13200 S.E. 30th St. Bellevue, Washington 98005 S&B Inc. (425)944-1700 Fax: (425)748-8312		PROJECT CITY OF MERCER ISLAND, WA WATER SYSTEM			
FILE: 12683-211-08 LAST 12/07/12 MODIFIED: 11:50 AM		TITLE SCHEMATIC MAIN RESERVOIR PUMP STATION CONTROL PANEL		DRAWING NUMBER D 12683 211 8 OF 8 F SIZE JOB NUMBER KEY SHEET REV	

SECTION 01 12 16  
WORK SEQUENCE AND CONSTRAINTS

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies project milestones, construction sequencing requirements, work restrictions, and constraints for the Work.
- B. The Contractor shall coordinate all work hours, shutdowns, and closures during the construction period with the Owner and all utility service companies.

**1.02 CONTINUITY OF OPERATIONS**

- A. The existing water distribution system is currently and continuously in operation, and those functions shall not be interrupted except as specified herein. The Contractor shall coordinate the work to avoid any interference with normal operation of equipment and processes.

**1.03 SUBMITTAL**

- A. Procedures: Section 01 33 00.
- B. Action Submittal:
  - 1. The Contractor shall submit a detailed outage plan and time schedule for operations which will make it necessary to remove an item from service. The schedule shall be coordinated with the construction schedule specified in the General Conditions of the Contract Documents and shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the length of time required to complete said operation.
- C. The Contractor shall observe the following restrictions:
  - 1. Systems or individual equipment items shall be isolated, decommissioned, or deenergized, in accordance with the detailed outage plan and schedule.
  - 2. The Owner shall be notified in writing at least one week in advance of the planned operation.

**1.04 SEQUENCE AND SCHEDULE OF CONSTRUCTION**

- A. It is the Contractor's responsibility to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall work.
- B. Contractor shall develop a construction schedule that supports the implementation, testing and commissioning requirements as defined by the contract documents and in Attachment A at the end of this Section.

## 1.05 OTHER CONTRACTS

- A. Sequence, schedule, and coordinate work in and around the activities of other contractors or operations staff on the site to avoid obstruction of work access and interference with, or delay of, the work of other contractors on the site.
- B. Other construction contracts underway at the Reservoir Pump Station site include the following:
  - 1. Booster Chlorination System. The project includes construction of an on-site hypochlorite generation and boosting system, reservoir mixing, and piping modifications. The work for this project is anticipated to be between March 2021 and December 2021.
  - 2. DOH Sanitary Improvements. The work for this project is anticipated to be completed by August 2021.

## PART 2 NOT USED

## PART 3 EXECUTION

### 3.01 ATTACHMENTS

- A. 01 12 16 Attachment A: Work Sequence

<b>Field or Heading</b>	<b>Comment or Description</b>
Work Package Sequence	The order in which a work package shall be constructed unless mutually agreed upon by the Owner, Engineer, and Contractor.
Site	Location of the work.
Work Period Performed	Identifies when the work is constrained to. If Anytime, work can be constructed, tested, and commissioned any season of the year provided the identified constraints are met.
Estimate I/O Point Quantity per Site	Estimate I/O point quantity at the site, as an indicator of size of work for cutover.
Allowed Cutover Time	Any limitation on the amount of time the control system can be down at a site.
Construction Constraints	Any limitation for doing work at the specific site.
Flexibility to Move Construction of Package within Sequence	Identifies if a specific Work Package has flexibility to be moved in the overall sequence. If there is only one site in the work package sequence, not applicable (N/A) is listed.

**END OF SECTION**

**SECTION 01 12 16\_ WORK SEQUENCE AND CONSTRAINTS**

**ATTACHMENT A**

**WORK SEQUENCE**

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**SECTION 01 12 16 ATTACHMENT A**

**WORK SEQUENCE**

<b>Work Package Sequence</b>	<b>Site</b>	<b>Work Period Performed</b>	<b>Estimate I/O Point Quantity per Site</b>	<b>Allowed Cutover Time (Control System Downtime)</b>	<b>Construction Constraints</b>	<b>Flexibility to Move Construction of Package within Sequence</b>
1	SOUTH FIRE STATION	Anytime	10	4 Hours	None.	Flexibility within Work Period
1	NORTH FIRE STATION	Anytime	10	4 Hours	None.	Flexibility within Work Period
2	SPU STATION 171	Anytime	25	6 Hours	None.	N/A
3	FIRST HILL PUMP STATION	Anytime	35	12 Hours	Site must remain in operation during panel cutover.	N/A
4	RESERVOIR PUMP STATION	Construction at site must be complete by August 31, 2021.	100	36 Hours	Site must remain in operation during panel cutover. Coordinate with other Construction at site per Section 01 12 16.	N/A

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## SECTION 01 14 19

### USE OF SITE

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. The Owner's operating personnel will be responsible for operating the existing distribution system throughout the execution of this contract. Equipment presently installed at remote distribution sites must be available to operating personnel at all times for use, maintenance, and repair. If it is necessary in the course of operating a site, for the Contractor to move his equipment, materials, or any material included in the work, Contractor shall do so promptly and place that equipment or material in an area which does not interfere with the site operation. The Contractor shall not adjust or operate serviceable or functioning equipment or systems except as specifically required by this contract.
- B. The existing distribution system will remain in operation throughout the execution of this contract. The Contractor shall schedule and conduct work to minimize necessary shutdowns and interference with normal distribution operations and maintenance.
- C. The Contractor shall notify the Owner, in accordance with Section 01 12 16, 1 week in advance of the time it is necessary to take out of service any existing tank, pipeline, channel, electrical circuit, equipment or structure. The Contractor shall be responsible for providing whatever temporary piping, pumping, power, and control facilities as are required to maintain continuous site operation except as otherwise specified. If a shutdown is required that will impact customer's water service, Contractor shall follow the Owner's shutdown procedures for notifying customers. The integrity of existing site utilities shall be maintained by the Contractor at all times.

#### **PART 2 NOT USED**

#### **PART 3 NOT USED**

**END OF SECTION**

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SECTION 01 22 00  
MEASUREMENT AND PAYMENT

**PART 1 MEASUREMENT AND PAYMENT**

**1.01 GENERAL**

- A. This section generally describes the scope of work included in the bid items listed in the Bidding Schedule and specifies the basis for measurement and payment for work completed under each item. Detailed requirements and extent of work are stated in the applicable specification sections and shown on the drawings. All work required under the Contract shall be included for payment within the bid items listed in accordance with the General Terms and Conditions whether or not each and every required element of work is included in the description.
- B. Progress payments and payment for materials on hand shall be in conformance with the General Terms and Conditions Article 7.
- C. Contractor shall submit properly completed invoice(s) electronically to the Owner's Project Manager or designated representative and also to the Public Works Mailbox at [publicworks@mercergov.org](mailto:publicworks@mercergov.org). Copies of the work order or request form with complete information shall be attached to invoices submitted for payment. The Contractor shall be paid upon submission of a properly itemized invoice, including sales tax. The Invoice will be reviewed by the Owner before payment is made, and the Owner's designated representative shall not authorize payment until, in their opinion, the work has been satisfactorily completed.

**1.02 OPERATIONS AND MAINTENANCE MANUALS**

- A. For items of equipment, acceptable operating and maintenance information shall be delivered to the Engineer before the Contractor will be paid for more than 90 percent of the purchase value of that equipment. Purchase value shall be the net price for the equipment as given on the invoice. Acceptable operating and maintenance information will be that for which the preliminary O&M manual submittal has been returned as No Exceptions Taken or Make Corrections Noted.
- B. Complete final operating and maintenance manuals per Section 01 78 23 must be delivered to the Engineer prior to the Project being 90 percent complete. Progress payments for work in excess of 90 percent completion will not be made until the specified final operating and maintenance information has been delivered to the Engineer.

**PART 2 BID ITEMS**

**2.01 BID ITEM 1 – GENERAL CONDITIONS AND ADMINISTRATIVE WORK – LUMP SUM BID**

- A. Bid Item 1 is for general conditions and administrative work of the Contract, including the following:
  - 1. Project meetings.
  - 2. Construction progress schedule.

3. Progress pay estimates.
4. Project safety requirements.
5. Construction facilities and temporary controls.
6. Traffic control.

- B. Measurement and payment for this item is subject to the percentage of work completed.
- C. Payment will be made monthly on a pro-rata basis for this item as a lump sum.

#### **2.02 BID ITEM 2 – ELECTRICAL WORK – LUMP SUM BID**

- A. Bid Item 2 includes the work of the Electrical Contractor specified in Section 26 05 00.
- B. Measurement and payment for this item is subject to the percentage of work completed.
- C. Payment will be made monthly on a pro-rata basis for this item as a lump sum.

#### **2.03 BID ITEM 3 – CONTROL SYSTEM WORK– LUMP SUM BID**

- A. Bid Item 3 includes the work of the Systems Integrator specified in the Sections in Division 40.
- B. Measurement and payment for this item is subject to the percentage of work completed.
- C. Payment will be made monthly on a pro-rata basis for this item as a lump sum.

#### **2.04 BID ITEM 4 – UNEXPECTED SITE CHANGES – ALLOWANCE**

- A. The price for any work paid for under this Bid Item will be negotiated prior to commencing such work and shall be for work to remedy unforeseen conditions or conflicts, not identified in the Contract Documents. Payment or credits for changes amounting to \$40,000 or less may be made under the Bid Item.
- B. At the discretion of the Owner, the following procedure for Unexpected Site Changes may be used in lieu of the more formal procedure outlined in General Terms and Conditions Article 5. The Contractor will be provided a copy of the completed order for Unexpected Site Changes. The agreement for the Unexpected Site Changes will be documented by signature of the Contractor.
- C. If the Contractor is in disagreement with anything required by the order for Unexpected Site Changes, the Contractor may protest the order as provided in the General Terms and Conditions. Payments or credits will be determined in accordance with the General Terms and Conditions. For the purpose of providing a common Proposal for all Bidders, the Owner has entered the amount of \$40,000 for Unexpected Site Changes in the Proposal to become part of the total Bid by the Contractor.

### **PART 3 NOT USED**

**END OF SECTION**

SECTION 01 31 19  
PROJECT MEETINGS

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies administrative and procedural requirements for meetings during construction.
- B. Contractor and Subcontractor representatives attending meetings must be qualified and authorized to act on behalf of their firms.

**1.02 PRECONSTRUCTION MEETING**

- A. The Engineer will schedule a meeting to be held prior to the Contractor mobilizing and beginning any work. This meeting is to review Construction Documents administration requirements and mobilization procedures.
- B. Meeting Location: City of Mercer Island Public Works Maintenance and Engineering Building, or as mutually agreed.
- C. Participants shall include:
  - 1. Contractor's Project Manager, Superintendent, Safety and Health Officer.
  - 2. Owner, Project Manager.
  - 3. Engineer.
  - 4. Owner's Maintenance and Operation Staff, as appropriate.
  - 5. Others, including major Subcontractors, as appropriate.
- D. Engineer will:
  - 1. Administer the meeting.
  - 2. Record and distribute copies of minutes within seven days of meeting to all meeting participants.
- E. Agenda: Discussion will pertain to detailed information, for example:
  - 1. The Work – including, but not limited to:
    - a. Scheduling and phasing requirements.
    - b. Contractor's use of premises.
    - c. Special conditions and coordination.
    - d. Security.
    - e. Permits.
  - 2. Communications – including, but not limited to:
    - a. Change and persons authorized to direct changes.
    - b. Requests for Information (RFI), field decisions, and clarifications.
    - c. Project meetings.
  - 3. Contractor's Site Specific Safety Plan.

4. Administrative and procedural requirements including, but not limited to:
  - a. Contract modification.
  - b. Progress payment.
  - c. Submittals - including Contractor's Construction Progress Schedule.
5. Owner testing and inspection.
6. Temporary Facilities and Controls including, but not limited to:
  - a. Deliveries and storage.
  - b. Temporary utilities and enclosures.
  - c. Noise and vibration control.
  - d. Utility process shutdowns.
  - e. Contractor parking.
  - f. Housekeeping and waste management.
7. Closeout Procedures – including Project Record documents.

### **1.03 CONSTRUCTION PROGRESS MEETINGS**

- A. Frequency: Monthly, unless otherwise agreed to by the Owner and Contractor.
- B. Meeting Location: City of Mercer Island Public Works Maintenance and Engineering Building, or as mutually agreed.
- C. Participants shall include:
  1. Contractor's Project Manager, Superintendent.
  2. Owner.
  3. Engineer.
  4. Owner's Operation and Maintenance Staff, as appropriate.
  5. Others, as appropriate.
- D. Contractor shall:
  1. Administer the meetings.
  2. Provide schedules, logs and other construction activity data in support of the issues discussed and recorded in meeting minutes.
  3. Record and distribute copies of minutes prior to the next meeting.
- E. Engineer and Owner will:
  1. Review meeting minutes and provide comments as appropriate.
- F. Agenda: Discussion will pertain to items, such as:
  1. Review and approve minutes of previous meeting noting exceptions, if any.
  2. Review progress since previous meeting.
  3. Review plans for progress during subsequent four-week look ahead schedule work period.
    - a. Identify pending meetings.
    - b. Discuss safety activities and any job hazards
  4. Discuss field observations, problems, and conflicts.

5. Review the comprehensive progress schedule, identify problems and discuss mitigation.
6. Review submittal schedule and RFIs.
7. Review proposed changes in the Work and substitution requests.

#### **1.04 DRAFT PROGRESS PAYMENT ESTIMATE REVIEW MEETINGS**

- A. Frequency: Monthly (Meeting may be combined with Construction Progress Meetings in Paragraph 1.03)
- B. Meeting Locations: City of Mercer Island Public Works Maintenance and Engineering Building, or as mutually agreed.
- C. Participants shall include:
  1. Contractor's Project Manager.
  2. Owner.
  3. Engineer.
  4. Others as appropriate.
- D. The Contractor shall:
  1. Administer the meeting.
  2. Present the draft monthly Progress Payment Estimate together with required back up information for review and approval by the Owner and Engineer.
  3. Revise and submit the monthly Application for Payment in accordance with the findings and agreements of the meeting.
- E. The Engineer will:
  1. Review the Contractor's draft Progress Payment Estimate in accordance with the progress of the Work and requirements of General Terms and Conditions Article 7.
- F. Agenda: Discussion will pertain to items such as:
  1. Percent of work complete.
  2. Off-site storage.
  3. Bill of quantities.
  4. Percentage of subcontract payment allocations.
  5. Other items required to be submitted prior to payment, including but not limited to the schedule update, construction photographs, and review of as-built drawings.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

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SECTION 01 32 16  
CONSTRUCTION PROGRESS SCHEDULE

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This section specifies the procedures for preparing and revising the critical path method construction schedule used for planning and managing construction activities. The schedule provides a basis for determining the progress status of the project relative to specific dates and completion time.

**1.02 DESCRIPTION**

- A. The Contractor shall provide a graphic construction schedule prepared by the critical path method (CPM) of analysis. The critical path schedule shall be prepared from estimates of the required duration and sequence for each item of work and function to be performed. A general guide for preparing such a schedule is contained in "The Use of CPM in Construction, A Manual for Contractors," published by the Associated General Contractors of America. Tabulation and analysis of the work schedule shall be performed by computer using a commercially available critical path software program. In addition to the capability to produce tabular reports, the computer software shall plot the construction schedule after the Contractor has produced it in a draft form as required by paragraph 1.03 Submittal Procedures.
- B. The schedule shall depict all significant construction activities and all items of work listed in the breakdown of contract prices submitted by the Contractor in accordance with the General Conditions of the Contract Documents. The dependencies between activities shall be indicated so that it may be established what effect the progress of any one activity has on the schedule.
- C. Time for completion and all specific dates as specified in the Contract Documents and sequencing requirements described in Section 01 12 16 shall be shown on the schedule. Activities making up the critical path shall be identified.
- D. No activity on the schedule shall have a duration longer than 21 days or assigned value greater than \$100,000, except activities comprising only fabrication, and delivery may extend for more than 21 days. Activities which exceed these limits shall be divided into more detailed components. The schedule duration of each activity shall be based on the work being performed during the normal 40-hour workweek with allowances made for legal holidays and normal weather conditions.

**1.03 SUBMITTAL PROCEDURES**

- A. Within 20 days after the date of Notice to Proceed, the Contractor shall complete a construction schedule conforming to paragraph 1.02 Description and representing in detail all planned procurement and on-site construction activities. The schedule shall be prepared on reproducible paper and may be in draft form with legible freehand lines and lettering. Upon completion of the schedule, the Contractor shall submit the original and two copies to the Engineer in accordance with Section 01 33 00.

- B. Within 7 days after receipt of the submittal, the Engineer shall review the submitted schedule and return one copy of the marked-up original to the Contractor. If the Engineer finds that the submitted schedule does not comply with specified requirements, the corrective revisions will be noted on the submittal copy, returned to the Contractor for corrections and resubmitted as specified in Section 01 33 00.

#### **1.04 SCHEDULE REVISIONS**

- A. Revisions to the accepted critical path construction schedule may be made only with written approval of the Contractor and Owner. Changes in timing for activities which are not on the critical path may be modified with written agreement of the Contractor and Owner. A change affecting the contract value of any activity, the timing of any activity on the critical path, the completion time and specific dates as specified in the Contract Documents, and work sequencing (Section 01 12 16) may be made only in accordance with applicable provisions of the General Conditions of the Contract Documents.

#### **1.05 PROJECT STATUS UPDATE**

- A. Project status review and update shall be provided each month as specified in the General Conditions of the Contract Documents.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

SECTION 01 32 20  
SCHEDULE OF VALUES

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. The work specified in this Section establishes the procedures for preparing the schedule of values to be used for preparation of the Contractor's progress pay estimates. Requirements for the submittal of a comprehensive construction schedule and schedule updates are specified in Section 01 32 16.

**1.02 REQUIREMENTS**

- A. Within 14 calendar days following receipt of Notice to Proceed, the Contractor shall submit to the Engineer, for review and approval, a complete breakdown of components of all bid items showing the value assigned to each portion of the work, prepared in such form, and supported by data that substantiates its accuracy as may be required by the Engineer. This schedule of values shall, once approved by Engineer, be used as the basis for reviewing and determining each monthly progress payment estimate and as such shall be subject to periodic review by the Engineer to assure that the schedule of values reasonably represents, in the opinion of the Engineer, the actual value of the individual items of work to be performed. No payments shall be made until the schedule of values has been approved.
- B. The Schedule of Values must be reviewed and accepted by the Engineer as the basis of calculating progress payment. If, in the opinion of the Engineer, the Schedule of Values is unbalanced, the Contractor will be required to present documentation substantiating the proposed values. If, in the opinion of the Engineer, the Schedule of Values lacks sufficient detail to calculate progress payments, the Contractor will be required to submit additional detail. Progress payments subsequent to the required submission date for the construction schedule will be withheld until the Schedule of Values has been accepted by the Engineer.
- C. Unless otherwise approved by the Engineer include each cost category listed below and the total cost assigned to each activity in the Schedule of Values for each line item.
  - 1. Labor
  - 2. Equipment
  - 3. Material
  - 4. Subcontractor
  - 5. Overhead and Profit
- D. The value to be allocated to the mobilization activity(ies) shall not exceed a total of 3 percent of Contract cost. Payment for this item will be made in equal portions in the first three progress payments following start of on-site construction; provided the Engineer is satisfied the Contractor is making a reasonable effort to mobilize for construction in a timely manner. Untimely delays in mobilization, as determined by the judgment of the Engineer, will be cause for postponement of payment for this item. In the event of default of the Contract, no further payments will be made to the Contractor for this item.

- E. If the Contractor intends to propose a construction schedule where there will be more than one substantial completion date, the schedule of values shall be structured to group the activities associated with each substantial completion date together.
- F. For each activity listed below, the associated cost in the Schedule of Values shall be at least the percentage of the Contract cost shown.
  - 1. Operation and Maintenance Data (see Section 01 78 23), 1 percent of the Contract cost upon acceptance of all submittals.
  - 2. Project Record Documents (see Section 01 78 39), 1 percent of the Contract cost upon acceptance of all submittals.
  - 3. Warranties (see Section 01 78 36), 0.25 percent of the Contract cost upon acceptance of all submittals.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

SECTION 01 33 00  
SUBMITTAL PROCEDURES

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes administrative and procedural requirements for submittals.

**1.02 ADMINISTRATIVE REQUIREMENTS**

A. General:

1. Furnish submittal items as specified in the contract documents.
2. Review submittal information to verify it is accurate and fulfills specified submittal requirements before submitting for review and comment.
3. Edit submittal content to clearly indicate only those items, models, or series of equipment, which are being submitted for review. Cross out or otherwise obliterate extraneous materials.
4. Ensure there is no conflict with other submittals and notify the Engineer in each case where the submittal may affect the work of another contractor or the Owner.
5. Coordinate submittals among subcontractors and suppliers including those submittals complying with unit responsibility requirements specified in the contract documents.
6. For each submittal, certify field conditions, compliance with the Contract Documents, and review of the submittal prior to submitting for review.
7. Designate the installation location within the facility, application, or intended purpose for each submittal item. Review comments are solely applicable to the circumstances designated in the submittal.
8. Coordinate submittals with the work so that work will not be delayed. Coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with others.
9. No extension of time will be allowed because of failure to properly schedule, coordinate or compile submittals.
10. Submittals will be rejected for lack of legibility, lack of coordination, ambiguity, or are incomplete. Incomplete submittals will be returned without review.
11. Do not proceed with work related to a submittal until the submittal process is complete. This requires that submittals for review and comment be returned to the Contractor stamped "No Exceptions Taken" or "Make Corrections Noted."
12. If desired, authorize material or equipment suppliers to deal directly with the Engineer regarding a submittal. Such dealings require written authorization from the Contractor and are limited to contract interpretations to clarify and expedite the work.

**1.03 DEFINITIONS**

A. Action Submittals:

1. Action Submittals content require review and response by the Engineer before proceeding with incorporating the subject equipment, materials, or procedure into the work.

2. Review comments on Action Submittals, and perform subsequent actions based on the REVIEW ACTION requirements specified below.
- B. Informational Submittals:
1. Informational Submittals are examined to verify that the specified submittal contents have been furnished as specified.
  2. The Contractor's actions are not contingent on the disposition of review comments on Informational Submittals.
  3. Review comments on Informational Submittals, and perform subsequent actions based on the REVIEW ACTION requirements specified below.
- C. Closeout Submittals:
1. Closeout Submittals consist of documentation that is not available for review at the time Action Submittals are submitted for review or documentation that is typically generated or furnished following incorporation of the equipment, materials, or procedure into the work. Closeout submittals include spare parts inventory listing, spare parts, extra stock materials, special tools and other materials or components that are furnished separate from the installed and completed work.
  2. Review comments on Closeout Submittals, and perform the subsequent actions based on the REVIEW ACTION requirements specified below.
- D. Samples:
1. Samples include partial sections of components, cuts, or containers of materials, color range sets, and swatches showing color, texture and pattern.
  2. Samples may be Action or Informational submittals.
- E. Mock-ups:
1. Mock-ups are scale representations of items to be constructed as part of the work as required in the Contract Documents.
  2. Mock-ups are Action Submittals.
- F. Review Actions:
1. The following definitions and actions are associated with the REVIEW ACTIONS DEFINED below:
    - a. **NO EXCEPTIONS TAKEN**: If the review indicates that the material, equipment or work method complies with the Contract Documents, submittal will be marked "NO EXCEPTIONS TAKEN." Implement the work method or incorporate the material or equipment covered by the submittal.
    - b. **MAKE CORRECTIONS NOTED**: If the review indicates limited corrections are required, submittals will be marked "MAKE CORRECTIONS NOTED." Implement the work method or incorporate the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, provide a corrected copy.
    - c. **AMEND AND RESUBMIT**: If the review reveals that the submittal is insufficient or contains incorrect data, submittals will be marked "AMEND AND RESUBMIT." Do not undertake work until the submittal has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

- d. **REJECTED – SEE REMARKS:** If the review indicates that the material, equipment, or work method does not comply with Contract Documents, the submittal will be marked "REJECTED - SEE REMARKS." Do not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" except at your own risk.
- e. **RECEIPT ACKNOWLEDGED:** This code is assigned to acknowledge receipt of an informational submittal. No further submittal activity is required by the Contractor for the submitted items if the submittal is marked "RECEIPT ACKNOWLEDGED".

#### **1.04 MASTER SUBMITTAL LIST**

- A. General: Immediately following the acceptance of the CPM Schedule by the Engineer, prepare a complete master submittal list of all submittals required by the specifications. Submit this schedule no later than fifteen (15) calendar days after Notice to Proceed. Organize the submittal schedule by principal subcontractor.
- B. Prepare schedule in chronological order. Show category of submittal, generic description of work covered, corresponding specification section number, and scheduled date for first submission.
- C. Maintain the list over the course of construction, and update the list as submittals are completed and transmitted to the Engineer. Provide updated list to Engineer monthly.
- D. Include the following as a minimum in the updated list:
  - 1. Submittal number.
  - 2. Date submitted.
  - 3. Requested time for return of comments.
  - 4. Special requests, if any, for that particular submittal.

#### **PART 2 NOT USED**

#### **PART 3 EXECUTION**

##### **3.01 SUBMITTAL PROCEDURES**

- A. General
  - 1. Engineer will review submittal information and indicate a REVIEW ACTION. Review of submittals does not relieve the Contractor of responsibility for performance of the work according to the Contract Documents.
  - 2. Coordinate submittal transmittal for related elements of work to ensure the submittals are processed as needed to meet the intent of the work and that delays are minimized.
  - 3. See General Terms and Conditions Article 4.9 for product substitutions.
  - 4. A review duration of 28 calendar days is allotted for each submittal, from the date of receipt by the Engineer to the date of return to the Contractor. Submittal review activity will be prioritized based on the order received unless otherwise requested by the Contractor.

- B. Submittal Preparation:
1. Excepting, mock-ups, spare parts, physical samples, and other items that cannot be converted to electronic media, furnish submittal contents electronically in a searchable PDF format.
    - a. Include a table of contents and labeled divider sheets that are coordinated with the table of contents. Provide submittals in searchable PDF format with bookmarks to match the table of contents of each submittal.
    - b. Limit PDF size to 200 pages. Provide multiple volumes if necessary.
    - c. Diagrams, drawings, pictures, and illustrations presented with a consistent orientation.
  2. If electronic submittals are not possible, place a permanent label or title block on each hard copy submittal for identification and submit the following:
    - a. Action and Closeout Submittals: Three copies of submitted information plus one reproducible original.
    - b. Informational Submittals: Three copies of submitted information.
  3. Shop Drawings, Samples and Mock-ups:
    - a. Submit one electronic copy per the requirements described above and the following:
      - 1) Shop Drawings: One reproducible and two prints. One marked up print will be returned to the Contractor when the review is complete.
      - 2) Samples: Two samples.
      - 3) Mock-up: As required by individual specification.
      - 4) Demonstrations: As required to facilitate installation and inspection.
    - b. Reference applicable specifications for additional requirements.
- C. Submittal Completeness:
1. Submittals without all required information are not acceptable and may be marked "REJECTED" and returned without review.
  2. For a submittal to be deemed complete, provide the information required below and specified in specification sections, including those elements in the special transmittal procedures where required.
- D. In the event of the need to "revise and resubmit", provide a complete stand-alone submittal with corrections, revisions, and new information clearly identified.
- E. Resubmit changes to submittals that require a stamp and signature by a licensed engineer or other certification with the requisite stamp and signature or certifications.

### **3.02 TRANSMITTAL PROCEDURE**

- A. General:
1. Unless otherwise specified, complete the Transmittal Form 01 33 00-A specified in Section 01 99 90.
  2. For operation and maintenance manuals, information and data submittals, complete the Transmittal Form 01 78 23-A specified in Section 01 99 90.



3. Use a separate form for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which a submittal is required. Identify the appropriate equipment numbers for submittal documents common to more than one piece of equipment. Submit a single form for multiple items, if the items taken together constitute a manufacturer's package or are functionally related, to facilitate checking or reviewing the group or package as a whole.
4. Assign a unique sequential number to each transmittal form accompanying each item submitted.
  - a. Format submittal numbers as follows: "XXX"; where "XXX" is the sequential number assigned to the original submittal.
  - b. Format resubmittals as follows: "XX XX XX - YYYZ"; where "XX XX XX" is the applicable specification section, "YYY" is the originally assigned submittal number and "Z" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 40 67 00 -3B, for example, is the second resubmittal of submittal 3 related to specification section 40 67 00.
5. Deviation from contract: If deviations from the material, equipment or method of work are proposed, describe the proposed deviation and explain the reason for proposing the deviation under "deviations" on the transmittal form accompanying the submittal copies.

**B. Check Marked Specification Transmittal Procedures**

1. When submittal requirements require a "marked" copy of the specification, provide a copy of the specification marked as indicated below. Provide the following when transmitting the submittal:
  - a. Provide a copy of the specification section(s) that specifies a marked copy of the specification. Include addendum updates and referenced specification sections, with addendum updates. Complete the following:
    - 1) Check-mark each paragraph to indicate submittal compliance with that specification requirement. Check marks (✓) shall denote full compliance with that paragraph as a whole.
    - 2) Mark paragraphs where deviations are proposed by underlining text that is the subject of the proposed deviation. Denoting each proposed deviation with a number in the margin to the right of the identified paragraph and provide a detailed written explanation for each numbered deviation. The remaining portions of the paragraph not underlined signify compliance with specified requirements.
    - 3) The Engineer is the final authority for determining acceptability of requested deviations.
  - b. For equipment specifications, provide a copy of the control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the subject equipment. Complete the following:
    - 1) Mark drawings or diagrams to show specific changes necessary for the equipment proposed in the submittal.
    - 2) If no changes are required, mark the drawings or diagrams with "no changes required".

- C. Provide a Certificate of Unit Responsibility assigning unit responsibility in accordance with the requirements of the specification Section. No other submittal material will be reviewed until the certificate has been received and found to be in conformance with the Specifications.
- D. Samples and Mock-ups:
  - 1. Submit samples and mock-ups in accordance with the Contract Documents. Package samples to facilitate review. Include the following with the Submittal Transmittal Form:
    - a. Generic description of the sample
    - b. Sample source
    - c. Product name and name of manufacturer
    - d. Compliance with recognized standards
    - e. Submittal Number
    - f. Availability and delivery time
    - g. Specification Section
  - 2. Submit samples and mock-ups before installation. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit four units to show variation range.
  - 3. Where samples are for selection of appearance characteristics from a range of standard choices, submit a full set of choices for the material or products.
  - 4. Maintain sets of approved samples and mock-ups at the Project Site, for quality comparisons throughout the course of construction.
  - 5. Demolish and remove all samples and mock-ups prior to substantial completion.

### **3.03 REVIEW PROCEDURE**

- A. General:
  - 1. Engineer will review each submittal, indicate a REVIEW ACTION, and return to the Contractor.
  - 2. Returned submittals indicate one of the following REVIEW ACTIONS: NO EXCEPTIONS TAKEN, MAKE CORRECTIONS NOTED, AMEND AND RESUBMIT, REJECTED – SEE REMARKS, or RECEIPT ACKNOWLEDGED.

### **3.04 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS**

- A. General:
  - 1. Review of contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, does not relieve the Contractor of responsibility for errors therein and is not regarded as an assumption of risks or liability by the Engineer or the Owner, or by any officer or employee thereof, and the Contractor has no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment reviewed. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" means that the Owner has no objection to the Contractor, upon his own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

**END OF SECTION**

SECTION 01 35 23  
PROJECT SAFETY REQUIREMENTS

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies minimum requirements for safety on the construction site including, but not limited to, Contractor responsibility for creating and maintaining a safe jobsite, Contractor safety program submittals, Contractor safety requirements, Contractor safety reporting, fire safety requirements, and hazard communication.
- B. The Contractor is responsible for compliance with all applicable laws and regulations regarding safety whether noted in this section or not. Furthermore, the Contractor is responsible for creating and maintaining a safe working environment on the Project Site whether the requirements of this Section address a particular situation or not.

**1.02 CONTRACTOR RESPONSIBILITY**

- A. The Contractor shall be solely and completely responsible for conditions of the construction site, including safety of all persons and property, during performance of the Work. The Contractor shall maintain the site and perform the Work in a manner which meets or exceeds statutory and regulatory requirements for the provision of a safe place to work and which minimizes safety risks to personnel of the Contractor, Subcontractors, Owner, Engineer, general public or other parties. This obligation shall apply continuously and not be limited to normal working hours.
- B. The Contractor shall ensure that all Contractor and Subcontractor personnel are provided sufficient training, and shall take such actions as are necessary to maintain a safe environment on the construction site. Such training and actions shall include but not be limited to ensuring that such employees are familiar with governing construction safety requirements and the requirements for compliance with applicable regulations. The Contractor shall monitor the jobsite to ensure that employees do not create unsafe conditions for others, and shall notify employees of the requirement to alert the Contractor to any potential health or safety hazard affecting themselves or others, and to comply with the provisions of the Site Specific Safety Plan.
- C. Safety Violations: In the event of Washington Industrial Safety and Health Act (WISHA) violations, by the Contractor or any of its suppliers or Subcontractors of any tier, or unsafe practices involving imminent danger to personnel of the Owner, Engineer, Contractor, Subcontractors, or others, the Contractor shall immediately correct the hazardous situation causing the violation prior to any Work continuing in the affected area. If such violations exist and corrective actions have not been taken by the Contractor, Owner may order the Contractor to stop work, to be followed up in writing the same day, until satisfactory corrective action has been taken.

### 1.03 CONTRACTOR SAFETY PROGRAM AND SAFETY PLAN SUBMITTALS

- A. Company Safety Program: Prior to performing any work on the site, the Contractor shall submit a copy of its Company Safety Program as an Informational Submittal per Section 01 33 00. The Company Safety Program shall contain, at a minimum, the following elements:
1. Organizational Structure: Include names of individuals who will perform safety duties, titles, work assignments, authority and reporting relationships.
  2. Training Program: Who, how and when training is provided; method of employee training concerning safety rules and procedures; training in use of protective equipment.
  3. Protective Equipment: List of personal protective equipment to be provided to employees.
  4. Accident Prevention and Loss Control Plan: Work site inspection and hazard correction procedures; disciplinary procedures for safety infractions; accident response, investigation and reporting procedures.
- B. Site Specific Safety Plan: Prior to performing any work on the site the Contractor shall develop and submit a copy of a Site Specific Safety Plan as an Informational Submittal per Section 01 33 00. The Site Specific Safety Plan shall be tailored to the unique issues of the Project and the specific types of hazards likely to be encountered, be in compliance with WISHA and all other regulatory requirements, and contain, at a minimum, the following elements.
1. Application of Company Safety Program: The Site Specific Safety Plan shall address how the following elements from the Company Safety Program will be specifically applied and modified in addressing unique issues related to the Project: organizational structure, training program, protective equipment.
  2. Specific Hazards: The Site Specific Safety Plan shall address, as applicable, the following, and other specific hazards for the Project:
    - a. Overhead hazards/flying objects
    - b. Open flame/Hot Work
    - c. Hazardous materials and chemical exposure (asbestos, lead, PCB, mercury, mold, etc.)
    - d. Rigging/Aerial lifts and forklifts
    - e. Electrical safety
    - f. Scaffolding and personnel lifts
    - g. Noise and dust
    - h. Lockout/Tagout and control of hazardous energy
    - i. Work in confined spaces
    - j. Housekeeping and safe access
    - k. Fall prevention
    - l. COVID-19 Plan

#### **1.04 CONTRACTOR SAFETY REQUIREMENTS**

- A. Personal Protective Equipment: Contractor shall ensure all construction personnel to be equipped with and utilize Personal Protective Equipment in accordance with Labor and Industries standards. As a minimum requirement, all personnel working on the construction site shall be required to use approved hardhats, high visibility clothing, safety glasses, gloves, and appropriate work footwear.
- B. First Aid: The Contractor shall maintain at its field office, or other well known place at the site, all materials necessary for giving first aid to the injured (e.g., a first aid kit), and shall establish, publish, and make known to all employees procedures for ensuring immediate removal to a hospital or a doctor's care, persons, who may have been injured on the construction site.
- C. Job Hazards Analysis: The Contractor shall plan daily work considering procedures with the potential for personnel injury and implement appropriate practices to avoid injuries with focus on engineering controls, personal protective equipment needs, and mitigation for exposure to cuts and lacerations. At each construction progress meeting, the Contractor shall present its plan for addressing hazards likely to be encountered in the next week.

#### **1.05 CONTRACTOR SAFETY REPORTING**

- A. Reporting Injuries and Incidents: Contractor shall immediately notify the Owner and Engineer of any injury or incident to personnel on the construction site. Contractor shall conduct an immediate investigation with an emphasis on preventative actions and lessons learned. The Contractor shall document the investigation and submit a copy to the Owner within 24 hours of the incident.
- B. Reporting Potentially Serious Hazards: Contractor shall immediately notify the Owner and Engineer of any potentially serious hazard to personnel on the construction site. Contractor shall conduct an immediate investigation and submit a report to the Owner within 24 hours of becoming aware of the potentially serious hazard. The report shall describe the potentially serious hazard, the results of the Contractor's investigation, and any steps the Contractor has taken to prevent an injury or incident from occurring based on the potentially serious hazard.
- C. Emergency Procedures:
  - 1. In the event of emergencies requiring ambulance, fire department, or police assistance call 9-1-1.
  - 2. Should the Contractor find it necessary to call for non-emergency police assistance or protection in the exercise of its responsibilities of the Project, call the City of Mercer Island Police Department at (206) 275-7610.

## 1.06 CONSTRUCTION FIRE SAFETY

### A. "Hot Work" Procedures:

1. Contractor shall establish a system for documentation and control of "hot work" activities which include the use of portable gas, grinding, or arc welding equipment, the storage of flammable materials (e.g., propane, butane, compressed gasses), cutting and welding activities, roofing/hot tar kettle work. Post Hot Work Permits in an accessible and conspicuous location.
2. Conduct operations in a manner that is fire-safe for the work area and adjacent areas.
3. Maintain the premise clear of rubbish, debris, or other materials constituting a potential fire hazard. The local fire code is incorporated herein by reference; adhere to all applicable provisions as determined by the authority having jurisdiction.
4. Whenever practical, perform cutting and welding operations off-site.
5. Prior to conducting "hot work" activities, ensure all of the following fire safety precautions have been taken.
6. Cutting and/or welding equipment must be thoroughly inspected and found to be in good repair, free of damage or defects.
7. A multi-purpose dry chemical, portable fire extinguisher must be located such that it is immediately available to the Work and is fully charged and ready for use.
8. At least one fire alarm pull station or means of contacting the fire department (i.e. site telephone) must be immediately available and accessible to person(s) conducting the cutting/welding operation.
9. Floor areas under and at least 35 feet around the cutting/welding operation must be swept clean of combustible and flammable materials.
10. All construction equipment fueling activities and fuel storage must be located at least 35 feet away from cutting/welding operations.
11. Fire resistant shields (fire retardant plywood, flameproof tarpaulin, metal, etc.), must cover combustible floors.
12. Provide combustible and finished surfaces, equipment, electrical cables, and personnel with protection to prevent damage or injury from molten metal, falling sparks, and welding arcs.
13. Spark/slag catchers (fire retardant plywood, flameproof tarpaulin, metal, etc.), must be suspended below any elevated cutting/welding operation.
14. All floor and wall openings must be covered to prevent sparks/slag from traveling to other unprotected area.
15. Containers in or on which cutting/welding will take place must be purged of flammable vapors.

- B. Occupant Egress in Existing Buildings: The Contractor shall not block active exits, exit hallways, exit corridors, and the exit access to a public way, and they are to remain free of construction materials, equipment, and rubbish at all times, unless approved by Owner.

- C. Emergency Access: Outdoor storage and staging operations and construction fencing shall not impede, restrict or narrow fire fighting access, including roads or lanes, or present a fire exposure to existing buildings. Provide adequate separation between buildings and construction trailers and sheds. Coordinate emergency access changes with emergency services.
  - 1. Access to emergency services including, but not limited to, fire hydrants, fire department connections, fire command centers, fire alarm panels, valves and similar equipment and systems for emergency vehicles and emergency response personnel must be kept free and unobstructed at all times, unless specifically approved by the Owner.
  - 2. Temporary obstruction of emergency access may be allowed for special cases (e.g., crane hoist, etc.) on a short-term basis. A written plan must be submitted to the Owner for approval at least two weeks prior to the scheduled date of obstruction.

#### **1.07 HAZARD COMMUNICATION**

- A. Responsibilities: The Contractor shall provide chemical hazard information (SDS), for all chemical products on the site, including but not limited to all paints, glues, mastics, epoxies and cleaning products. Maintain a 3-ring binder on-site of all SDS for materials used on the Project and indicate where they are used.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

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SECTION 01 45 00  
CONTRACTOR QUALITY CONTROL

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies administrative and procedural requirements for quality control services, field inspections and field testing.
- B. The Contractor is responsible for the quality assurance and quality control of their respective work for the construction of this project in accordance with the Contract Documents.

**1.02 NOT USED**

**1.03 DEFINITIONS**

- A. **Factory Test:** Tests made on various materials, products and component parts prior to shipment to the job site.
- B. **Field Tests:** Tests and analyses made at or in the vicinity of the job site in connection with the actual construction.
- C. **Certified Inspection Report:** Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exceptions included in the report.
- D. **Certificate of Compliance:** Certificate from the manufacturer of the material or equipment identifying said manufacturer, product and stating that the material or equipment meet specified standards, and shall be signed by a designated officer of the manufacturer.
- E. **Standard Compliance:** Condition whereby specified materials or equipment must conform to the standards of organizations such as the American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL) or similar organization.
- F. **Quality Assurance:** The day-to-day, in-process supervisory observations of work and materials conducted by the Contractor to assure that the proper methods and materials are being used and installed by tradesmen.
- G. **Source Quality Control:** The in-process testing and inspections conducted by the Contractor to verify that the materials, equipment; workmanship and shop manufactured constructs are in compliance with the Contract Documents, applicable Codes and standards.
- H. **Field Quality Control:** The testing and inspections conducted by the Contractor in the field during and at the completion of each construct to verify that the in-process and completed construction is in compliance with the Contract Documents, applicable Codes and standards.

## **1.04 SUBMITTALS**

- A. Action Submittals:
  - 1. Procedures: Section 01 33 00.
  - 2. A copy of this specification section with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
  - 3. Check-marks (✓) denote full compliance with a paragraph as a whole. Deviations shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined signify compliance with the specification. Include a detailed, written justification for each deviation. Failure to include a copy of this marked-up specification section, along with justification(s) for requested deviations, with the submittal, is cause for rejection of the entire submittal with no further consideration.
  - 4. If requested by the Engineer during the work, manufacturer's field services and reports.
  
- A. Informational Submittals:
  - 1. Procedures: Section 01 33 00.
  - 2. Manufacturers' field services and reports unless requested by Engineer to be submitted for review.
  - 3. Inspection reports when inspection by the Contractor is specified in the Contract Documents.

## **1.05 REGULATORY REQUIREMENTS**

- A. General: Comply with all Federal, State, and local Codes as referenced herein. Such regulations apply to activities including, but not limited to, site work and zoning, building practices and quality, on and offsite disposal, safety, sanitation, nuisance, and environmental quality.

## **1.06 CONTRACTOR'S RESPONSIBILITIES**

- A. Monitor quality assurance over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Coordinate the schedule for all specified inspections.
- C. Comply fully with manufacturers' instructions, including each step in sequence.
- D. Should manufacturers' instructions conflict with Contract Documents, request clarification before proceeding from Engineer.
- E. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- F. The Contractor shall take all necessary measurements in the field to verify pertinent data and dimensions shown on the Drawings or to determine the exact dimensions of the Work.

**1.07 NOT USED**

**1.08 NOT USED**

**1.09 JOB SITE CONDITIONS**

- A. Schedule to ensure all preparatory work has been accomplished prior to proceeding with current work. Proceeding with the work constitutes acceptance of conditions. Allow adequate time for materials susceptible to temperature and humidity to “stabilize” prior to installation. Establish and maintain environmental conditions (i.e., temperature, humidity, lighting) as recommended by the various material manufacturers for the duration of the work.

**PART 2 PRODUCTS**

**2.01 SOURCE QUALITY CONTROL**

- A. Contractor Responsibilities: Provide source quality control according to paragraph 1.06 herein. Timely prepare and submit submittals, and revise as indicated by review comments. Comply with technical requirements in each specification Section that applies to the work.
- B. Engineer Responsibilities: Facilitate completion of submittal review per Section 01 33 00.
- C. Acceptance Criteria: Acceptable characteristics and quality of a particular item or construct is defined in that item’s or construct’s specification Section.

**PART 3 EXECUTION**

**3.01 FIELD QUALITY CONTROL**

- A. Field quality control responsibilities of the Contractor and Engineer are substantially the same as described in paragraph 2.01, with the exception that this work occurs primarily on the jobsite as the work progresses.
- B. Acceptable characteristics and quality of a particular item or construct is defined in that item’s or construct’s specification Section.

**3.02 NOT USED**

**3.03 CORRECTION OF DEFECTIVE WORK**

- A. Any defective or imperfect Work, equipment, or materials furnished by the Contractor which is discovered before the Final Acceptance of the Work, or during a warranty period, shall be removed immediately even though it may have been overlooked by the Engineer and approved for payment. The Contractor shall repair such defect, without compensation, in a manner satisfactory to the Engineer.
- B. Unsuitable materials and equipment may be rejected, notwithstanding that such defective Work, materials and equipment may have been previously overlooked by the Engineer and accepted or approved for payment.

- C. If any workmanship, materials or equipment shall be rejected by the Engineer as unsuitable or not in conformity with the Specifications or Drawings, the Contractor shall promptly replace such materials and equipment with acceptable materials and equipment at no additional cost to Owner. Equipment or materials rejected by the Engineer shall be tagged as such and shall be immediately removed from the site.
  
- D. The Engineer may order tests of imperfect or damaged Work equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor, and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the Work, equipment, or material was not impaired, the Work, equipment or materials may be deemed acceptable, in the discretion of the Engineer. If the results of such tests reveal that the required functional capability of the questionable Work, equipment or materials has been impaired, then such Work, equipment or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect Work, equipment or material in lieu of performing the tests.

**END OF SECTION**

SECTION 01 50 00  
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section includes the following:
  - 1. Temporary utilities: electricity, lighting, heating, ventilation, telephone service, water, and sanitation facilities.
  - 2. Temporary controls: barriers, fencing, protection of work, and security.
  - 3. Construction facilities: parking, progress cleaning, project signage, and temporary trailers or storage units.

**1.02 TEMPORARY POWER**

- A. The Contractor shall connect to existing power service where feasible. Owner will pay cost of energy used. Contractor shall exercise measures to conserve energy.
- B. Contractor shall make arrangements for additional power requirements, as needed, either with portable generators or with the electrical utility for power takeoff points, voltage and phasing requirements, transformers and metering and pay resulting costs and fees. The Contractor shall provide any special connections that are required.
- C. All costs for installing, maintaining, and removing temporary power facilities are the responsibility of the Contractor.

**1.03 SUBMITTALS**

- A. Procedures: Section 01 33 00.
- B. Action Submittals:
  - 1. Submit a site plan defining the limits of the proposed staging areas and the proposed temporary facilities required to support the work operations. Identify the location of any relocated facilities such as Owner employee parking.

**1.04 TEMPORARY HEATING**

- A. The Contractor shall provide temporary heating of buildings and enclosures as necessary to protect work and material against damage by humidity, dampness, and cold and to facilitate completion of the work. The Contractor shall supply the fuel, equipment and materials required for temporary heating.

**1.05 TEMPORARY VENTILATION**

- A. The Contractor shall ventilate enclosed areas to maintain a safe work environment, to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

#### **1.06 TELEPHONE SERVICE**

- A. Provide, for Contractor's own use, telephone service at the construction site. These telephone costs shall be paid by the Contractor.

#### **1.07 TEMPORARY WATER SERVICE**

- A. The Contractor shall provide for all workers on the project, an adequate and reasonably convenient, uncontaminated drinking water supply. All facilities shall comply with the regulations of the local and State Department of Health.

#### **1.08 TEMPORARY SANITARY FACILITIES**

- A. Contractor shall provide, for Contractor's and Engineer's use, toilet and wash-up facilities for the work force at the site. Comply with applicable laws, ordinances and regulations pertaining to the public health and sanitation of dwellings and camps.

#### **1.09 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities from damage during construction and demolition operations.

#### **1.10 FENCING**

- A. Maintain, at all times during the construction period, fences which shall, to the satisfaction of the Engineer, enclose the areas of the site where the Work is being performed.

#### **1.11 CONSTRUCTION SIGNS**

- A. Commercial or advertising signs for the Contractor, subcontractors, or trade unions are not allowed on the site or site entrance other than a sign to direction for site deliveries.

#### **1.12 CONTRACTOR'S SECURITY**

- A. Where the Contractor's work or facilities modify or impact existing fencing at the site, provide security and facilities to protect the work and existing facilities from unauthorized entry, vandalism, or theft.

#### **1.13 PROTECTION OF NEW WORK AND EXISTING PROPERTY**

- A. Protect existing structures, property, cultivated or planted areas and other surface improvements from damage and provide bracing, shoring or other work necessary for such protection.
- B. Protect installed work and provide special protection where specified in the Specifications.
- C. Repair or replace damaged structures, work, materials or equipment to a condition equal to or better than prior to the damage at no additional cost to the Owner. Repair and/or replacement shall be approved by the Owner.

#### **1.14 MAINTENANCE OF TRAFFIC**

- A. Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian.
- B. Whenever it is necessary to cross, obstruct or close roads, driveways and walks, whether public or private, provide and maintain suitable and safe bridges, detours or other temporary expedients for the accommodation of public and private travel, and give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.
- C. Traffic control shall be provided, in accordance with Section 01 55 00.

#### **1.15 PARKING AND STAGING**

- A. The Contractor shall prepare the designated staging area at the start of construction and establish designated areas for employee parking, temporary trailers and/or storage units, and material and equipment laydown. The contractor is responsible for preparing and maintaining this staging area throughout the construction period.
- B. Space for Contractor staging area shall be provided at the Reservoir Pump Station site, as required. Contractor shall coordinate with the Owner on the designated staging area location at the site.

#### **1.16 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Clean the exposed surfaces of piping, ductwork or equipment which has become soiled with dirt, mortar, or other materials before covering with insulation, painting, or enclosing in the building structure.
- E. Remove waste materials, debris and rubbish from the site immediately upon such materials becoming unfit for use in the work. In the event that this material is not removed, the Owner reserves the right to have the material removed and the expense charged to the Contractor.
- F. Provide a legal, off-site debris disposal site.

- G. Contractor shall not burn or bury rubbish or waste materials within the limits of the Project.
- H. Replace air-handling filters if units were operated during construction. Clean ducts, blowers, and coils, if necessary.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**



SECTION 01 55 00  
TRAFFIC CONTROL

**PART 1 GENERAL**

**1.01 WORK INCLUDED**

- A. Work specified in this section includes providing for the safe and expeditious movement of vehicular traffic on the project site, public roads, and rights-of-way.

**1.02 REFERENCES**

- A. This section contains references to the following documents. They are a part of this section insofar as specified and modified herein. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

Reference	Title
ANSI	American National Standards Institute, Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)

**1.03 SUBMITTALS**

- A. General:
  - 1. Procedures: Section 01 33 00.
  - 2. The Vehicular Traffic Control Plans shall be updated and submitted to the Engineer whenever significant changes in traffic control measures are necessary.
- B. Action Submittals
  - 1. Vehicular Traffic Control Plan:
    - a. Submit a Vehicular Traffic Control Plan, as described herein. No vehicular traffic disruptions or revisions shall be made before receiving approval of the Vehicular Traffic Control Plan from the Engineer.
    - b. The Vehicular Traffic Control Plan shall consist of drawings and narrative sufficient to describe the methods to be used for control of vehicular traffic on all roads on or adjacent to the construction site. The plan shall include:
      - 1) Drawings showing vehicular routing during each phase of the work, including permanent and temporary routing of all roadways.
      - 2) Drawings showing the location of barricades, lighting, signing, and any other vehicular traffic control devices anticipated to be used during each phase of the work.
      - 3) Arrangements for vehicular access to buildings on the site.
      - 4) Arrangements for emergency access to buildings on the site.
      - 5) Anticipated traffic blockages resulting from construction activities.
      - 6) Anticipated locations where temporary pipes, cables, or hoses will be placed across or parallel to roadways. Drawing details of ramps over utilities or shallow burial placement and protection cover.

- 7) Projected volumes of truck traffic for each phase of the work. Projections shall be expressed as the average daily (one-way) truck trips on a monthly basis.
- 8) Areas within Contractor's staging area designated for parking shall be identified on drawings.

#### **1.04 GENERAL MAINTENANCE OF TRAFFIC REQUIREMENTS**

- A. Maintain vehicular traffic within public rights-of-way in accordance with the current edition of the Manual of Uniform Traffic Control Devices and as supplemented by these specifications.
- B. Maintain emergency access to and from buildings within the construction site. There shall be no delay to medical, fire, police, or other emergency vehicles with flashing lights or sirens. Alert all flaggers and personnel of this requirement.
- C. Adhere to all traffic regulations of the City of Mercer Island and other local jurisdictions as applicable. Notify the Owner, Engineer, and the local Police, Fire and Public Works Departments with jurisdiction over the Work, daily of each work activity related to the Project and at least 48 hours prior to full roadway closures, re-openings, or partial obstruction of public rights of way.
- D. Maintain vehicular traffic at all locations to the greatest extent possible and reduce and reroute traffic only for the shortest time possible, consistent with effective construction operations. The required travel lanes shall not be blocked by the Contractor's activities, including trucks delivering materials. Material deliveries and other related trucking activities shall occur in the Contractor's protected work area.
- E. Provide signs and other devices, and erect and maintain barricades, standard construction signs, warning signs, and detour signs as necessary to alert and forewarn the public at all times. Do no work on or adjacent to roads or trails until all necessary signs and traffic control devices are in place. Standard roadway warning construction signage used on this project shall be a minimum 30 inches by 30 inches.
- F. The legal speed limits in the vicinity of the project site are posted. The maximum allowable speed limit on the plant site is 10 miles per hour. The Contractor shall inform its subcontractors of these limits and the importance of strict adherence to all traffic regulations and shall repeat this information at regular safety and subcontractor coordination meetings throughout the life of the Contract.
- G. Interference or delay to the Contractor's operations resulting from safeguarding traffic will not be a basis for extra compensation.

#### **1.05 REGULATION OF TRUCK TRAFFIC**

- A. For the purposes of this section, a truck shall be a motor vehicle defined as a truck, truck tractor, tractor, or semi-trailer in RCW 46.04, used for transporting materials, equipment, or other property, and having a gross vehicle weight of 10,000 pounds or more.

- B. The Contractor shall restrict truck traffic to and from the construction site to the hours between 7:00 a.m. and 6:00 p.m. on weekdays. No truck traffic shall be allowed at other times or during weekends or holidays, except with the written authorization of the Engineer. In the event that construction activities require truck traffic outside the hours listed in this paragraph, the Contractor shall request approval from the Owner or Engineer at least fourteen (14) calendar days prior to the date of such construction activities. This request shall include the anticipated time and duration of the activities and the reasons why the activities cannot be undertaken within the hours listed in this paragraph.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

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SECTION 01 66 00  
PRODUCT STORAGE AND HANDLING REQUIREMENTS

**PART 1 GENERAL**

**1.01 DAMAGE**

- A. Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Owner.

**1.02 NOT USED**

**PART 2 EQUIPMENT**

**2.01 PACKAGE AND MARKING**

- A. All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.
- B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or subassembled units where possible.

**2.02 IDENTIFICATION**

- A. Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel. Location of label will be easily visible.

**2.03 SHIPPING**

- A. Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.
- B. Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. The Contractor shall bear the costs arising out of dismantling, inspection, repair and reassembly.

**2.04 FACTORY APPLIED COATINGS**

- A. Unless otherwise specified, each item of equipment shall be shipped to the site of the work with the manufacturer's shop applied epoxy prime coating. The prime coating shall be applied over clean dry surfaces in accordance with the coating manufacturer's recommendations. The prime coating will serve as a base for field-applied finish coats..

## **2.05 STORAGE**

- A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.
- B. Equipment and materials to be located outdoors may be stored outdoors if protected against moisture condensation. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

## **2.06 PROTECTION OF EQUIPMENT AFTER INSTALLATION**

- A. After installation, all equipment shall be protected from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and painting of new or existing piping and equipment. As a minimum, vacuum cleaning, blowers with filters, protective shieldings, and other dust suppression methods will be required at all times to adequately protect all equipment. During concreting, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switchgear, unit substation, and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.

## **PART 3 NOT USED**

**END OF SECTION**

SECTION 01 74 19  
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes administrative and procedural requirements for salvaging recycling, and disposal of nonhazardous construction waste.

**1.02 PERFORMANCE REQUIREMENTS**

- A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators.
- B. Packaging: Salvage or recycle 100 percent of the following uncontaminated packaging materials:
  - 1. Paper
  - 2. Cardboard
  - 3. Boxes
  - 4. Plastic sheet and film
  - 5. Polystyrene packaging
  - 6. Wood crates
  - 7. Plastic pails

**PART 2 NOT USED**

**PART 3 EXECUTION**

**3.01 WASTE MANAGEMENT PRACTICES**

- A. Provide containers, storage, signage, transportation, and other items as required.
- B. Train workers, subcontractors, and suppliers on proper waste management practices.
- C. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- D. Control runoff from waste management areas to prevent pollution of surface waters and groundwater.

**3.02 RECYCLING DEMOLITION AND CONSTRUCTION WASTE**

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Stockpile materials away from construction area. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Do not store within the drip line of trees.
  - 3. Remove recyclable waste and transport to recycling receiver or processor.

### **3.03 DISPOSAL OF CONSTRUCTION AND DEMOLITION WASTE**

- A. Remove waste materials and legally dispose of them in a location acceptable to authorities having jurisdiction.
- B. Do not allow waste materials to accumulate on-site.
- C. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- D. Do not burn waste materials.

**END OF SECTION**



## SECTION 01 74 23

### FINAL CLEANUP

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This section specifies administrative and procedural requirements for final cleaning.

##### **1.02 CLEANING**

- A. General cleaning and maintenance of the site during construction is required by General Terms and Conditions Section 3.10; cleaning required for specific trades of work is specified in sections pertaining to that trade of work.
1. If Contractor fails to clean up as provided herein, and after reasonable notice from Owner, Owner may do so and the cost thereof shall be back charged to Contractor.
- B. Final Cleaning: Perform the following cleaning operations as a prerequisite for Owner's final inspection. The following are examples, but not by way of limitation, of cleaning levels required:
1. Remove labels that are not permanent labels.
  2. Remove protective coatings from all accessories.
  3. Remove and clean glazing compound, and other substances that are noticeable vision-obscuring materials, from transparent and reflective materials including mirrors and glass in doors and windows inside and out.
  4. Clean exposed exterior and interior hard-surfaced finishes, including cabinet interiors, to a dust-free condition, free of stains, films and similar foreign substances.
  5. Leave floors broom-clean. Vacuum carpeted surfaces and clean consistent with manufacturer's recommendations for installation.
  6. Clean plumbing fixtures to a sanitary condition.
  7. Clean light fixtures and lamps.
  8. Remove and clean all construction debris and refuse from: a) roofs, mechanical and electrical rooms, tunnels and equipment vaults; b) limited access spaces including above ceiling areas and shafts, and; c) physically inaccessible components of the Work including gutters, downspouts, floor drains and other drainage systems.
  9. Wipe surfaces of mechanical and electrical equipment including elevator equipment and similar equipment. Remove excess lubrication and other substances.
  10. Clean the Project Site of rubbish, litter and other foreign substances. Sweep paved areas broom clean, remove stains, spills, and other foreign deposits.
  11. Leave entire Project Site clean and ready for occupancy. All interior and exterior building and fixture surfaces shall be turned over to the Owner in a new condition, free of all damage, dust, dirt, spots, stains, encrustations, and other blemishes.
  12. Vacuum debris from completed control panels and cabinets.

- C. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner per Section 01 74 19 – Construction Waste Management and Disposal. Do not use Owner's containers for trash generated by cleaning or construction, unless approved by Owner.
1. Where extra materials of value remain after completion, or associated work has become Owner's property, arrange for disposition of these materials as directed.
  2. Use low toxic cleaning supplies for surfaces, equipment and personnel use. Submit products for Owner's information.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

SECTION 01 75 00  
TESTING AND COMMISSIONING

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies the requirements for testing and commissioning of the equipment constructed as part of the Work. Testing and commissioning include documentation and procedures, preoperational testing, component testing, functional testing, operational testing, commissioning, and transfer to the Owner.

**1.02 DEFINITIONS**

- A. Site: A facility within the water distribution system with a common process goal including all associated structures, equipment, and materials (e.g., First Hill Pump Station).
- B. Equipment: All mechanical, electrical, and instrumentation equipment and devices specified in the Contract Documents to provide a completed operational site.
- C. System:
  - 1. An arrangement of items, such as equipment, structures, components, piping, wiring, materials, or incidentals, so related or connected to form an identifiable, unified, functional, operational, safe, and independent part of the process system.
- D. Preoperational Test Phase:
  - 1. Factory testing as specified in the individual equipment specifications.
  - 2. Manufacturer's standard factory and recognized industry practice tests.
- E. Component Test Phase:
  - 1. Conducted by Contractor to verify operation and performance of equipment and components adheres to the Contract Documents.
  - 2. Includes:
    - a. Equipment and Component Checkout: Testing to verify that equipment and components have been installed correctly (e.g., is the electrical wiring properly connected?).
    - b. Equipment Performance Testing: Following completion of equipment and component checkout, performance testing of equipment, if specified in the individual equipment specification.
- F. Functional Test Phase:
  - 1. Follows completion of Component Test Phase for all equipment included within the system.
  - 2. Overall test of system control and operation demonstrating interlocks, alarms, data acquisition, and control, over entire range of operation, including, but not limited to, the following:
    - a. Changes in operating parameters (e.g., does the system respond correctly to a change in influent flow rate?).
    - b. Alarm conditions (e.g., does the system respond correctly to a high level alarm?).

- c. Sequences (e.g., does the system correctly start/stop/control equipment for an automatic startup or shutdown sequence?).
  - d. Operator interface (e.g., does the system respond correctly to set point and/or discrete changes made at the operator interface?).
- G. Operational Test Phase: Testing the system in full operation and to demonstrate that all functional requirements of the Contract Documents have been met.
- H. Commissioning: The initiation of full site operation by the Owner's personnel under actual conditions. During this period, complete Operational Testing of systems that could not be completed during the Operational Test Phase.

**1.03 QUALITY ASSURANCE**

- A. Reference Standards:
- 1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
  - 2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM	ASTM International
IEEE	Institute of Electrical and Electronics Engineers
ISA	International Society of Automation
NEMA	National Electrical Manufacturer's Association

- B. Install testing equipment and apparatus with personnel trained in the trades and professions required to assure competent workmanship.
- C. Supervise the installation of specific equipment testing items specified to be accomplished by factory-trained installation specialists furnished or certified by the equipment manufacturers.

**1.04 SUBMITTALS**

- A. Procedures: Section 01 33 00.
- B. Refer to Sections 40 61 21 and 26 05 00.

**1.05 CONTRACTOR'S TESTING MANAGER**

- A. Minimum Qualifications:
  - 1. Refer to Section 40 61 21.

- B. The Contractor's Testing Manager shall be responsible for the following:
1. Review and approve all functional and performance tests, results, and documentation for all equipment and systems.
  2. Develop schedules for all testing, integrate testing into the master construction activity schedule, and coordinate all required testing.
  3. Develop test procedures and forms for documentation of all equipment tests, system functional tests, and cross system functional tests, unless otherwise noted in individual sections. Test procedures shall be in accordance with equipment manufacturer's recommendations, where applicable. Test procedures shall fully describe system configuration and steps required for each test. The test procedures reflect actual procedures used. The test procedures shall be appropriately documented so that another party can repeat the test to verify results.
  4. Complete test procedure schedule, procedures, forms, and other documentation.
  5. Coordinate directly with all subcontractors, manufacturer's representatives, the Programmer, and the Engineer specific to their responsibilities.
  6. Observe the startup and initial testing of equipment and then all final testing of equipment and systems.
  7. Note and document any inconsistencies or deficiencies in system operations and ensure system compliance or recommend modifications to system design which will enhance system performance.
  8. Coordinate testing participation and approve procedures, after verifying that previous test phases have been satisfactorily conducted and the systems are ready for the next test phase.
  9. Document all test results and assemble a final report.
  10. Participate in commissioning activities.

## **1.06 SEQUENCE AND COORDINATION**

- A. Test Phases and Sequence:
1. Preoperational Test Phase: Factory Tests.
  2. Component Test Phase: Field testing of installed equipment, including component checkout and performance testing.
  3. Functional Test Phase: Operation and control strategy testing for complete systems.
  4. Operational Test Phase: Operation of systems comprising a complete site using process fluids present during normal operation of the site. During this phase, the site is operated by Owner's personnel, with assistance from the Contractor. During this phase, complete any testing activities that cannot be completed during the Functional Test Phase due to testing limitations.
  5. Commissioning: Operation of related systems comprising a complete site, demonstrating performance of all functions for which it was designed.
- B. If, during testing, a portion of the Work fails to comply with the Construction Documents and is adjusted, altered, renewed, or replaced, tests on that portion, and other affected portions shall be repeated within a reasonable time.
- C. Test results shall be within the tolerances set forth in the Contract Documents. If no tolerances are specified, conform to tolerances established by recognized industry practice.

- D. Where, in the case of an otherwise satisfactory installed test, doubt or dispute arises between the Owner and the Contractor regarding the results, methods, or test equipment, the Owner may request the test be repeated. The repeat test using modified methods or equipment will be paid per the following:
1. If the test results confirm the satisfactory installed test results, costs for the repeat test will be paid by the Owner through the change order process, in accordance with General Terms and Conditions Article 5.
  2. If the results of test fail to comply with the Contract Documents, all costs associated with the repeat tests and equipment necessary to comply with the Contract Documents are at the Contractor's expense.

## **PART 2 NOT USED**

## **PART 3 EXECUTION**

### **3.01 TEST MATERIALS AND EQUIPMENT**

- A. Provide test gauges, meters, recorders and monitors, as required, to supplement or augment the instrumentation system specified in the Contract Documents. Select devices designed to measure the performance of the specific equipment and systems. Instruments to be recently calibrated.

### **3.02 INSTALLATION**

- A. Install all equipment in accordance with manufacturer's requirements and the Contract Documents. Notify the Engineer of any conflict between a manufacturer's installation recommendations and the Contract Documents.

### **3.03 TESTING**

- A. General Requirements:
1. Test and inspect equipment, partially completed, or fully completed portions of the work to demonstrate compliance with the Contract Documents.
  2. Pay all testing costs, including temporary facilities and connections.
  3. Test the following:
    - a. Electrical devices in accordance with Division 26.
    - b. Process control system devices in accordance with Division 40.
  4. Obtain Owner's approval for testing only after Engineer's inspection of equipment for conformance with the Contract Documents.
  5. Tests and inspections shall be in accordance with recognized standards of the industry.
- B. Procedures:
1. To prevent equipment damage, design testing procedures to duplicate, as nearly as possible, conditions of operation. Once the testing procedures have been reviewed and approved by the Engineer, organize into system test packages and include the proper checkout, alignment, adjustment, and calibration signoff forms for each item of equipment.

2. Jointly use forms with the Engineer to ensure that documentation for each electrical and instrumentation equipment item has been properly recorded for installation and testing. Failure to follow the Owner approved procedure will result in non-acceptance of the equipment.
  3. Fulfillment of the test and inspection requirements are by either of the following:
    - a. Tests and inspections performed in Engineer's presence, or
    - b. Certificates or reports of tests and inspections performed by persons or organizations approved by Owner.
  4. Maintain the systems test packages, which contain tests and sign-off forms including, but not limited to, equipment, electrical, and instrumentation on-site. Submit test packages to the Engineer for inspection upon request.
- C. Preoperational Test Phase:
1. Test items at the place of manufacture during or upon completion of manufacture, as specified. Tests shall be comprised of, but not limited to, electric and instrumentation tests, performance and operating tests, recognized industry practice tests, and tests specified in the individual equipment specifications.
- D. Component Test Phase:
1. General:
    - a. Equipment to be tested to the specified requirements before a system is placed into operation.
    - b. Incorporate Contract Document requirements into the installed tests and inspection procedures and proceed in a logical, step-wise sequence to ensure that the installed equipment has been properly assembled, serviced, aligned, adjusted, connected, and calibrated prior to operation.
    - c. Perform all changes, adjustments, or replacements required to make the equipment operate.
  2. Equipment and component checkout procedures include, but are not limited to:
    - a. Testing specified in the individual equipment specifications.
    - b. Electrical system testing as specified in Division 26.
    - c. Process control system testing as specified in Division 40.
    - d. Testing, checking and correcting deficiencies of:
      - 1) Power, control and monitoring circuits for continuity prior to connection to power source.
      - 2) Voltage of all circuits.
      - 3) Phase sequence.
      - 4) Instrumentation and control signal generation, transmission, reception and response.
      - 5) Tagging and identification systems.
      - 6) Proper connections, alignment, calibration and adjustment.
    - e. Calibrate all instrumentation, alarms, and safety equipment.
    - f. Perform other tests, checks, and activities required to make component ready for Functional Test Phase.

E. Functional Test Phase:

1. General:

- a. Once the Owner approves the Component Test Phase results and finds no deficiencies in that portion of the work, test and operate all individual Systems under specified operating conditions to determine as comprehensively as possible whether the equipment and System meet the functional requirements of the Contract Documents.
- b. Following Functional Testing:
  - 1) Check equipment for loose connections, unusual movement or other indications of improper operating characteristics.
  - 2) Correct deficiencies to the Owner's satisfaction.
  - 3) Disassemble and inspect equipment which exhibits unusual or unacceptable operating characteristics. Repair or remove from the site and replace with new. Test until equipment complies with the Contract Documents.

2. Functional test procedures include, but are not limited to, the following:

- a. Demonstrate discrete and analog points are displayed on graphics screens.
- b. Demonstrate operator entries via operator interface are communicated to the control system.
- c. Demonstrate entries via the control system for the equipment and systems as described in Division 40.
- d. Verify discrete and analog inputs from field devices update operator interface panel.
- e. Demonstrate operator entries via interface panel control as described in Division 40.
- f. Whenever possible actuate all alarms from field devices by physically changing actual operating condition so that field device causes alarm. Perform similar exercising of instruments across their range of operation. Electronically simulate conditions only when physical initiation is not possible. Provide and complete a checklist to demonstrate that all alarms are received on operator interface.
- g. Test to the Owner's satisfaction prior to proceeding to Operational Test Phase.

F. Operational Test Phase:

1. General:

- a. Operational testing shall be performed after Functional Testing has been completed. Operational testing is a demonstration period with the system in full operation. During this time, the Owner operates the system over a continuous twenty-one (21) day period.
- b. Coordinate to ensure site operations are not compromised.
- c. Prior to start of Operational Test Phase, configure all systems for complete automatic operation as specified in Division 40.

2. Refer to Section 40 61 21 for Operational Test procedures and requirements.

### 3.04 COMMISSIONING

- A. After successful completion of the Operational Test Phase, completion of specified training, and submission of all specified documentation, the Commissioning Period begins.



- B. The Contractor shall be available at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being constructed.
- C. The Owner's personnel will be responsible for operation of the site. The site shall be fully operational and capable of providing normal flows.
- D. The Owner will be responsible for costs of continuous normal operational and routine maintenance during Commissioning.
- E. The Contractor shall be responsible for all costs of necessary repairs or replacements required to keep the site operational. Failures of equipment will require restart of Commissioning Period.
- F. Provide required skilled labor to support the Owner around the clock to ensure the site maintains its fully operational mode and to address any warranty or performance issues in a timely manner that prevents adverse impact to the performance of the site.
- G. The Commissioning Period is 4 weeks without equipment failures for all sites being commissioned. Failure of equipment or facilities where, in the opinion of the Owner, a significant interruption or impact to performance occurs will be grounds for restarting the Commissioning Period.

### **3.05 SCHEDULING**

- A. Identify time frames for testing and commissioning activities in the Construction Progress Schedule specified in Section 01 32 16.
- B. Update schedule as the testing process occurs.
- C. Use daily and hourly scheduling when required by the tasks to be completed and coordinated.

**END OF SECTION**

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SECTION 01 77 00  
CLOSEOUT PROCEDURES

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section specifies the following sequence and procedures for Project closeout:
  - 1. Final Inspection.
  - 2. Substantial Completion (per General Terms and Conditions Section 7.5).
  - 3. Final Completion (per General Terms and Conditions Section 7.8)
  - 4. Contract Completion.

**1.02 FINAL INSPECTION**

- A. Request for Final Inspection: complete the following actions prior to the Engineer's Final Inspection.
  - 1. Final Cleaning per Section 01 74 23.
- B. Final Inspection: Upon receipt of the Request for Final Inspection, the Engineer will commence Final Inspection and, as necessary, provide a Corrective Work Items List. If a list of Corrective Work Items List is issued, make the required corrections and/or identify items that, in the opinion of the Contractor, are not required by the Construction Documents; resolve these items with the Engineer.
- C. Re-Inspection: After completing the Corrective Work Items List and noting completion of each item, request a re-inspection. Items whose completion is delayed due to circumstances acceptable to the Owner will be exceptions. Engineer will confirm completion of the Corrective Work Items List. If Engineer is required to perform more than one re-inspection, costs for additional inspections shall be borne by the Contractor.

**1.03 SUBSTANTIAL COMPLETION**

- A. Prior to Substantial Completion: Substantial Completion is achieved when the Work, or portion of the Work, other than incidental Corrective Work Items (punch list), is complete. Tasks to complete prior to Substantial Completion include, but are not limited to, the following:
  - 1. Removal of temporary facilities and controls not required in other areas.
  - 2. Waste properly disposed per Section 01 74 19.
  - 3. Final cleaning complete per Section 01 74 23.
  - 4. Completion of all testing, training, and commissioning per Sections 01 75 00 and 40 61 21 and demonstration and training per Section 01 79 00.
  - 5. Spare parts delivery and acceptance per Divisions 26 and 40.
  - 6. Accepted preliminary O&M manuals, per Section 01 78 23.

#### **1.04 FINAL COMPLETION**

- A. Prior To Final Completion: Final Completion is achieved when all Work is fully complete in accordance with the Construction Documents. Task to complete include, but are not limited to, the following:
1. All Work is complete and correct to the satisfaction of the Owner.
  2. All temporary facilities and controls removed.
  3. All waste properly disposed per Section 01 74 19.
  4. All cleaning complete per Section 01 74 23.
  5. Final Operation and Maintenance Manuals provided per Section 01 78 23.
  6. Warranties and Bond Manual submitted per Section 01 78 36.
  7. Submittal of the Project Record Documents per Section 01 78 39.
  8. All final permits submitted.
  9. All Change Orders are approved and signed by both parties.

#### **1.05 CONTRACT COMPLETION**

- A. Refer to General Terms and Conditions Section 7.8.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

SECTION 01 78 23  
OPERATION AND MAINTENANCE DATA

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section specifies Operation and Maintenance (O&M) manuals.
- B. Refer to Section 01 22 00 – Measurement and Payment for requirements related to when O&M information shall be provided in relation to payment for individual pieces of equipment and in relation to overall project payment.

**1.02 SUBMITTALS**

- A. Action Submittals
  - 1. Procedures: Section 01 33 00
  - 2. Provide completed Operational and Maintenance Transmittal Form (Form 01 78 23-A). Form is located in Section 01 99 90.
  - 3. Preliminary O&M Manuals
    - a. At least thirty (30) days prior to the Operational Test Phase specified in Section 01 75 00, submit one hard copy and one electronic copy of the Preliminary Operation and Maintenance manuals. Identify copies as “Preliminary.”
    - b. Engineer will complete review of preliminary O&M manuals and deliver review comments within twenty (20) days of receipt.
    - c. Preliminary O&M manuals must be accepted prior to the on-site training specified in 01 79 00. Acceptable operating and maintenance information will be that for which the submittal has been returned as No Exceptions Taken or Make Corrections Noted.
  - 4. Final O&M Manuals
    - a. Final O&M Manuals are a requirement for achieving Physical Completion, as specified in 01 77 00 – Closeout Procedures.
    - b. Submit Final O&M manuals addressing all of Engineer’s review comments made on Preliminary O&M Manuals submittal.
    - c. Provide one electronic copy of the final O&M Manual for review. When final O&M manual submittal review is returned as No Exceptions Taken, submit two hard copies.

**1.03 OPERATION AND MAINTENANCE MANUAL**

- A. Operation and Maintenance Manuals shall contain all the information needed to operate, maintain and repair all systems and equipment and material provided.

- B. Group equipment and components by equipment/component type. Match testing, training and commissioning systems as much as possible. The information provided shall include, but not be limited to, the following:
1. General: The names, addresses, and telephone numbers of the manufacturer, the nearest manufacturer's representative, and the manufacturer's nearest supplier of equipment and parts. Include the manufacturer's web site information.
  2. Operating Instructions:
    - a. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.
    - b. Service Requirements: Provide instructions for services to be performed by the operator such as adjustments, maintenance, and inspection.
    - c. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product and describe conditions under which product should not be allowed to operate.
  3. Preventive Maintenance:
    - a. Provide manufacturer's preventative maintenance schedule for routine inspections, tests, and adjustments required to ensure proper and economical operation and minimize repairs. Provide manufacturer's projection of preventive maintenance man-hours, by type of craft, on a daily, weekly, monthly, and annual basis.
  4. Corrective Maintenance:
    - a. Troubleshooting Guides and Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
    - b. Wiring and Control Diagrams: Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring terminals identically to actual installation.
    - c. Maintenance and Repair Procedures: Provide instructions and list tools required to restore equipment to proper operational condition.
    - d. Removal and Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, subcomponents, and accessories. Provide tolerances, dimensions, settings, and adjustments required. Include a combination of text and illustrations.
    - e. Spare Parts and Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Identify spare parts and supplies that require a long lead time. Provide list prices.
    - f. Corrective Maintenance: Provide manufacturer's projection of corrective maintenance man-hours by type of craft. Separately identify and tabulate corrective maintenance requiring equipment manufacturer's participation.

5. Appendices:
  - a. Parts Identification and Assembly Drawings: Identify each component, subcomponent, and accessory subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification. When illustrations omit the part numbers and description, cross reference the illustrated part to the listed part. Group parts by components, subcomponents, and accessories.
  - b. Training Requirements: Provide manufacturer's information for use in Owner training.
  - c. Testing Equipment and Special Tool Information: Provide information on required test equipment; provide information on special tools needed for the operation, maintenance, and repair.
- C. Following the acceptable installation and operation of an equipment item, the item's instructions, procedures and wiring diagrams shall be modified and supplemented by the Contractor to reflect any field changes or information requiring field data. As-constructed wiring diagrams shall be included in the final O&M manual submittal.
- D. Hard copies shall be bound in slant-D, 3 ring 4" capacity ring view binders with insertable clear vinyl overlay on the front cover and spine. The binders shall have heavy duty nylon reinforced hinges.
  1. Provide typed cover slip sheet identifying Project name, equipment name, equipment number(s), Contractor, and date. Provide typed spine slip sheet identifying equipment name, equipment number(s), and date. For the final Operation and Maintenance Manual leave the date blank.
  2. Each copy shall have a typed index and tabbed dividers corresponding to the index numbering between equipment categories or specification sections.
  3. Each volume shall not exceed 3-1/2 inch thickness of paper contents.
- E. Deliver electronic copies via USB flash drive.
  1. Electronic O&M manuals shall be in searchable Adobe Acrobat PDF format. Include a table of contents and labeled divider sheets that are coordinated with the table of contents. Provide manuals in searchable PDF format with bookmarks to match the table of contents.
  2. Organize electronic O&M manuals by volume to match hard copy requirements in Paragraph 1.03.D.
  3. Where scanned pages are used, each scanned page shall be provided with a bookmark and identified in the index. In addition, annotate each scanned page identifying the content. For example, for a scan of a Special Warranty, insert an annotation in the file stating "Special Warranty Documentation, Page 1."
  4. Index each manual with hyperlinks and bookmarks to each section.
  5. Consistently orient all diagrams, drawings, pictures and illustrations.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**



## SECTION 01 78 36

### WARRANTIES

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's Standard Product Warranties and Special Warranties.
- B. Refer to General Terms and Conditions Section 7.9 for the required terms of the Contractor's warranty.
- C. If there is any discrepancy in the Contract Documents regarding the warranty period or its date of commencement, the passage granting the Owner the longest warranty period ending on the latest date shall govern.
- D. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors that are required to countersign Special Warranties with the Contractor.

##### **1.02 DEFINITIONS**

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by Standard Product Warranties or to provide greater rights to the Owner. Refer to individual sections of the Specifications for Special Warranty requirements.

##### **1.03 WARRANTY REQUIREMENTS**

- A. All warranties begin at the date of Substantial Completion for the site, portion of the Work, or piece(s) of equipment for which Substantial Completion has been issued.
- B. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to access the failed, warranted Work.
- C. Upon determination that Work covered by a warranty has failed, correct or replace the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of correcting, replacing, retesting, and recommissioning defective Work regardless of whether the Owner has benefited from use of the Work.

- D. When Work covered by a warranty has failed and been corrected, replaced, retested, and recommissioned, reinstate the warranty by written endorsement. The reinstated warranty duration shall be the equivalent of that for the original warranty.
- E. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- F. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- G. The Owner reserves the right to refuse to accept Work for the Project where a Special Warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- H. Owner acceptance of warranties does not relieve the Contractor of the warranty requirements specified in General Terms and Conditions Section 7.9.
- I. Ensure all Standard Product Warranties and Special Warranties are transferrable to Owner.

#### **1.04 SUBMITTALS**

- A. Action Submittals
  - 1. Procedures: Section 01 33 00.
  - 2. Preliminary and Final Warranties and Bonds Manuals: Assemble executed licenses, certificates, warranties, special warranties, bonds, and any required service and maintenance contracts from the respective manufacturers, suppliers, and Subcontractors. Provide two (2) preliminary review copies, identified "Preliminary." Provide two (2) final signed copies of the Warranties and Bonds Manual following review and acceptance of the preliminary manual by the Owner.
  - 3. Provide electronic copies preliminary and final Warranties and Bonds Manual in scanned Adobe Acrobat (.pdf) file format.
  - 4. Include complete information for each of the following with the preliminary and final Warranties and Bonds Manual:
    - a. Table of Contents arranged by specification section.
    - b. Product or work item, including applicable specification section number(s) per the Contract Documents.
    - c. Firm, with name of principal, address, telephone number, email address, and web site address.
    - d. Scope of warranty.
    - e. Start date of warranty or service and maintenance contract.
    - f. Duration of warranty or service and maintenance contract.
    - g. Notification procedures.
    - h. Instances which might affect validity of warranty or bond.

- i. Contractor, name of responsible principal, address, and telephone number.
- j. For Special Warranties, prepare a written document containing all pertinent information and ready for execution by the required parties.

**PART 2 NOT USED**

**PART 3 NOT USED**

**END OF SECTION**

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SECTION 01 78 39  
PROJECT RECORD DOCUMENTS

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section specifies requirements for project Record Drawings.

**1.02 DEFINITIONS**

- A. **Contract Drawings:** Drawings that are part of this Contract. Contract drawings include drawings distributed by Addenda and modified or added by Change Order.
- B. **Record Drawings:** Record Drawings shall include updated Contract Drawings depicting actual work as installed by the Contractor. Record Drawings shall include changes from RFIs, Change Orders, field conditions, and shall depict to actual number and dimension the as-constructed work shown and specified in the Contract with isometric drawings, schematic drawings, or with instructions to “field route” or “homerun” the installation. Record drawings shall include updated working drawings to depict actual work as installed by the Contractor and submitted under Division 40. Record Drawings shall include Record Circuit and Panel Schedules and Conduit and Cable Lists.
- C. **Working Drawings:** Shop drawings, shop plans, or any other supplementary plans or similar data that the Contractor submits to the Engineer for approval.

**1.03 SUBMITTALS**

- A. Procedures: 01 33 00
- B. Action Submittals:
  - 1. Final Record Drawings, Record Circuit and Panel Schedules, and Conduit and Cable Lists shall be submitted as specified. The Contractor shall submit red-line mark-ups of all Contract Drawings depicting work that deviates from the Contract Drawings. Drawings shall depict as-constructed equipment and raceway lay-out conditions. These drawings shall be identified as Final Record Drawings. The drawings shall be prepared in conjunction with all of the Contractor’s subcontractors and suppliers in accordance with Paragraph 2.01 below. The redline mark-ups shall utilize standard engineering drafting methods and inclusion of NOTES and KEY NOTES where notes are applicable. References to other documentation such as RFIs are not acceptable; the changes described in that documentation shall be depicted on the drawings.
  - 2. The Contractor shall submit Record Drawings of all Circuit and Panel Schedules and Conduit and Cable Lists depicting as-built conditions. Drawings shall be prepared in conjunction with all of the Contractor’s subcontractors and suppliers.

3. Contractor-Prepared Drawings: The Contractor shall submit AutoCAD \*.dwg files and .pdf plots of all drawings prepared by the Contractor and all of its subcontractors and suppliers depicting work in all disciplines in accordance with this and other Sections. The Contractor shall submit the AutoCAD files for Contractor-Prepared Drawings on CDs or DVDs along with the Final Record Drawings and Record Schedules and Lists specified.
  - a. Contractor shall submit the final Contractor-Prepared Drawings as AutoCAD files and .pdf plots at the end of the project. Upon completion of the project Work, the Contractor shall provide the final Record Drawings to the Engineer as a condition of Physical Completion.
4. All drawings provided in electronic format shall be provided in the latest release of AutoCAD at the time of the submittal. Contractor shall update and maintain drawings in the latest version of AutoCAD throughout this project. Drawing format shall include borders and title blocks clearly identifying Contract, equipment, and the scope of the drawing. Drawings shall be legible at a 50 percent reduction; reduced drawings will be used for insertion in operations and maintenance manuals. Text size shall be 0.125 inch for 22 x 34 inch drawings and 0.063 inch for 11 x 17 inch drawings.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. The marked-up Record Drawings shall be available for review by the Owner and Engineer at all times. The Record Drawings shall be maintained on full-size drawings 22-inch by 34-inch bond paper, reproduced from the most recent version of the appropriate drawings, stamped "Record Drawings" and marked up to reflect the "as-built" and "as-constructed" conditions of the Contract Drawings. Contractor provided equipment, junction boxes, panels, cabinets, etc. shall be shown, including conduit specified in the Contract Drawings as isometrics drawings, schematic drawings, or with instructions to "field route" or "homerun" the installation.
- B. The Record Drawings shall be marked up with all of the Contractor's subcontractors and suppliers using the methods and devices described below. Record Drawings shall be prepared for all disciplines and mark-ups shall be shown on all affected drawings.
- C. The Record Drawings and the Record Circuit and Panel Schedules and Conduit and Cable Lists shall, as a minimum, include the following:
  1. All Contract drawings and Contractor-Prepared drawings, via submittal, of the electrical and instrumentation work required to perform the Contract.
  2. All Contract schematics and Contractor-Prepared schematics, via submittal, of internal wiring of supplied equipment. The Contractor shall utilize the equipment supplier's drawings when preparing Record Drawings for connection of said equipment.
  3. All Contract circuit and panel schedules and conduit and cable lists.
- D. Record Drawings and the Record Circuit and Panel Schedules and Conduit and Cable Lists shall show all of the Contractor's work.

## **2.02 MARKING DEVICES**

- A. The Contractor shall utilize standard drawing and drafting tools to draw straight and neat lines depicting elements added to and changed on the drawings. The Contractor shall cloud all areas on the drawings where additions or changes occur. All clouded areas shall be dated to indicate the date the change is being recorded. The drawing markings shall, unless directed otherwise, use the following color coding:
  - 1. Additions – Red.
  - 2. Deletions – Green.
  - 3. Comments – Blue.
  - 4. Dimensions – Graphite.

## **PART 3 EXECUTION**

### **3.01 RECORDING**

- A. In addition to the items above, the following additional construction items shall be recorded on the Record Drawings:
  - 1. Electrical schedules and diagrams: Raceway, conduit, and cable schedules and lists listing actual raceway and conductor sizes and routing along with the quantity of the actual cables carried in each. Information is to be based on field cable pulling records.
  - 2. Field changes of dimensions and details.
  - 3. Changes made by Change Order.

### **3.02 RECORD DRAWING REVIEW AND ACCEPTANCE**

- A. Record Drawings and Raceway, Conduit, and Cable Schedules and Lists will be used to verify and document progress. The Engineer will not field verify all drawing additions and changes but rather will conduct random spot checks of the drawings by field verifying the accuracy of additions and changes. The Engineer will initial all clouded drawing changes that were field verified. Where the Engineer finds greater than 10% errors in the accuracy of the drawing additions and changes in any month's drawing set review, the Contractor shall be responsible for engineering fees to conduct a detailed review of the drawing set.
- B. All inaccuracies in the Record Drawings, Schedules, and Lists uncovered through random spot checks or in a subsequent detailed review shall be corrected prior to acceptance.
- C. The Contractor shall submit a Transmittal of Final Project Record Documents. The Transmittal of Final Project Record Documents shall be submitted and accepted by the Engineer prior to the Engineer signing off on the portion of the work as being complete. The transmittal of the Final Record Drawings shall include the electronic version of the Record Drawings and Record Conduit, and Cable Schedules and Lists.

### **3.03 RECORD DRAWING PAYMENT**

- A. Payment for Project Record Documents shall be as specified in Section 01 32 16.

**END OF SECTION**

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SECTION 01 79 00  
DEMONSTRATION AND TRAINING

**PART 1 GENERAL**

**1.01 DESCRIPTION**

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

**1.02 QUALITY ASSURANCE**

- A. Where required by the detailed specifications, the Contractor shall provide on-the-job training of the Owner's personnel. The training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

**1.03 SUBMITTALS**

- A. Procedures: Section 01 33 00.
- B. Action Submittals:
  - 1. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials that are used during the training shall be included.
  - 2. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date and time of each training session.
  - 3. Submittals shall be made not less than 30 days prior to provision of the training.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. Where specified, the Contractor shall conduct training sessions for the Owner's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available to the Owner at least 30 days prior to the date scheduled for the individual training session.

**2.02 LOCATION**

- A. Training sessions shall take place at the site of the work at the Reservoir Pump Station, or as mutually agreed.

## 2.03 LESSON PLANS

- A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.
- B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids, and reference material shall be the property of the Owner and shall be suitably bound for proper organization and easy reproduction.

## 2.04 FORMAT AND CONTENT

- A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:
  - 1. Familiarization
    - a. Review catalog, parts lists, drawings, etc., which have been previously provided for the utility files and operation and maintenance manuals.
    - b. Check out the installation of the specific equipment items.
    - c. Demonstrate the unit and indicate how all parts of the specifications are met.
    - d. Answer questions.
  - 2. Safety
    - a. Using material previously provided, review safety references.
    - b. Discuss proper precautions around equipment.
  - 3. Operation
    - a. Using material previously provided, review reference literature.
    - b. Explain all modes of operation (including emergency).
    - c. Check out Owner's personnel on proper use of the equipment.
  - 4. Preventive Maintenance
    - a. Using material previously provided, review preventive maintenance (PM) lists including:
      - 1) Reference material.
      - 2) Daily, weekly, monthly, quarterly, semiannual, and annual jobs.
    - b. Show how to perform PM jobs.
    - c. Show Owner's personnel what to look for as indicators of equipment problems.
  - 5. Corrective Maintenance
    - a. List possible problems.
    - b. Discuss repairs--point out special problems.
    - c. Open up equipment and demonstrate procedures, where practical.
  - 6. Parts
    - a. Show how to use previously provided parts list and order parts.
    - b. Check over spare parts on hand. Make recommendations regarding additional parts that should be available.

7. Local Representatives
  - a. Where to order parts: name, address, telephone.
  - b. Service problems:
    - 1) Who to call.
    - 2) How to get emergency help.
8. Operation and Maintenance Manuals
  - a. Review any other material submitted.
  - b. Update material, as required.

## **2.05 VIDEO RECORDING**

- A. The Owner may elect to record each training session. In which case, the Owner will retain the services of a commercial video taping service. The Contractor shall advise all manufacturers providing training sessions that the material will be video taped..

## **PART 3 EXECUTION**

### **3.01 SUMMARY**

- A. Training shall not be performed until the submittals specified above have been reviewed and accepted by the Engineer.
- B. Preliminary operation and maintenance manuals shall be approved, as specified in 01 78 23, prior to the individual training session for the associated equipment.
- C. The Contractor shall furnish ten copies of necessary training manuals, handouts, visual aids and reference materials at least 1 week prior to each training session.
- D. The following services shall be provided for each item of equipment or system as required in individual specification sections. Additional services shall be provided, where specifically required in individual specification sections.
  1. As a minimum classroom equipment training for operations personnel will include:
    - a. Using slides and drawings, discuss the equipment's specific location and an overview.
    - b. Purpose and function of the equipment.
    - c. Identify and discuss safety items and procedures.
    - d. Routine preventative maintenance, including specific details on ancillary components.
    - e. Operator detection, without test instruments, of specific equipment trouble symptoms.
    - f. Routine disassembly and assembly of equipment if applicable (as judged by the Owner on a case-by-case basis) for purposes such as operator inspection of equipment.
  2. As a minimum, hands-on equipment training for operations personnel will include:
    - a. Identify location of equipment and review the purpose.
    - b. Discuss and perform the preventative maintenance activities.

- c. Perform routine disassembly and assembly of equipment if applicable.
- d. Identify and review safety items and perform safety procedures, if feasible.
- 3. Classroom equipment training for the maintenance and repair personnel will include:
  - a. Theory of operation.
  - b. Description and function of equipment.
  - c. Normal and major repair procedures.
  - d. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
  - e. Routine and long-term calibration procedures.
  - f. Safety procedures.
  - g. Preventative maintenance such as battery replacement.
- 4. Hands-on equipment training for maintenance and repair personnel shall include:
  - a. Locate and identify equipment components.
  - b. Review the equipment function and theory of operation.
  - c. Review normal repair procedures.
  - d. Review and perform the safety procedures.
  - e. Perform Owner approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

**END OF SECTION**

SECTION 01 99 90  
REFERENCE FORMS

**PART 1 FORMS**

**1.01 DESCRIPTION**

- A. The forms listed below and included in this section are referenced from other sections of the project manual:

<b>Form No.</b>	<b>Title</b>
01 33 00-A	Submittal Transmittal Form
01 78 23-A	Operation and Maintenance Transmittal Form
01 78 23-B	Equipment Record Form
26 05 00-A	Wire and Cable Resistance Test Data Form
40 61 13-A	Loop Wiring and Insulation Resistance Test Data Form
40 61 13-J	Individual Loop Test Data Form

**01 33 00-A. SUBMITTAL TRANSMITTAL FORM**

**Submittal Transmittal**

Submittal Description:	Submittal No: <sup>1</sup>	Spec Section:
------------------------	----------------------------	---------------

	Routing	Sent	Received
Owner:	Contractor/CM		
Project:	CM/Engineer		
	Engineer/CM		
Contractor:	CM/Contractor		

We are sending you:

- Attached
- Under separate cover via \_\_\_\_\_
- Submittals for review and comment
- Product data for information only

Remarks: \_\_\_\_\_

Item	Copies	Date	Section No.	Description	Review action <sup>a</sup>	Reviewer initials	Review comments attached

<sup>a</sup>Note: NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected  
Attach additional sheets if necessary.

**Contractor**

Certify either a or b:

- a.  We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).
- b.  We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.	Deviation

Certified by: \_\_\_\_\_

Contractor's Signature: \_\_\_\_\_

<sup>1</sup>See Section 01 33 00-1.04. A, Transmittal Procedure.

**01 78 23-A. OPERATION AND MAINTENANCE TRANSMITTAL FORM**

Date:	Submittal No: <sup>2</sup>
To:	Contract No:
	Spec. Section:
	Submittal Description:
Attention:	From:

Checklist	Contractor		Engineer	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Start-up, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance man-hours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks:

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Contractor's Signature : \_\_\_\_\_

<sup>2</sup> See Section 01 33 00-1.04.A, Transmittal Procedure.

## 01 78 23-B. EQUIPMENT RECORD FORM

Equip Descrip		Equip Loc	
Equip No.	Shop Dwg No.	Date Inst	Cost
Mfgr		Mfgr Contact	
Mfgr Address		Phone	
Vendor		Vendor Contact	
Vendor Address		Phone	

Maintenance Requirements	D	W	M	Q	S	A	Hours



**26 05 00-A. WIRE AND CABLE RESISTANCE TEST DATA FORM**

Wire or Cable No.: \_\_\_\_\_ Temperature, °F: \_\_\_\_\_

Location of Test	Insulation resistance, megohms
1.	
2.	
3.	
4.	
5.	
6.	
7.	

CERTIFIED \_\_\_\_\_ Date \_\_\_\_\_  
Contractor's Representative

WITNESSED \_\_\_\_\_ Date \_\_\_\_\_  
Owner's Representative

**40 61 13-A. LOOP WIRING AND INSULATION RESISTANCE TEST DATA FORM**

Loop No.: \_\_\_\_\_

List all wiring associated with a loop in table below. Make applicable measurements as indicated after disconnecting wiring.

Wire No.	Panel Tie	Field TB	Continuity Resistance <sup>a</sup>		Insulation Resistance <sup>b</sup>			
			Cond./ Cond.	Cond./ Shield	Shield/ Gnd.	Shield/ Cond.	Cond./ Gnd.	Shield/ Shield
A			--	(A/SH)				
B			(A/B)	--				
C			(A/C)	--				
D			(A/D)	--				
etc.								

NOTES:

- a. Continuity Test. Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of  $\pm 2$  ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.
- b. Insulation Test. Connect one end of a 500 volt megger to the panel ground bus and the other sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED \_\_\_\_\_ Date \_\_\_\_\_  
Contractor's Representative

WITNESSED \_\_\_\_\_ Date \_\_\_\_\_  
Owner's Representative

**40 61 13-J. INDIVIDUAL LOOP TEST DATA FORM**

Loop No.: \_\_\_\_\_

Description: (Give complete description of loop's function using tag numbers where appropriate.)

- a. Wiring tested:  
(Attach test form 40 61 13-A)
- b. List step-by-step procedures for testing loop parameters. Test loop with instruments, including transmitters and control valves, connected and functioning. If it is not possible to produce a real process variable, then a simulated signal may be used with the Engineer's approval.

CERTIFIED \_\_\_\_\_ Date \_\_\_\_\_  
Contractor's Representative

WITNESSED \_\_\_\_\_ Date \_\_\_\_\_

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# TECHNICAL SPECIFICATIONS

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SECTION 26 05 00  
COMMON WORK RESULTS FOR ELECTRICAL

**PART 1 GENERAL**

**1.01 DESCRIPTION**

A. Scope:

1. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in Division 40 sections but are subject to the general requirements of this section. The electrical drawings included in this project manual are functional in nature and do not specify exact locations of equipment or equipment terminations.
2. Electrical work consists of the following:
  - a. Trace existing electrical circuits interconnected to the existing PLC panels to document to/from locations prior to replacing the process control system equipment specified in Division 40. A list of the remote sites is located in Section 40 67 00, Attachment A. A list of the inputs/outputs associated with each PLC panel is specified in Section 40 61 93, Attachment A. Provide documentation of the electrical wire trace in a form of circuit & raceway schedule showing to/from location and the circuit/raceway label.
  - b. Label or re-labeling external circuits terminating in the existing PLC panels prior to replacing and/or modifying the existing PLC panels.
  - c. Adding industrial enclosure nameplate and warning signage as required by NEC 409.110 to the face of the existing PLC panel enclosures or new PLC panel enclosures as specified in Section 40 67 00, Attachment A.
  - d. Provide temporary power and control circuits as required to maintain critical sites as indicated in Division 01.
  - e. Add to circuit & raceway schedule developed for existing circuits - all new electrical cables and raceways to fully document electrical construction.
  - f. Demolition of obsolete raceway/wiring.
3. All electrical work shall be executed in accordance with the following:
  - a. National Electrical Code (NEC) edition in force at time of permitting.
  - b. State of Washington local rules and regulations.
4. If there is any conflict between these drawings and specifications and the applicable codes, rules, and regulations; the codes, rules, and regulations shall apply.
5. Furnish labor, equipment, tools, materials, supplies, and perform operations necessary to install a complete and operable electrical system. Furnish incidental material and perform work shown on the Drawings and in the Specifications.
6. Obtain electrical permits, arrange for required inspections, correct deficiencies resulting from inspections, and pay permit fees and inspections charges. Pay fines and the cost of extra work incurred by action or inaction of the Contractor, at no additional cost to the Owner or Engineer.
7. Test the electrical system to assure:
  - a. New circuits are wired as specified on the drawings and Division 40's sections and match the developed circuit and raceway schedule.

- b. The existing circuits have been reterminated and match the developed circuit and raceway schedule.
  - c. The system grounding and short circuit protection is present and properly working.
8. Furnish properly executed certificates of final electrical inspection and approval from the Code Authority Having Jurisdiction (AHJ) at the conclusion of the work, before final acceptance.
  9. All electrical equipment and material supplied and installed shall be listed for the purpose intended by a third party testing agency acceptable to the AHJ per paragraph 1.02 B.
  10. During the course of construction, Contractor shall provide storage for materials and assume complete responsibility for losses due to any cause whatsoever. Storage shall not interfere with traffic conditions in any public thoroughfare. Protect completed work, underway, and materials against loss or damage. Close circuit openings with caps or plugs during installation. Cover fixtures and equipment and protect against dirt or damage caused by water, chemicals, or mechanical accident.
  11. Provide a construction set of electrical cable and raceway schedule for the remote sites. Some of the existing panels have drawings available for reference but the material may not be completely accurate.
  12. Coordinate all work under this section with the Owner to assure that any power outages are carefully planned.
  13. Coordinate the work under this Section with the work being done under Division 40's sections. The Contractor shall promptly notify the Engineer of any conflicts within the Plans and Specifications. All changes required in the work of the Contractor as a result of his failure to notify the Engineer shall be made by the Contractor at his own expense.

## **1.02 QUALITY ASSURANCE**

### **A. References:**

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.



Reference	Title
ANSI Z535.1	American National Standard for Safety – Color Code
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
IEEE Std 803A	IEEE Recommended Practice for Unique Identification in Power Plants and Related Facilities – Component Function Identifiers
NECA-1	National Electrical Contractors Association – Standard Practices for Good Workmanship in Electrical Contracting
NFPA-70	National Electrical Code (NEC)
NFPA-70E	Standard for Electrical Safety in the Workplace
ACI 318	Building Code Requirements for Structural Concrete

**B. Listed and Labeled Products:**

1. Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.
2. When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority, to undergo inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

**C. Factory Tests:**

1. Perform factory tests at the place of fabrication and on completion of manufacture or assembly where specified in the individual product specification section.
  - a. Include the costs of factory tests in the contract price.

**1.03 SUBMITTALS**

**A. Procedure: Section 01 33 00.**

**B. Submittals - Shop Drawings:**

**1. Package 1:**

**a. Conformance with Contract Documents:**

- 1) Provide a copy of this section with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
  - a) Check-marks (✓) denote full compliance with a paragraph as a whole. Underline deviations and denote them with a number in the margin to the right of the identified paragraph. Paragraph portions not underlined signify specification compliance. Include a detailed, written justification for each deviation. Show conformance with all paragraphs. Failure to include a copy of the marked-up specification section and justification(s) for requested deviations is cause for rejection of the entire submittal with no further consideration.
- 2) Show conformance across suppliers and vendors in one submittal. Partial submittals from multiple vendors showing contractor's division of labor or portions of the work are not acceptable.

- b. Submittal information shall be manufacturer's catalog descriptive literature with identifying arrows pointing to the specific equipment, devices, and materials to be supplied for the individual specification sections. Catalog information shall include technical specifications and application information, including NEMA and electrical ratings, range, weight, accuracy, etc. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.
  - c. Submittal information including but not limited to catalog cuts and other such formatted materials shall be assembled in a three-ring binder(s) for the submittal. Binders shall contain a cover sheet, indexed by product. Products shall contain an index sheet with equipment listed and cross-referenced to the appropriate specification paragraph.
  - d. Proof of Certification: Raceway installer trained and certified per PVC -coated conduit system manufacturer.
2. Package 2:
- a. Operating and maintenance information with construction drawings as two sets. Provide construction drawings in 11" x 17" format. One set in a protective covering and shipped with the equipment in the internal equipment pocket at the time of equipment delivery to the project site. Second set provided in the operating and maintenance manual.
  - b. Certificates of final electrical inspection and approval from the Code Authority Having Jurisdiction (AHJ) as specified in paragraph 26 05 00-1.01 A.8.
  - c. Provide circuit and raceway schedule that has been developed for existing circuits and new electrical cables and raceways.
- C. Final Submittals:
- 1. Provide the material as specified in Section 01 78 50.

#### **1.04 DRAWINGS**

- A. Prepare specified drawings on 11-inch by 17-inch drafting media complete with borders and title blocks clearly identifying project name, equipment and the scope of the drawing.
- B. Prepare drawings to reflect the final constructed state of the project installation or supplied equipment. Provide drawing quality, clarity, and size of presentation to permit insertion in operation and maintenance manuals.

#### **1.05 PROJECT/SITE CONDITIONS**

- A. General:
  - 1. Unless otherwise specified, equipment and materials shall be sized and derated for the site ambient conditions, but not less than an ambient temperature of 40 degrees C at an elevation ranging from sea level to 500 feet without exceeding the manufacturer's stated tolerances.
- B. The following areas are designated as corrosive:
  - 1. Outdoor areas shall be considered corrosive. Any pump vaults or electrical vaults or manholes or handholes or cable trench/utilidor in the ground shall be considered corrosive locations.

- C. Hazardous (Classified) Areas: None.
  - 1. None.
- D. Not used.
- E. Seismic:
  - 1. Electrical equipment and supports shall be braced in accordance with all applicable building codes.
- F. Construction Materials:
  - 1. General:
    - a. All electrical and instrumentation materials shall conform to all applicable local, state, and federal codes, standards, and requirements. Where specifications listed herein conflict with any local, state or federal codes, standard or requirement, the applicable code, standard, or requirement shall take precedent.
    - b. Refer to the individual specification section for each component for material composition and installation practices.
  - 2. Conduit:
    - a. All indoor conduit shall be rigid steel conduit, unless specified otherwise.
    - b. All systems of conduit must be installed completely before any conductors are pulled in.
    - c. Raceway ends shall be capped during construction. Conduits in which water or foreign matter have accumulated shall be thoroughly cleaned to the satisfaction of the Engineer or be replaced.
    - d. A tagged 200 lb rated nylon pull cord shall be provided in all empty conduits with at least twenty four (24) inches coiled free at each end. Only tags with a metal rim, made for this purpose, shall be used.
    - e. Conduit shall be installed in accordance with the requirements of the NEC. All conduit joints shall be cut square, threaded, reamed smooth and made up tight. Bends or offsets shall be made with standard conduit ells.
    - f. Provide liquid-tight flexible steel conduit at all motor and instrument connections.
    - g. Provide rigid metal conduit at all stub-ups to boxes and equipment for raceways leaving the ground.
    - h. Provide plastic bushings at all raceway terminations to prevent conductor damage as conductors exit raceway.
  - 3. Conductors:
    - a. All conductors shall be copper unless otherwise specified.
    - b. The insulation for power and control conductors shall be type XHHW-2.
    - c. Conductors shall be sized according to the drawings. Wire size #8 and larger shall be stranded. Minimum wire size shall be #12 except where specified otherwise for signal and pilot control conductors.
    - d. Conductors shall not be pulled into conduit until the cabinets and outlet boxes are free of foreign matter and moisture.
    - e. Conductors shall be continuous from termination to termination.
    - f. All conductors shall be installed in conduit.

- g. Internal panel wiring shall be color-coded and any wiring leaving the panel shall pass through properly numbered or coded terminal strips. Every switch, control relay, circuit breaker, and other component, either inside or outside the control panel shall be visibly identified by permanently attached phenolic plates.
- 4. Grounding:
  - a. All electrical equipment and panels shall be grounded in accordance with the requirements of the NEC.
  - b. No portion of the electrical system shall be energized until the service ground has been connected.
  - c. Provide green equipment grounding conductor in each raceway.

## **1.06 STORAGE OF MATERIALS AND EQUIPMENT**

- A. Store equipment and materials in the factory-sealed container and protect with additional covering and materials to avoid physical damage or weather damage.

## **1.07 ELECTRICAL NUMBERING SYSTEMS**

- A. Raceway Numbers:
  - 1. Tag raceways with brass or aluminum tags at the access locations including handholes, pull boxes, junction boxes, and at the terminations. Contractor shall propose a raceway numbering scheme and use the scheme consistently at each facility.
- B. Wire and Cable Circuit Numbers:
  - 1. Identify wire and cable circuit numbers at both ends. Contractor shall propose a circuit numbering scheme which integrates the raceway number. Use alphabetized suffix as necessary to provide unique circuit numbers for a common device.
  - 2. Include copies of schematic diagrams, wiring connection diagrams, and interconnection diagrams inside of the equipment enclosure, laminated in the equipment print holder.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT AND MATERIALS**

- A. General:
  - 1. Provide new equipment and materials free from defects. Provide material and equipment of the same or a similar type of the same manufacturer throughout the work. Use standard production materials wherever possible.

### **2.02 RACEWAYS, BOXES, AND SUPPORTS**

- A. Enclosures:
  - 1. Panel enclosures shall comply with the requirements of NEMA 250.
  - 2. Manufacturer:
    - a. Hoffmann Enclosures, Inc.
    - b. Rittal.
    - c. Or equal.

B. Raceways and Boxes:

1. Pullboxes, handholes, and device boxes are generally called boxes herein. Size boxes, manholes, and handholes in accordance with the National Electrical Code. Provide separate raceways for lighting, receptacles, power, control, instrumentation, and signaling systems.

C. Boxes and Wireways:

1. Provide indoor boxes, larger than FD boxes, constructed of stainless steel.
2. Provide boxes constructed of Grade 316L stainless steel rated NEMA-4X for corrosive areas and for outdoor locations.
3. Size and provide wireways at locations above and below boxes, panels and groups of devices. Comply with the NEC sizing for conductor fill requirements. Wireway NEMA type shall match the location and area classification and equipment NEMA enclosure ratings.

D. Terminal Cabinets:

1. Provide cabinets located indoors-conditioned space with NEMA-12 rating. Provide cabinets located outdoors, in process areas and in corrosive areas with NEMA-4X rating of stainless steel. Provide cabinets with hinged doors and 2 or 3-point stainless steel quick release latches with locking features via handle or latching clasps with provisions for padlocks.
2. Provide adjustable terminal strip mounting accessories and with channel mounted terminal blocks rated 30 amperes, 600 volt AC. Provide No. 8 minimum strap-screw type terminal strip, suitable for ring tongue, locking spade terminals. Provide Phoenix Contact products with capture feature and terminal identification method per terminal, as specified.

E. Raceway and Box Supports:

1. Provide stainless steel framing channel with end caps to support groups of conduit. Provide individual conduit supports that have one-hole stainless steel malleable iron pipe straps used with stainless steel clamp backs and nesting backs.
2. Provide stainless steel supports, channel, fittings, all-thread, and fasteners in outdoor locations, in corrosive areas, and as shown. Provide factory end-caps for supports and channels.
3. Independently support boxes by stainless steel brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden or plastic plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

F. Nameplates:

1. Provide nameplates for all boxes and enclosures with nameplate wording as shown on the drawings. Provide the tag number or box number with device functional description on device nameplate. Nameplate wording may be changed without additional cost where changes are made during the submittal process or prior to commencement of engraving.

2. Provide machine engraved laminated white phenolic nameplates with black lettering for panel-mounted equipment with the instrument tag number/description in 3/32-inch minimum size lettering and attach to the panel or enclosure with a minimum of two self-tapping 316 stainless steel screws. Provide nameplates for power sources indicating the power loads and nameplates for power loads that indicate the power sources, in accordance with these specifications and the NEC.

G. Raceway Markers:

1. Provide raceway markers: 0.036-inch minimum thickness, solid brass tags or aluminum tags with raceway number or the circuit number, stamped in 3/16-inch minimum height characters and attach tags to the raceway with 316 stainless steel wire. Install raceway markers inside of pull boxes, handholes, manholes, and where entering electrical equipment enclosures.

H. Identification Tags:

1. Provide the following:
  - a. Equipment: Typical size 1-inch x 3-inch wide, white with black engraved equipment number and equipment description.
  - b. Raceway/Conduit: Tags with raceway or conduit number or circuit shown.
  - c. Instrument: 1.5-inch wide, aluminum tag with instrument number and description.
  - d. Conductor: Power, control, or instrument cable with the circuit identified as shown; power source or power/control panel identified; power load, equipment, instrument, or device identified; purpose of the conductors identified.
  - e. Fastener: nylon-coated 48-mil stainless steel wire. Manufacturer: Brady catalog number 23310 or equal with double ferrule type brass wire clamps. Manufacturer: Brady number 23312.

I. General Raceway Requirements:

1. Provide additional pullboxes for conduit runs with greater than 360 degrees in any run between pull boxes. Limit maximum conduit runs without additional pullboxes to 400 feet, less 100 feet for every 90 degrees for the conduit run change in direction.
2. Determine conduit routing that conforms to the installation requirements set forth herein and in accordance with the NEC requirements for size and number of pullboxes. The RACESPEC sheets with specified requirements begin on the next page.

J. Electrical Enclosure Hole Seals:

1. Provide conduit hole seals to seal unused conduit holes. Conduit hole seal shall be made of stainless steel with grey coating, water tight gaskets, and mounting hardware only accessible from inside of enclosure.
2. Seal shall match and maintain enclosure's designed NEMA enclosure type.

## 2.03 RACEWAY SPECIFICATION SHEETS (RACESPEC) - RMC-STEEL

A. Materials:

1. Table A specifies the type of raceway supports required for each location and application.

TABLE A

Location	Framing channel	Threaded rod, hardware, and fittings
Indoor, architecturally finished area	Stainless Steel	Stainless Steel
Indoor, Electrical Room	Stainless Steel	Stainless Steel
Outdoor areas, process areas, wet wells	Stainless Steel	Stainless Steel

- Table B specifies the type of raceway required for each location and application by RACESPEC sheet. Unscheduled conduit shall be galvanized, rigid steel, RACESPEC type GRS.

TABLE B

Location	Application/Condition	RACESPEC
Indoor noncorrosive	Exposed	GRS
Outdoor corrosive	Exposed	PGRS
Nonhazardous	Final connection to equipment and light fixtures	LFS

B. General Raceway Requirements:

- Provide additional pullboxes for conduit runs with greater than 360-degrees in any run between pull boxes. Limit maximum conduit runs without additional pullboxes to 400-feet, less 100 feet for every 90 degrees for the conduit run change in direction.
- Determine conduit routing that conforms to the installation requirements set forth herein and in accordance with the NEC requirements for size and number of pullboxes. The RACESPEC sheets with specified requirements begin on the next page.

C. RACESPECS:

- RACESPECS start on the next page.

Raceway Identification:	<b>GRS-Steel</b>
Description:	Galvanized Rigid Steel Conduit
Compliance:	ANSI C80.1, UL 6 NEC Type RMC
Finish:	Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.
Manufacturers:	Allied Tube and Conduit Corp., Wheatland Tube Co., or equal.
Minimum size:	Unless otherwise shown: 3/4-inch for exposed; 1-inch for concealed or embedded; 2-inch for duct bank encased.
Fittings:	
Hubs, Rings, Hubs:	Insulated throat with bonding locknut, hot-dip galvanized. The hubs shall utilize a neoprene "O" ring and shall provide a watertight connection. O-Z Gedney, CHM-XXT, or equal.
Unions:	Electro-galvanized ferrous alloy type Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or equal. Threadless fittings are not acceptable.
Conduit Bodies:	Oversized conduit bodies: Ferrous alloy type with screw taps for fastening covers to match the conduit system. Gaskets shall be made of neoprene.  3/4" thru 4" - Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for conduit entrances.  5" and 6" - Electro-galvanized iron or cast-iron box.
Boxes:	
Indoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.
Outdoor:	Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.
Corrosive:	NEMA 4X stainless steel or nonmetallic.



Raceway Identification:

**GRS-Steel** (continued)

Elbows:

(3/4" thru 1.5")

Factory fabricated or field bent.

(2" thru 6")

Factory fabricated.

Expansion Fittings:

Expansion fittings in embedded runs shall be watertight and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4-inch movement in any direction. Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or equal.

Manufacturers:

Allied Tube and Conduit Corp., Wheatland Tube Co., or equal.

Installation:

Rigid steel conduit shall be made up tight and without thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot-dip galvanized malleable iron straps with nesting backs.

Conduit entering boxes shall be terminated with a threaded hub as specified or standard fittings with grounding bushing.

Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

Raceway Identification:	<b>LFS</b>
Description:	Liquid-Tight Flexible Steel Conduit
Application:	Final connection to motors and equipment subject to vibration or adjustment.
Compliance:	UL 360
Construction:	Spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquid-tight plastic cover.
Minimum size:	3/4 inch
Fittings:	Cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral and O-ring seals around the conduit and box connection and insulated throat. Forty-five and 90-degree fittings shall be used where applicable.
Manufacturers:	AFC Cable Systems
Installation:	Final connection to equipment subject to vibration or adjustment. Length of flexible liquid tight conduit shall not exceed 15 times the trade diameter of the conduit and not exceed 36 inches in length. Use conductive thread compound.

Raceway Identification:	<b>PGRS</b>
Description:	Rigid Steel Conduit, Corrosion-Resistant, Polyvinyl Chloride (PVC) Coated. Provide factory made and coated elbows.
Compliance:	ANSI, ETL and UL. The PVC coated rigid galvanized steel conduit shall be stamped with the ETL Verification Mark "ETL Verified to PVC-001".
Construction:	PGRS shall be hot-dip galvanized rigid steel conduit as specified in RACESPEC GRS, with a PVC Coating.
Finish:	PGRS shall be hot-dip galvanized rigid steel conduit with a PVC Coating. The PVC coating shall be gray, minimum 40 mils thick, bonded to the outside and continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes. Thread protectors shall be used on the exposed threads of the PVC coated conduit.  A 2-mil coat of urethane enamel coating shall be bonded to the inside. Coating shall be free of pinholes. Bond strength shall exceed the tensile strength of the PVC coat.
Minimum size:	3/4 inch
Fittings:	Similarly coated to the same thickness as the conduit and provided with Type 316 stainless steel hardware. Conduit and fittings shall be manufactured by the same company. Male threads on elbows and nipples, and female threads on fittings or conduit couplings shall be protected by application of urethane coating.
Covers:	PVC coated covers shall have V-groove seal and stainless steel hardware.
Hubs:	Hubs for connection of conduit to junction, device, or terminal boxes shall be threaded cast ferrous alloy. Hubs shall have the same PVC coating as the conduit and insulating grounding bushings.  Hubs shall utilize a neoprene "O" ring and shall provide a watertight connection.

Raceway Identification:	<b>PGRS</b> (continued)
Boxes:	
Nonhazardous:	NEMA Class 4X stainless steel or nonmetallic.
Manufacturers:	Robroy Industries, Plasti-Bond, Perma-Cote, KorKap or equal.
Installation:	<p>Plastic coated conduit shall be made up tight, threaded, and installed using tools approved by the PVC-coated conduit manufacturer.</p> <p>Exposed conduit threads shall be covered by a plastic overlap coated and sealed per manufacturer's recommendations.</p> <p>Pipe wrenches and channel locks shall not be used for tightening plastic coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.</p> <p>PVC coated conduit shall be supported away from the structure using PVC coated conduit wall hangers or PVC coated conduit mounting hardware.</p> <p>Damaged work shall be replaced</p>
Training:	Installers shall be trained and certified in the proper installation techniques provided by the PVC-coated conduit system manufacture. Proof of certification shall be provided under paragraph 26 05 00-1.03.

## 2.04 CONDUCTORS, WIRE, AND CABLE

- A. Provide products specified.
- B. **Unscheduled Conductor Sizing:**
  - 1. Size conductors, wire, and cables in accordance with the National Electrical Code where not specified on the Drawings, and install in the minimum size raceway as specified in the RaceSpecs herein.
- C. **Control Wire Color Coding:** Provide control wires with the following colors for the shown voltage:

<b>Voltage</b>	<b>Color</b>
120 VAC Power, line and load	Black
120 VAC Control	Red
24 VAC	Orange
12 VAC	Brown
Foreign Voltage (AC) (Interlock)	Yellow
AC Neutrals	White
Ground	Green
24 VDC (+ & -)	Violet
12 VDC (+ & -)	Blue
Foreign Voltage (DC)	Violet/white or Blue/White

- D. **Power Conductors:**
  - 1. Provide power conductors with following colors for the shown voltage:

<b>Wire</b>	<b>480Y/277V, 3Ø</b>	<b>208Y/120V, 3Ø</b>	<b>240/120V, 3Ø</b>
Phase A	Brown	Black	Black
Phase B	Orange	Red	Orange per NEC 408.3(E) and 215.8
Phase C	Yellow	Blue	Blue
Ground	Green	Green	Green
Neutral	White or Gray per NEC 210.4(D)	White	White

- 2. Provide black insulation conductors larger than #10 AWG with colored 3/4 inch vinyl plastic tape to identify the phase color at each cable termination. Tape wrap with 25 percent overlay to provide minimum of 3-inches of coverage.
- E. **Unscheduled Wire And Cable:**
  - 1. Provide the insulation and jacket material specified in the CABLESPEC sheets for scheduled and unscheduled (not shown) conductors. Provide stranded copper conductors for all wire and cable #8 and larger.

F. Electrical Enclosure Conductor Ratings:

1. Provide conductors with 600-volt insulation ratings in panels and other electrical enclosures. Conductors with less than 600-volt insulation ratings are prohibited, unless specifically identified.
2. Bundle and lace conductors in panels and electrical equipment at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Provide lacing using plastic cable ties that are tensioned and cut off using a tool specifically designed for the purpose such as a Panduit GS2B. Other methods of cutting cable ties are prohibited.
3. Bundle conductors crossing hinges into groups not exceeding 10 to 15 conductors and protected using nylon spiral flexible covers to protect conductors and provide oversized plastic panel wiring duct within panels.
4. Provide slack in junction boxes, pull boxes, handholes and manholes sufficient to allow cables or conductors to be routed along the walls with the amount of slack equal to largest dimension of the enclosure.
5. Provide dedicated electrical wireways and insulated cable holders mounted and secured on stainless steel unistrut in manholes and handholes.

G. Instrument Signal Cable:

1. Provide terminal blocks at instrument cable junctions within dedicated terminal boxes provided by the installer. Provide twisted shielded cable with individual shield for each pair. Provide twisted shielded cable multi-pair with overall shield and jacket. Provide triads wherever 3 wire circuits are required. Circuits shall not be made using conductors from different pairs or triads.
2. Install instrument, signal, and data communication circuits without splices between instruments, terminal boxes, or panels. Shields as a signal path, except for circuits operating at radio frequencies and utilizing coaxial cables are not acceptable. Common ground return conductors for two or more circuits are not acceptable.
3. Bond shields to the signal ground bus at the control panel. Isolate shields from ground and other shields at other locations by cutting short or taping. Provide terminal strips for signal leads and shield drain wires.
4. Terminate spare circuits and the shield drain wire on terminal blocks at both ends of the cable run. Shields or drain wires for spare circuit cables shall be bonded at control panel only with the other end insulated by tape cover.

H. Terminating Materials:

1. Use an UL listed tool for the applied compression type of connectors with the correct size and type. Provide tin-plated high conductivity copper connectors. Mechanical clamp, dimple, screw-type connectors are prohibited.
2. Provide polymeric insulating material over motor terminations with high dielectric strength mastic or material to seal the ends against ingress of moisture and contamination.
3. Cover splices with electrical products designed for the application, and insulate with a heat-shrinkable sleeve or boot.

- I. Seals And Sealant Materials:
  - 1. Corrosive Area Conduit Seals:
    - a. Corrosive area seals: Sealing compound shall be non-hardening type for corrosive areas.
    - b. Sealing compound shall be hard type installed in UL listed for explosion-proof sealing fittings after the conductors are installed, tested, and accepted.
  - 2. Fire Stop Sealant Materials:
    - a. Provide non-combustible silicone sealant for sealing apertures and cable through-penetrations for electrical conductors meeting UL 263 4-hour time-temperature requirements.
    - b. Manufacturer: STI Inc., Pensil Silicone Sealants PEN300 SpecSeal Firestop, or equal.
  - 3. Conduit Seal Bushing:
    - a. Collar shall be hot-dip galvanized cast ferrous alloy or aluminum alloy. Sealing ring shall be one-piece neoprene. Hardware shall be stainless steel. Seal shall prevent gases and liquids from exiting the conduit. Manufacturer: O-Z/Gedney, CSBI, or equal.
- J. Circuit Numbering Marking System:
  - 1. Identify each power, control, and signal conductor at each terminal connection. Machine print the letters and numbers with black on white alphanumeric characters representing the circuit numbering system.
  - 2. Identify conductors, including spares. Provide cable markers and wire markers for distribution and utilization equipment circuits identifying the power source and circuit source from which it is served.
  - 3. Provide the identification system of vinyl power cable strap-on cable markers, vinyl multi-conductor control cable strap-on cable markers, and vinyl or polyolefin wire slip-on sleeves and encircle the conductor.
  - 4. Provide conductor marker used in outdoor, damp, or wet locations on heat-shrinkable polyolefin shrinkable marking sleeves covered with clear heat-shrink sleeve or clear tape cover.
  - 5. Print conductor markers using the Brady Marker "XC PLUS", the Brady LS2000 printer with the Bradysleeve wire marking system, or Engineer accepted equal.
- K. Terminal Blocks: Refer to Section 40 67 00.

L. CABLESPEC SHEETS

1. The following CABLESPEC sheets are included in this section:

Type	Volt	Product	Purpose
XHHW-2	600	SINGLE CONDUCTOR, XLP INSULATED INDUSTRIAL GRADE CONDUCTOR	POWER, CONTROL, LIGHTING, & RECEPTACLES
P-OS	600	SINGLE TWISTED, SHIELDED PAIR OR TRIAD, INSTRUMENTATION CABLE	SIGNAL
EN	600	250 MHZ ENHANCED CATEGORY 6 ETHERNET CABLE, 4 PAIRS, SHIELDED	GIGABIT ETHERNET CABLE, PANEL INTERIOR
PN	600	PROFINET CATEGORY 5e CABLE, 4 CONDUCTORS	PROFINET CABLE, PANEL INTERIOR



Cable System Identification:	<b>XHHW-2</b>
Description:	Single conductor cross-linked polyethylene power and control cable for sizes no. 14 AWG and larger
Voltage:	600V
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8
Insulation:	XHHW-2, 90 degree C dry, 75 degree C wet, cross-linked polyethylene in accordance with with ICEA S-95-658/NEMA WC70
Flame Resistance:	UL 1685, IEEE 1202
Manufacturer(s):	Okonite, Southwire, General Cable or approved equal
Uses Permitted:	Conduit
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Megger Test: Test in accordance with this section.

Cable System Identification:	<b>P-OS</b>
Description:	Type TC single twisted, shielded cable 90 degree C Dry/75 degree C Dry. Pair or triad, 18 or 16 AWG as specified for instrumentation 4-20 mA analog signal.
Voltage:	600V
Conductor Material:	Bare annealed copper; stranded in accordance with ASTM B8
Insulation:	15 mil, 90 degree C, polyvinylchloride (PVC) per UL Standard 1277
Jacket:	Polyvinylchloride (PVC) per UL Standard 1277
Lay:	Twisted on a 2-inch lay
Shield:	100 percent, 1.35 mil aluminum-Mylar tape with 18 AWG 7-strand tinned copper drain wire
Manufacturer(s):	Okonite, Okoseal-N type P-OS, or approved equal.
Uses Permitted:	Instrumentation cable tray, conduit
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Megger Test: Test in accordance with this section.

Cable System Identification:	<b>EN</b>
Description:	DataTuff 600 MHz Enhanced Category 6, Gigabit Ethernet, 4 pair cable.
Voltage:	600V
Conductor Material:	Solid bare copper 23 AWG
Insulation:	Polyolefin (PO)
Jacket:	Polyvinyl chloride (PVC), 0.339-inch diameter
Shield:	Unshielded
Flame Resistance:	UL 1666 Riser
Manufacturer(s):	Belden 7927A, or approved substitute.
Uses Permitted:	Instrumentation cable tray, conduit
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Megger Test: Test in accordance with this section.

Cable System Identification:	<b>PN</b>
Description:	DataTuff Category 5e, 1 Quad (2 pair) #22 TC cable.
Voltage:	600V
Conductor Material:	Tinned Copper stranded 22 AWG
Insulation:	Polyolefin (PO)
Jacket:	Industrial Grade Thermoplastic Elastomer (TPE), 0.272-inch diameter. Jacket Color Green (RAL 6018)
Shield:	100 percent, aluminum-Polyester tape. 85 percent stranded tinned copper drain wire
Flame Resistance:	UL 1685 Vertical Tray Flame Test
Manufacturer(s):	Belden 7962A, or approved substitute.
Uses Permitted:	Instrumentation cable tray, conduit
Execution:	
Installation:	Install in accordance with this Section.
Testing:	Megger Test: Test in accordance with this section.

## 2.05 WIRING DEVICES

- A. Unless specified otherwise, provide UL approved wiring ivory devices for the current and voltage ratings specified and comply with NEMA WD-1 with provisions for back wiring and side wiring with captive held binding screws.
- B. Heavy Duty 120v Receptacles:
  - 1. Single Phase: Duplex 20-amp, NEMA 5-20R accepting NEMA 5-15P and 5-20P plugs. Cooper 5362, Hubbell 5362, or equal.
  - 2. Ground Fault Interrupting: Ground fault interrupting (GFI) receptacles: duplex, 20 amp, NEMA 5-20R, specification grade that accepts NEMA 5-15P and 5-20P plugs. Provide GFI receptacles outdoors and as shown, UL listed with provisions for testing and resetting. Manufacturer: Hubbell GF-5352-I, or equal.
- C. Pilot Devices:
  - 1. Provide heavy-duty push buttons, selector switches and indicating lights: 30mm, oil-tight, NEMA 4X. Indicating lights shall be light emitting diode (LED) type lamps. Unless otherwise shown, provide push-to-test type indicating lights. Provide diode isolating type pilot indicating lights specified for remote-test. Provide red indicating lamps for "RUN" indication and green indicating lamps for "STOP".
  - 2. Coordinate with Drawings for power requirements. For 120VAC control units: heavy-duty type Allen-Bradley 800H, or equal. For 24VDC: Allen-Bradley 800T, Square-D Class 9001 Type J, or equal.

## 2.06 GROUNDING SYSTEM

- A. Provide electrical system grounding electrode conductors, equipment grounding conductors for equipment grounding and raceways, grounding electrodes, grounding electrode conductors, connections, and bonding in compliance with the National Electrical Code-Article 250 and the National Electrical Safety Code.
- B. Provide annealed bare copper, concentric stranded grounding conductors. Provide the minimum sizes per NEC Article 250 for grounding conductors or service entrance conductors, if not sized on the drawings.
- C. Bond grounding conductors entering enclosures together to metallic enclosure and to metallic raceways terminating at the enclosure. Clean the conductor and enclosure metal surface at the point of connection prior to making equipment grounding connections or bond connections.

## 2.07 RACEWAY GROUND

- A. Install metallic conduits to provide a continuous ground path. Use insulated grounding bushings and bonded to the ground grid system in compliance with Article 250 of the National Electrical Code.
- B. Provide an equipment-grounding conductor with green insulation in all metallic and nonmetallic conduit, raceway, wireway, gutter, or duct banks.
- C. Provide an equipment grounding conductor with green insulation for size up to #6 AWG and provide green color insulation tape band for conductor size #4 AWG and larger.

## 2.08 POWER, CONTROL, AND METERING EQUIPMENT

- A. Coordinate demolition of existing equipment and installation of new equipment with electric power utility company.
- B. Comply with the power utility service entrance section standards that includes the power utility metering equipment. Coordinate the correct meter socket requirements. Submit proposed equipment to power utility for acceptance prior to submitting to the Engineer. Provide and install equipment according to power utility requirements.
- C. Panelboards:
  - 1. Provide panelboards: circuit breaker, dead front type with bus bar construction composed of individually mounted circuit breakers with screw-connection, designed to be removed without disturbing other breakers. Provide lockable, hinged door-in-door construction for flush mounted panels and hinged-trim covers for surface mounted panels.
  - 2. Provide tin-plated copper buss and with the current rating as shown on the panel schedules sized in accordance with UL 67 and withstand rating equal to the interrupting rating of the smallest circuit breaker in the panel. Series rated products are prohibited. Silver plated equipment is prohibited.
  - 3. Provide panelboards with a separate ground bus and a full capacity neutral bus. Mount neutral bus on insulated standoffs. Provide removable link connector from the neutral bus to the ground bus. Provide listed and labeled panelboard for service entrance disconnect as shown.
- D. Circuit Breakers:
  - 1. Provide circuit breakers: molded-case type provided for the current ratings and pole configurations as shown or as specified on the panelboard schedule and with a minimum interrupting current rating as shown on drawings or schedules, but not less than 22,000 AIC for 240 volt rated devices. Series rated branch, main, or other devices are prohibited.
  - 2. Provide circuit breakers listed in accordance with UL 489 for the service specified and load terminals with solderless connectors. Provide bolt-on type circuit breakers. Provide circuit breakers with machine-printed, circuit number labels indicating the load served.

## 2.09 PRODUCT DATA

- A. The following information shall be provided in accordance with Section 01 33 00:
  - 1. Operating and maintenance information as specified in Section 01 78 23.
  - 2. One 11" x 17" set of drawings in a protective covering and shipped with the equipment in the internal equipment pocket at the time of equipment delivery to the project site.
  - 3. Record documents as specified in Section 01 78 39.
  - 4. Certificates of final electrical inspection and approval from the Code Authority Having Jurisdiction (AHJ) as specified in paragraph 26 05 00.01-1.01 A 4.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

#### **A. Construction:**

1. Perform the work specified by Contract Documents in accordance with these specifications.
2. Coordinate the location of electrical material or equipment with the work and adjust conduit location to accommodate equipment in accordance with the accepted submittal drawings from the manufacturer.

#### **B. Housekeeping:**

1. Protect electrical equipment from dust, water and damage. Cover the exterior to keep dry. Electrical distribution equipment such as motor control centers, switchgear, switchboards, panelboards, and other power source buses shall be clean and free of dust and dirt.
2. Protect electrical equipment temporarily exposed to weather, debris, liquids, or damage during construction as specified in Shipment, Protection, and Storage section. Touch up scratches on equipment as specified in Coating Systems section before final acceptance.
3. Wipe clean and vacuum equipment on the inside prior to acceptance testing and energization and again prior to detailed inspection and acceptance of the work.

#### **C. Installation:**

1. Perform the installation work specified in accordance with these specifications.
  - a. Lighting and receptacle circuits may be in the same conduit in accordance with derating requirements of the NEC. Lighting and receptacle circuits in conduits with power or control conductors is prohibited.
  - b. Install power conductors derived from uninterruptible power supply systems in separate raceways.
  - c. Adjust motor circuit protectors in accordance with manufacturer's instructions and NEC requirements.
  - d. Adjust motor overload device in accordance with manufacturer's instructions and NEC requirements.

#### **D. Conductors, Wire, and Cable Installation:**

1. Splices are not allowed except by permission. Submit proposed splice locations to the Engineer and Owner for review prior to installation. Splices and terminations are subject to inspection prior to and after insulating and may require re-termination after inspection. Underground splices will not be allowed.
2. Identify conductors at each connection terminal and at splice points with the identification marking system specified.
3. Install wire and cable into raceways, conduit, cable trays, or wireways without damaging or putting undue stress on the insulation or jacket. Provide manufacture's recommended and UL Listed pulling compounds lubricants for pulling wire and cable. Grease is prohibited.

4. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed. Provide wire or cable support where wire or cable exits a raceway. Provide reusable stainless steel Kellums grips or equal product where cable support is required and where loads are removable.
5. Scratch-brush the contact areas and tinfoil the connection where flat bus bar connections are made with tinfoiled or uninfoiled flat bus bar. Provide non-oxide material approved for the function. Torque bolts to the bus manufacturer's recommendations.
6. Adhere to raceway fill limitations defined by NEC and the following: Lighting and receptacle circuits may be in the same conduit in accordance with de-rating requirements of the NEC. Lighting and receptacle circuits shall not be in conduits with power or control conductors. Signal conductors shall be in separate conduits.
7. Splices and tees only allowed with **pre-approval**. Install **pre-approved** in-line splices and tees with tubular compression connectors and insulate. Splices and tees in underground handholes or pull boxes shall be insulated using Scotch-cast epoxy resin splicing kits.
8. Provide self-insulating tubular butt-splice type of compression connectors for terminations at solenoid valves, 120-volt motors, and other devices furnished with pigtail leads.
9. Conductors in all handholes and manholes shall have adequate slack to be tied up around the perimeter of the vault and will be suspended by insulators around the vault's perimeter as needed to support the cable.

E. Raceway Installation:

1. Provide additional pullboxes for conduit runs with greater than 360 degrees in any run between pull boxes. Limit maximum conduit runs without additional pullboxes to 400 feet, less 100 feet for every 90 degrees for the conduit run change in direction.
2. Determine conduit routing that conforms to the installation requirements set forth herein and in accordance with the NEC requirements for size and number of pullboxes.
  - a. Install exposed conduit either parallel or perpendicular to structural members and surfaces.
  - b. Route two or more exposed conduits in the same general routing parallel with symmetrical bends.
  - c. Install exposed conduit on supports spaced not more than 10 feet apart.
  - d. Install conduits out from the wall using framing channel where three or more conduits are located in parallel run.
  - e. Install conduits between the reinforcing steel in walls or slabs that have reinforcing in both faces. Verify installation method for conduits larger than 2-inch with Engineer prior to installation.
  - f. Install conduit in slabs that have only a single layer of reinforcing steel, under the reinforcement.
  - g. Install conduits with large radii under the slab in a one-sack concrete slurry.
  - h. Route conduit clear of structural openings and shown future openings.
  - i. Provide conduit roofs or wall penetrations with flashing sealed watertight and fire-stop, as required to maintain the structural rating.
  - j. Grout conduit into any openings cut into concrete and masonry structures.



- k. Cap conduits during construction to prevent entrance of dirt, trash, and water.
- l. Terminate exposed conduit stubs for future use with pipe-caps and provide couplings and pipe-plugs where flush with the slab.
- m. Determine concealed conduit stub-up locations from the manufacturer's shop drawings.
- n. Terminate conduit in equipment with conduit couplings with pipe-plugs flush with structural surfaces for empty conduit.
- o. Install conduit horizontally with at least 7-foot headroom clearance.
- p. Terminate conduit with fittings that ensure that the NEMA rating of the enclosure and provide conduit hubs, as required heretofore.
- q. Connect underground metallic or nonmetallic conduit that turns out of concrete, masonry, or earth to a 90-degree elbow of PVC-coated rigid steel conduit before emergence. Taped or painted RMC-Steel or RNC is prohibited.
- r. Provide conduit crossing structural joints with structural movement with O-Z "Type DX" or Crouse-Hinds "Type XJG-SA," aluminum, bonded, weather-tight expansion fitting of the same size and type as the conduit.
- s. Seal conduits in corrosive areas using removable mastic material.
- t. VFD motor feeder circuits shall be routed a minimum of 12 inches from any control conduits. Should they cross they shall cross at 90 degrees.

**F. Electrical Equipment Labeling – Arc Flash**

- 1. Electrical equipment shall have field marked signs and labeling to warn qualified persons of the potential electric arc flash hazards per NEC Article 110.16 Flash Protection.
- 2. Electrical distribution equipment and utilization equipment shall be field labeled to identify the power source and the load as specified. Refer to NEC Article 110.22 for Identification of Disconnecting Means installation criteria. Specific information is required such as the equipment tag number and equipment description of both the power source and the load equipment.

**3.02 TESTING**

- A. Provide electrical equipment acceptance tests in accordance with the latest version of NETA Acceptance Testing Specification for electrical distribution and utilization equipment to demonstrate that all electrical equipment is functioning as designed.
- B. Pre-test conductors prior to installation, as appropriate. Replace damaged conductors. Test all power and control conductors after installation per test forms included in Section 01 99 90. Provide completed test forms.
  - 1. Prior to energizing the electrical circuits, insulation resistance measurements tests shall be performed using a 1000-volt megohmmeter to verify the conductor is acceptable for use on the project. The test measurements shall be recorded on the specified forms and provided in accordance with paragraph 1.03.

- C. Insulation Resistance Measurements:
1. General:
    - a. Insulation resistance measurements shall be made on conductors and energized parts of electrical equipment. Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, NEMA or ANSI standards for the equipment or material being tested, unless otherwise specified. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.
  2. Insulation resistance measurements shall be recorded in a format similar to Form 26 05 00-A, included in Section 01 99 90. Insulation with resistance of less than 10 megohms is not acceptable.
  3. Conductor And Cable Tests:
    - a. The phase-to-ground insulation resistance shall be measured for all circuits rated 120 volts and above except lighting circuits. Measurements may be made with motors and other equipment connected. Solid state equipment shall be disconnected, unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.
- D. Testing:
1. Test per Section 40 61 21 requirements in the following sequence:
    - a. Performance testing
    - b. Functional testing
    - c. Operational testing
  2. Prior to testing, all protective devices shall be adjusted and made operative.

**END OF SECTION**

## SECTION 40 61 13

### PROCESS CONTROL SYSTEM GENERAL PROVISIONS

#### PART 1 GENERAL

##### 1.01 SUMMARY

- A. This section specifies general requirements applicable to all work on the drawings and in Sections 40 61 13 through 40 67 00 of these specifications for the process control, instrumentation, communication, network, and signal systems. This work will be referenced as the Process Control System (PCS) to be provided by a single Systems Integrator (SI) meeting the qualifications section of this specification.
- B. Electrical requirements applicable to this work are specified in Section 26 05 00.
- C. Description of Work
  - 1. This section covers general work requirements for the Process and Instrumentation and Control System. Detailed requirements are in individual related specification sections.
  - 2. Systems Integrator: The scope of the work to be performed by the Systems Integrator in general, is as follows. Refer to the individual Division 40 specifications for the detailed scope of work assigned to the Systems Integrator.
    - a. Provide new control system hardware include programmable logic controllers (PLCs), input/output (I/O) modules, operator interface terminals (OIT) or panel-mounted PCs, network switches, and uninterruptible power supplies (UPS).
    - b. Provide and test custom fabricated back panels to be installed in existing enclosures.
    - c. Provide and test custom fabricated back panels and enclosures where the size of the existing enclosure is insufficient size for the new control system equipment. Repurpose existing enclosure to serve as a terminal junction box for routing existing field wiring to new enclosure location.
    - d. Demolition of existing control system equipment to be replaced and demolition of obsolete equipment/wiring within existing panels.
    - e. Collaborate with the Programmer to provide a fully integrated PLC-based SCADA system.
    - f. Provide testing, start up, and commissioning services in coordination with the Programmer.
    - g. Configure network switches for the addition of Profinet networked devices (VFDs).
  - 3. Programming: The PCS programming work shall be provided by the Owner's Programmer and consists of the following. All other work specified in the applicable sections not specifically assigned to the Programmer shall be the responsibility of the Contractor and Systems Integrator.
    - a. Perform process control system programming, including programmable logic controller (PLC) and SCADA system programming, to implement the specified process control descriptions.
    - b. Develop Functional Testing procedures and forms, as described in Section 40 61 21.

- c. Assist with testing and commissioning of the revised control system in coordination with Systems Integrator.
- d. Refer to the individual Division 40 specifications for the detailed scope of work assigned to the Programmer.

**1.02 RELATED SECTIONS**

- A. The requirements of this section are applicable to work specified in Sections 40 61 13 through 40 67 00 of these specifications.

**1.03 REFERENCES**

- A. Reference Standards:
  1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.
  2. Unless otherwise specified, references to documents mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids).
  3. If referenced documents have been discontinued by the issuing organization, references to those documents mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
  4. Where document dates are given in the following listing, references to those documents mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
IEEE 100	Standard Dictionary of Electrical and Electronics Terms
ISA 5.1-2009	Instrumentation Symbols and Identification
ISA 5.4	Instrument Loop Diagrams
ISA 20	Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA 51.1	Process Instrumentation Terminology
ISA TR20.00.01	Specification Forms for Process Measurement and Control Instruments Part 1: General Considerations
NEMA ICS 1	General Standards for Industrial Control and Systems
NFPA 70 (NEC)	National Electric Code
NFPA 79	Electrical Standards for Industrial Machinery

**1.04 DEFINITIONS**

- A. Abbreviations:
  1. A: ampere(s)
  2. HIM: human interface module

3. HMI: human-machine interface
4. I/O: input/output
5. mA: milli-ampere(s)
6. OIT: operator interface terminal
7. PC: personal computer
8. PCS: process control system
9. PLC: programmable logic controller
10. SCADA: supervisory control and data acquisition
11. SI: Systems Integrator
12. STP: shielded twisted pair
13. VAC: volt(s) alternating current
14. VDC: volt(s) direct current
15. VFD: variable frequency drive
16. W: watt(s)

**B. Definitions General:**

1. General: Definitions of terminology related to Instrumentation and Industrial Electronic Systems used in the specifications as defined in IEEE 100, ISA 51.1, and NEMA ICS 1.
2. Data sheets: Refer to ANSI/ISA-20-1981 or ISA-TR20.00.01-2007.
3. Two-wire transmitter: A transducer that derives operating power supply from the signal transmission circuit and requires no separate power supply connections. A two-wire transmitter produces a 4- to 20-milliampere current regulated signal in a series circuit with a 24-volt direct current (VDC) driving potential and a maximum circuit resistance of 600 ohms.
4. Four-wire transmitter: A transducer that derives operating power from separate power supply connections. A four-wire transmitter produces a 4- to 20-milliampere current regulated signal in a series circuit with a maximum circuit resistance of 600 ohms. Four-wire transmitters typically require 120-volt alternating current (VAC) or 24 VDC input power supply.
5. Galvanic isolation: An electrical node having no direct current path to another electrical node. Galvanic isolation refers to a device with electrical inputs and/or outputs that are isolated from ground, the device case, the process fluid, and separate power supply terminals. Inputs and/or outputs may be externally grounded without affecting the characteristics of the devices or providing a path for circulation of ground currents.
6. Panel: An instrument support system that may be a flat surface, partial enclosure, or complete enclosure for instruments and other devices used in process control systems including consoles, cabinets, and racks. Panels provide mechanical protection, electrical isolation, and environmental protection from dust, dirt, moisture, and chemical contaminants that may be present in the atmosphere.
7. Systems Integrator: A firm engaged in the business of detailed control system design and engineering, instrumentation component purchase, system and panel assembly, control device programming, and implementing of the specified process control and industrial automation systems.

8. Programmer: Brown and Caldwell, Seattle, Washington, providing the SCADA/PLC application programming described in Section 40 61 96.

C. Definitions—Signal Types:

1. Analog, low level: Signal with full output level of 100 millivolts or less including thermocouples and resistance temperature detectors.
2. Analog, high level: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4 to 20 mA transmission.
3. Digital code: Coded information from the output of an analog-to-digital converter or digital transmission terminal.
4. Discrete control or events: Dry contact closures and signals monitored by solid-state equipment, relays, or control circuits.
5. Discrete control or events, low voltage: Dry contact closures and signals monitored by solid-state equipment, relays, or control circuits operating at less than 30 volts and 250 milliamperes.
6. Modulated signals: Signals from modems or low-level audio signals. Normal signal level: plus 4 dBm to minus 22 dBm. Frequency range is 300 to 10,000 hertz.
7. Pulse frequency: Counting pulses emitted from speed or flow transmitters.
8. Radio frequency (RF) signals: Continuous wave alternating current signals with fundamental frequency greater in a range of 310 kilohertz to 300 gigahertz.

D. Definition—Drawing Types:

1. Elementary or schematic diagram:
  - a. Use graphic symbols to indicate the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing of the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.
  - b. Indicate connections to internal and external components connected to the panel. Note which devices are external to the panel.
  - c. Depicted in ladder logic format.
  - d. Indicates contact arrangement of internal and external devices such that circuits are complete and match equipment furnished.
  - e. Indicates equipment designations/tag numbers to match contract drawings.
2. Block diagram: A diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.
3. Network block diagram:
  - a. A diagram of the overall control system, containing annotated boxes showing the primary network components (controllers, routers, switches, computers, displays).
  - b. Include annotated interconnecting lines showing the system communication media and communication protocols.
  - c. Indicate manufacturer and model of the primary network components and software.
  - d. Indicates functions performed by each device (e.g., Historical Data Server, Field controller, Database Server, Operator workstation, etc.)

4. Connection diagram:
  - a. Purpose is to show wiring requirements between internal panel components.
  - b. Show components of a control panel in an arrangement similar to the actual panel layout.
  - c. Indicate internal wiring between components.
  - d. Show terminal blocks used for internal wiring and field wiring, with identification as such.
  - e. Indicate insulation color code, signal polarities, wire numbers, and terminal block numbers.
5. Interconnection diagram:
  - a. Purpose is to show wiring requirements between panels, standalone devices, components, and instruments.
  - b. Indicate wire numbers, cable numbers, raceway numbers, terminal box numbers, terminal block numbers, panel numbers, and field device tag numbers.
  - c. Show external connections between terminals of equipment and outside points, such as motors and auxiliary devices.
  - d. Indicate references to connection diagrams that interface to the interconnection diagrams.
  - e. Interconnection diagrams are to be of the continuous line type. Show bundled wires as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable.
  - f. Show termination of each cable. Clearly mark each termination point. Show each wire's identification as actually installed. The wire identification for each end of the same wire shall be identical. Identify devices and equipment.
  - g. Depict terminal blocks as actually installed and identified in the equipment with individual terminal identification.
  - h. Indicate external jumpers, shielding, and grounding terminations.
  - i. Indicate polarities for signal and DC circuit.
  - j. Depict spare wires and cables installed or slated for installation.
6. Arrangement, layout, or outline drawings:
  - a. Show the physical space and mounting requirements of a piece of equipment.
  - b. Indicate ventilation requirements and space provided for connections or the location to which connections are to be made.
  - c. Indicate clearance requirements for ventilation and access.
  - d. Show the dimensioned external and interior control panel views with components and Bill of Material.
7. Loop diagrams:
  - a. Prepared per ISA 5.4 – Loop Diagrams.
  - b. Show device element wiring of the system. Indicate device terminations, with terminal numbers.
  - c. Show circuits for hardwired device interlocks.
  - d. Show circuit cable and wire cable numbers, signal polarities, and terminal block numbers.

- e. Show connection to power supplies. Include alternating current (AC) and direct current (DC) power supplies and circuit information for instruments furnished under this contract.
- f. Indicate controller or I/O card address/node, rack, slot, and point wiring terminals.
- g. Show power supplies for signal loops. Indicate in which panel components reside and power originates with circuit numbering/name. Where new/modified loops connect to an existing power supply, show the existing power supply name, location, and circuit.
- h. Indicate surge protection type, manufacturer, and model number (i.e., types include floating ground reference or grounded reference).
- i. Show new and modified terminal blocks with numbering in new and existing panels.
- j. Indicate signal loop grounding terminations.
- k. Indicate loop numbers, wire numbers, and cable numbers used in field wiring and panel wiring.
- l. Indicate field element being controlled or monitored (i.e., normally open contact from relay CR17, or FIT 365).

## **1.05 ADMINISTRATIVE REQUIREMENTS**

### **A. Coordination:**

1. Coordinate the process and instrumentation control system for proper operation with related equipment and systems specified in other Divisions.
2. Coordinate with Programmer to fully integrate the control system components into the PCS SCADA system.
3. Integrate equipment in conformance with the drawings, specifications, and recommendations of the equipment manufacturer and the related processes equipment manufacturers.
4. Obtain manufacturer's technical information for items of equipment not provided with, but connected to, the control system. Provide the necessary coordination and components for correct signal interfaces between equipment and the control system.
5. Coordinate interface requirements and schedule with other project subcontractors and equipment suppliers.
6. Present to the Engineer conflicts between the plans, specifications, manufacturer/vendor drawings, and installation instructions, etc. for resolution before proceeding.

### **B. Pre-submittal conference:**

1. Schedule a pre-submittal conference with the Contractor, Systems Integrator, Owner, and Engineer within 30 calendar days after Contract award to discuss the work, equipment, and submittal format, and to establish the framework for project coordination and communication.
2. Provide the following materials 10 days prior to the conference:
  - a. Proposed Systems Integrator that will meet the qualifications requirements of this section.



- b. Indicate full conformance with the specification sections covered by this section with a contract deviations request. Requested contract deviations to reference and to be attached to the applicable contract specifications and drawings. Provide justification for requested deviations.
  - c. Proposed "equal" products that differ from specified manufacturers/models with comparative listing of the published specifications for the specified item and the proposed item.
  - d. Project schedule with deliverables and milestones through project completion.
  - e. Sample submittal drawings, as specified to be provided for this project. Samples can be a copy from a previous project provided that represents the format being proposed for this project.
    - 1) Control system block diagram.
    - 2) Documented controller and operator interface program.
    - 3) Control panel schematic diagram.
    - 4) Interconnection diagram.
    - 5) Control panel arrangement drawing.
3. The pre-submittal conference will not replace the Product and Shop Drawing Submittal review process.

## 1.06 SUBMITTALS

### A. General:

- 1. Procedures: Section 01 33 00.
- 2. This article indicates general requirements applicable to all PCS submittals. Additional information to be submitted with each section will be listed under Action Submittals or Closeout Submittals in this and each related section.
  - a. Submit all information for sections covered by a submittal as a complete package in one submittal. Partial submittals of a section from multiple vendors showing contractor's division of equipment, labor, or portions of the work are not acceptable.
  - b. Include a table of contents in each submittal divided by specification section and content of each section such as drawings and components. Clearly indicate the article or paragraph to which each table of content item applies.
  - c. Related sections indicate additional detail for each submittal.
  - a. Provide submittals in searchable PDF format with bookmarks to match the table of contents of each submittal. Limit PDF size to 200 pages. Provide multiple volumes if necessary.
  - d. Submitted information is to conform to the following:
  - e. Shop Drawings: Prepare drawings in AutoCAD with borders and title blocks identifying the project, system, revisions to the drawing, and type of drawing. Include a date and description for each revision of a drawing including the date and description of the revisions. Drawing prints shall be 11" by 17" with a minimum lettering size of 1/8".

- f. Product Literature: Provide manufacturer's specifications, data sheets, and catalog literature for the equipment and components that clearly and unambiguously show what is being provided and that it meets the requirements specified. Indicate provided and available options, materials of construction, environmental characteristics, electrical characteristics, and connection requirements. Include only applicable information.
- g. Conformance with Contract Documents:
  - 1) Provide a copy of sections applicable to the submittal group with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. .
  - 2) Check-marks (✓) denote full compliance with a paragraph as a whole. Underline deviations and denote them with a number in the margin to the right of the identified paragraph. Paragraph portions not underlined signify specification compliance. Include a detailed, written justification for each deviation. Show conformance with all paragraphs in a section. Failure to include a copy of the marked-up specification sections and justification(s) for requested deviations is cause for rejection of the entire submittal with no further consideration.
  - 3) Provide a marked up copy of the contract document wiring diagrams and instrumentation drawings relating to the submitted equipment, with addendum updates that apply to the equipment in this section, to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, mark the drawing or drawings "no changes required." Failure to include copies of the relevant drawings with the submittal is cause for rejection of the entire submittal with no further review. Contract drawings include the following:
    - a) Panel layout and arrangement drawings
    - b) Panel power distribution drawings
    - c) I/O card drawings
    - d) Network block diagrams
    - e) Demolition drawings
    - f) Equipment installation details
  - 4) Show conformance across suppliers and vendors in one submittal. Partial submittals from multiple vendors showing contractor's division of labor or portions of the work are not acceptable.
  - 5) Provide a detailed written request and explanation for each deviation. Failure to include a copy of the marked-up specification sections and drawings, along with justification(s) for requested deviations to the contract requirements, with the submittal, is cause for rejection of the entire submittal with no further consideration.

- B. Action Submittals.
  - 1. Procedures: Section 01 33 00.
  - 2. Quality Assurance (within 30 days of contract Notice to Proceed):
    - a. Systems Integrator qualifications per paragraph 1.07, Quality Assurance.
    - b. Project personnel qualifications per paragraph 1.07, Quality Assurance.
  - 3. Provide Action Submittal packages specified in individual Division 40 specifications.
- C. Closeout Submittals.
  - 1. Procedures: Section 01 78 23.
  - 2. Provide Closeout Submittal packages specified in individual Division 40 specifications.
  - 3. Provide record drawing prints of drawings and schedules following project startup, but prior to acceptance of the work, showing the final constructed state of the process instrumentation and control systems.
  - 4. Include the following in each operation and maintenance manual:
    - a. Final reviewed submittals, including revised as-built record drawings.
    - b. Manufacturer's operation and maintenance instructions, edited for this project.
    - c. Written record of menu configuration, jumpers, switch settings, and other configurable parameters for control system devices.
    - d. Final network equipment software configurations.
  - 5. Maintenance Material Submittals
    - a. Provide one listing of spare parts that is divided by specification section.
    - b. Include list prices for spare parts, expendable supplies, and tools.
    - c. Indicate spare parts packaging and storage methods.
    - d. Indicate spare parts or components that could be deleted or reduced based on manufacturer's recommendations.
    - e. Indicate where manufacturer's recommendations exceed the spare parts specified.
    - f. Obtain spare parts from the equipment manufacturer. Do not provide third-party equivalent replacements.
    - g. Packaging, Testing, and Storage:
      - 1) Provide protective toolboxes for special tools.
      - 2) Test spare boards, circuit cards, power supplies, and similar spare electronic assemblies on site prior to acceptance.
      - 3) Carefully repackage operable parts. Immediately remove inoperable parts from the site and order replacement parts. Test replacement parts prior to acceptance.
      - 4) Package spare parts for protection against dirt and moisture. Label each package as to its contents with a description and part number.
      - 5) Do not place spare parts for different equipment items in the same package.

## **1.07 QUALITY ASSURANCE**

- A. All work covered by Sections 40 61 13 through 40 67 00 shall be the responsibility of a single Systems Integrator as defined within this article.

- B. The instrumentation and control system functions are shown on the drawings and specified in subsequent sections of Division 40. The Systems Integrator drawings and integration practices shall be as defined in IEEE 100, ISA 51.1, and NEMA ICS 1.
- C. Demonstrate the overall system performance to the Engineer for acceptance.
- D. Systems Integrator qualifications:
  - 1. Evidence of Experience—Company specializing in the products and work of this section and related sections:
    - a. Minimum of 5 years of documented company experience with control systems for water distribution, the equipment specified, as well as overall systems responsibility for systems of similar size and complexity.
    - b. Experience in performing three similar successful projects (equipment type, software type, Systems Integrator responsibilities, complexity, and dollar value of work performed by Systems Integrator) in the last 10 years. At least one project currently in progress or completed within the last 2 years.
    - c. Three (3) years' experience with Siemens SIMATIC ET200SP PLC platform installation and configuration.
    - d. End-user satisfaction of projects in the past 3 to 5 years based on end-user interviews by the Owner or Engineer. Submit project descriptions of projects completed within the past 5 years with contact names, addresses, and telephone numbers from the project Owner, General Contractor, and Principal Design Firm.
    - e. Proven track record of completed projects without unresolved, unrealistic, and unnecessary claims.
    - f. At the time of bid, hold a current Washington contractor's license in a classification appropriate to this work.
    - g. Panel fabrication and staging facilities within the Continental United States and adequate to provide services for this project. Demonstrate by including the following:
      - 1) Minimum 5,000 square feet of dedicated space for panel fabrication and testing.
      - 2) Panel shop shall be UL 508A recognized to produce panels to UL 508A standards and labeling.
    - h. Financial resources available and projected for successful completion of this project. Submit financial data for Systems Integrator division when subsidiary to a parent corporation. Include 2 years of financial data:
      - 1) Financial statement.
      - 2) Balance sheet.
      - 3) Dun & Bradstreet Report.
    - i. Identify which major trade work (i.e., electrical, instrumentation) will be completed by the contractor's forces and which will be performed by sub-contractors. Provide previous project experience for all sub-contractors proposed.

- E. Systems Integrator Personnel Qualifications: Provide qualified personnel to complete the work specified for this project. Present information to identify key personnel who will be assigned to this work. List the experience in the last 10 years of the proposed project team for this project, with emphasis on the construction of projects that include live control system migration and implementation projects for water distribution and/or sewer collection systems. Demonstrate by including the following:
  - 1. Organization chart and resumes for proposed project personnel showing experience for the proposed roles on this project, including the following:
    - a. Project manager: An engineer or qualified specialist to manage, coordinate, and supervise the system integration work and testing. Manager shall have a minimum of 5 years of experience, or experience on at least five separate projects, in managing the system integration and startup of similar electrical and process control systems for water or wastewater SCADA control system PLC replacement.
    - b. Systems engineer: Control System Engineer (CSE) registration, Professional Engineer (PE) registration, or completion of the relevant core courses in the Engineering Skills Training program as certified by ISA.
    - c. Startup engineer: Experience on at least five separate projects, in managing the testing and startup of similar electrical and instrumentation control systems.

## **1.08 ENVIRONMENTAL CONDITIONS**

- A. Ambient conditions: Per Section 01 11 00.
- B. Corrosive locations: Per Division 26.
- C. Seismic:
  - 1. Brace equipment and supports per installation detail drawings.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT/MATERIALS**

- A. General requirements:
  - 1. New.
  - 2. Free from defects.
  - 3. Rated for the installed environment.
- B. Similar control system components, instrument, instrument accessory, and devices used throughout the work shall be manufactured by one firm, where possible.
- C. The components, modules, devices, and control system equipment shall be recognized industrial-quality products. Recognized commercial- or office-grade products are prohibited.
- D. Use electronic equipment of solid-state construction with printed or etched circuit boards of glass epoxy of sufficient thickness to prevent warping.

## 2.02 SOFTWARE

- A. Software packages are to be latest versions available or compatible with software currently in use. All licenses shall be transferred to the Owner.

## 2.03 ENCLOSURES

- A. Table A specifies the instrument and control panel enclosure material and minimum NEMA rating for the location and application.

**TABLE A**

<b>Location</b>	<b>Enclosure Material and NEMA Rating</b>
Indoor: architecturally finished area	NEMA 12: mild steel
Indoor: electrical room	NEMA 12: mild steel
Indoor: process areas	NEMA 4X: 316 stainless steel, or as specified
Indoor: corrosive area	NEMA 4X: 316 stainless steel, or as specified
Outdoor: corrosive area	NEMA 4X: 316 stainless steel
Outdoor: non-corrosive areas	NEMA 4X: 316 stainless steel
Corrosive area (hypochlorite)	NEMA 4X: non-metallic

## 2.04 NAMEPLATES

- A. Provide nameplates for field-mounted equipment covered by this section with the following requirements:
  - 1. Include the equipment description and the equipment tag number, where nameplate engraving is not specified or shown.
  - 2. Machine engraved black phenolic with white stamped 5/32-inch-high lettering, as minimum, unless otherwise specified or shown.
- B. Nameplate wording may be changed without additional cost or time, if changes are made prior to commencement of engraving.
- C. Attach nameplates to support hardware with a minimum of two self-tapping type 316 stainless steel screws unless the panel has a NEMA 4 or NEMA 4X rating. Provide room-temperature-vulcanizing (RTV) sealant to adhere nameplates for NEMA 4 or NEMA 4X panels. Nameplates shall be located in a readily visible location so the nameplate will remain to identify the service when the device is removed. Attach field instrument nameplates with braided stainless steel straps where not stand-mounted.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify field measurements prior to fabrication.

### **3.02 INSTALLATION**

#### **A. General:**

1. Install equipment in locations that are accessible for operation and maintenance services. Equipment not accessible shall be reinstalled at no cost to the Owner.
2. Installation, settings, and testing procedures are specified in this Section, Section 40 67 00, and subsequent sections of Divisions 26 and 40.

#### **B. Field Equipment:**

1. Equipment shall be provided with ports and adjustable items accessible for in-place testing. Install equipment between 48 inches and 60 inches above the floor or permanent work platform. Equipment shall be mounted to avoid shock or vibration that may impair operation. Equipment shall be mounted for unobstructed access and walkways. Equipment support systems shall not be attached to handrails, process piping or mechanical equipment
2. Space instruments and cabinets from concrete walls by 5/8 inch with framing channel between instrument or cabinet and wall. Add supports to block wall to avoid damage to the wall.
3. Design support systems, including panels, in accordance with installation detail drawings to prevent deformation greater than 1/8 inch in any direction under the attached equipment load and under an external load of 200 pounds.
4. In wet or outdoor areas, make conduit penetrations into instrument housing or panels through the bottom (preferred) or side of enclosures to minimize water entry from around or from inside of conduits. Provide conduit hubs for connections and waterproof mastic for moisture sealant.
5. Provide nameplates for field-mounted equipment. Attach nameplates in a readily visible location, but such that if the field device is replaced, the nameplate will remain to identify the service.

### **3.03 FIELD QUALITY CONTROL**

#### **A. Delivery Inspection:**

1. Notify the Engineer upon arrival of material or equipment to be incorporated into the work. Remove protective covers or otherwise provide access in order that the Engineer may inspect such items.

#### **B. Inspection and Installed Tests:**

1. Refer to Section 40 61 21.

### **3.04 CLEANING**

- A. Execute final cleaning prior to final project assessment.
- B. Clean surfaces exposed to view, remove temporary labels, stains, and foreign substances.
- C. Replace filters of operating equipment.
- D. Remove waste and surplus materials, rubbish, and construction facilities from site.

**3.05 TESTING AND COMMISSIONING**

A. Refer to Section 40 61 21.

**END OF SECTION**



SECTION 40 61 21  
PROCESS CONTROL SYSTEM TESTING

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section specifies testing requirements applicable to Division 40 specification sections for the process control system.
- B. Systems Integrator shall coordinate process control system testing. Except where the role of the Programmer is specifically identified, the work specified in this section shall be performed by the Systems Integrator.
- C. Provide the labor, tools, documentation, material, power, and services necessary to provide the process instrumentation and control system inspection and testing specified herein. Coordinate all testing with Section 01 75 00:
  - 1. Pre-Operational Testing:
    - a. Factory Acceptance Testing (FAT).
  - 2. Component Testing Sequence:
    - a. Wiring Testing.
    - b. Network and Bus Cable System Inspection and Testing.
    - c. Loop Testing.
  - 3. Functional Testing Sequence:
    - a. Process Control Strategy/Functional Testing.
    - b. Control System Closed Loop Testing.
    - c. Functional Checkout.
  - 4. Operational Testing.
  - 5. Commissioning.
- D. Related sections:
  - 1. Section 01 75 00 – Testing and Commissioning
  - 2. Section 40 61 13 – Process Control System General Provisions
  - 3. Section 40 61 93 – Process Control System Input/Output List
  - 4. Section 40 61 96 – Process Control Descriptions

**1.02 REFERENCES**

- A. Definitions:
  - 1. The term “instrumentation” covers field and panel instruments, analyzers, primary sensing elements, transmitters, power supplies, and monitoring devices.

**B. Reference Standards:**

1. This section contains references to the following documents with additional references listed in Section 40 61 13.
  - a. References are part of this section as specified and modified. In case of conflict between the requirements of this section and those of the referenced documents, the requirements of this section prevail.
  - b. Version: Latest documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no bids) unless noted otherwise.
  - c. If referenced documents have been discontinued by the issuing organization, use the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
  - d. Where document dates are given in the following listing, reference to those documents means the specific document version associated with that date, whether the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ISA 51.1	Process Instrumentation Terminology

**1.03 ADMINISTRATIVE REQUIREMENTS**

**A. Coordination:**

1. Coordinate testing with Section 01 75 00.
2. Coordinate with Programmer as described in this Section for testing.
3. Provide notice to the Owner and Engineer prior to conducting a test.
4. Provide a detailed step-by-step test procedure, between 30 and 40 days before the commencement of testing activity, complete with forms for the recording of test results, testing equipment used, and a place for identification of the individuals performing and witnessing the test.

**1.04 SUBMITTALS**

A. Procedures: Section 01 33 00.

B. Requirements: Section 40 61 13.

**C. Action Submittals:**

1. Quality Assurance submittal:
  - a. PCS Testing Manager Qualifications per Paragraph 1.05.
  - b. Example test forms per Field Test Procedure Documentation per paragraph 2.02, revised to show project labeling.
2. FAT Submittal:
  - a. FAT schedule and location.
  - b. FAT procedures and testing documentation, per paragraph 3.02.

3. Testing Submittal: Provide the following submittal after review of the Quality Assurance and FAT Submittals:
  - a. Preliminary Testing Submittal:
    - 1) Submit detailed testing plan and proposed testing documentation after review of the Quality Assurance submittal showing conformance with Part 2 of this section. Obtain approved submittal prior to testing per Paragraph 2.02:
      - a) Sample control description. Coordinate with Engineer for inclusion of sample control descriptions in the submittal.
      - b) Sample I/O interface summary.
      - c) Sample testing status spreadsheets.
      - d) Sample outline of the specific procedures used for the following testing phases:
        - (1) Component Testing Sequence.
        - (2) Functional Testing Sequence. Coordinate with Programmer, who is responsible for development of the Functional Testing Sequence, for inclusion in this submittal.
        - (3) Operational Testing.
      - e) Proposed test forms per this section.
        - (1) Coordinate with Programmer, who is responsible for development of the Functional Testing forms, for inclusion in this submittal.
    - b. Detailed Testing Submittal: Upon approval of the Preliminary Testing Submittal and at least 30 days prior to actual start up activities, the Systems Integrator shall submit the following per Paragraph 2.02:
      - 1) Final control descriptions. Coordinate with Engineer for inclusion of final control descriptions in the submittal.
      - 2) Final I/O Interface Summaries.
      - 3) Testing status spreadsheets.
      - 4) Final test procedures. Coordinate with Programmer, who is responsible for development of the Functional Testing procedures, for inclusion of the final Functional Test procedures in this submittal.
      - 5) Detailed test forms for each test for this project.
        - a) Component Test results.
        - b) Functional Test results. Coordinate with Programmer, who is responsible for development of the Functional Testing forms, for inclusion in this submittal.
        - c) Operational Test results.
      - 6) Certified Factory Calibration Reports.

#### D. Closeout Submittals

1. Final Test Report Submittal: in bookmarked PDF format and assembled in a three-ring binder and submitted at the completion of the inspection and testing activities for a site.
  - a. Label the binder cover and spine to identify the project name and site name. Include in the test report the applicable test procedures for the site and the completed inspection and test report forms associated with the equipment and systems of that site.
  - b. Organize test results by equipment item or system with individual, labeled tab dividers to identify each. The responsible testing entity is to acknowledge system deficiencies and noncompliant test results identified in the final test report as corrected.
  - c. Documentation of network data communication nodes for network-type instruments, devices, and variable-frequency drives.
  - d. Test equipment and test equipment calibration date.
  - e. Component test results.
  - f. Functional test results.
  - g. Operational test results.

### 1.05 QUALITY ASSURANCE

#### A. PCS Testing Manager

1. Appoint a startup engineer or qualified specialist as Process Control System (PCS) Testing Manager to manage, coordinate, and supervise the testing work.
2. PCS Testing Manager Qualifications:
  - a. The PCS Testing Manager shall have at least 5 years of total experience, or experience on at least five separate projects, in managing the testing and startup of similar electrical and instrumentation control systems.
3. The quality assurance program includes:
  - a. Definition of testing groups, with testing executed on an site-by-site basis.
  - b. Testing for each site executed in sequential tasks.
  - c. Regularly updated testing status tracking by site and task.
  - d. Regularly updated separate testing documentation for each site.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Test forms: Conform to the requirements of Reference Forms 40 61 13-A and 40 61 13-J included in Section 01 99 90. Develop additional or detailed forms as necessary. Use terms on test forms that comply with ISA 51.1.
- B. Project Labeling:
  1. The items specifying project labeling herein include the following as a minimum: Owner's name, site name, project name, and project number.

## 2.02 TESTING DOCUMENTATION

### A. Documentation Records:

1. Develop a record-keeping system to document progress and completion for each task at each site.
2. The following documentation shall be kept current and available for inspection on site in a location designated by the Owner:
  - a. PCS Testing Manager's qualifications, project startup, and testing history, including resume per paragraph 1.05.
  - b. List of names of Contractor's and System Integrator's personnel associated with final construction and testing, and normal and emergency contact telephone numbers.
  - c. Testing Status spreadsheet with breakdown for each site, with percentage complete on each testing sequence task.
  - d. Testing status specific to wiring test and loop testing status spreadsheet to include the I/O list organized by sites and system and loop number. Percent complete of the PCS system will be based on percentage of I/O points tested.
  - e. Test Report Volumes.

### B. Test Report Volumes:

1. Develop and maintain testing documentation for each site in separate volumes. Always keep each volume current and available for inspection on site in a location designated by the Owner. Include the following as a minimum:
  - a. Three-ring binder with front cover and spine labeled: "Testing Documentation for (applicable) Site Name" including project labeling.
  - b. Table of Contents with same labeling as the volume cover with tabs for each section:
  - c. Section 1: Control Description
  - d. Section 2: I/O Interface
  - e. Section 3: Test Procedures and Forms
  - f. Section 4: Test Report

### C. Control Description:

1. Coordinate with Engineer to provide a control description outlining operation for each site. The Control Description Specification Section 40 61 96 may be used as a basis, but coordinate with Engineer for inclusion of the final control description.

### D. I/O Interface:

1. Provide I/O spreadsheets for each site. Coordinate with Programmer for information related to PLC programming and I/O configuration. Spreadsheets are to include the following for each I/O point:
  - a. Information shown in Section 40 61 93.
  - b. Signal number/tag.
  - c. Annotation description that may be logically abbreviated and that is subject to approval.
  - d. Complete physical I/O channel designation and addressing or communication I/O register designation.

- e. Bit state (0 and 1) designations for digital I/O, e.g. 0 = OFF and 1 = RUNNING; 0 = ALARM and 1 = NOT IN ALARM.
- f. Process range; engineering units and multipliers; and raw signal range count for analog I/O.
- g. Signals: Fixed point and scaled at the controller with minimum four significant implied digits of scaling; e.g., 0 to 1,400 at controller for a pH range of 0 to 14 at operator interface.
- h. Provide operator interface scaling to display decimal digits required.
- i. Indicate pass/fail for each point for both pre-loop test and loop tests.
- j. Indicate date of tests and comment for failed points.

E. Field Test Procedure Documentation:

1. Organize and assemble test procedures for each analog and discrete loop in the process control system in separate volumes for each site. Organize by I/O point. Submit final test records in electronic form by scanning and converting the records and files to Adobe PDF format, to preserve actual signatures and signoffs.
2. Include a detailed, step-by-step description of the required test procedure, panel and terminal block numbers for points of measurement, input test values, expected resultant values, test equipment required, process setup requirements, and safety precautions.
3. Include test report forms for each loop, including forms for component, functional, and operational tests, with the test procedure documentation. Record the actual test results on these forms and assemble them into final test reports.
4. Preprint and populate information in the test report forms to the extent possible prior to commencing testing.
5. Include on the test report forms:
  - a. Project name.
  - b. Site name.
  - c. Instrument loop description.
  - d. Instrument loop identification number.
  - e. Time and date of test.
  - f. Inspection checklist and results.
  - g. Reference to applicable test procedure.
  - h. Expected and actual test results for each test point in the loop including programmable controller data table or register values.
  - i. Test equipment used.
  - j. Space for remarks regarding test procedure or results, observations, etc.
  - k. Name, date, and signature of testing personnel.
  - l. Test witness's name and signature.

## PART 3 EXECUTION

### 3.01 GENERAL

#### A. General Requirements:

1. Materials, equipment, and construction included under this specification shall be inspected in accordance with this section and subsequent sections of this division. Testing shall be performed by the Contractor in accordance with this and subsequent sections of this division.
2. No required test shall be applied without prior notice to the Owner and Engineer. Between 30 and 40 days before the commencement of any testing activity, the Contractor shall provide a detailed step-by-step test procedure complete with forms for the recording of test results, testing equipment used, and a place for identification of the individual performing or, if applicable, witnessing the test.

#### B. Test Equipment and Materials:

1. Provide test equipment to conduct the specified tests that simulate inputs and read outputs with a rated accuracy at the point of measurement at least three times greater than the component under test.
2. Test instruments shall have a current calibration sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required. Certified calibration reports traceable to the National Institute of Standards and Technology shall be included with the final test report.
3. Vendor software tools may document the systems where a licensed copy of the identical software including connectors, cables, keys, interface cards and devices required for operation is submitted with the final documentation files.

#### C. Performance Deviation Tolerances:

1. Tolerances shall be specified in Division 40. Where tolerances are not specified, refer to the manufacturer's published performance specifications.
2. Overall accuracy requirements for loops consisting of two or more components shall be the root-summation-square (RSS) of the component accuracy specifications. Tolerances for each required calibration point shall be calculated and recorded on the associated test report form.

#### D. Installed Tests:

1. The Contractor's PCS Testing Manager shall coordinate, manage, and supervise the quality assurance program that includes:
  - a. Testing plan with the sequence for the test work.
  - b. Documentation program that records tests results.
  - c. Performance testing program systems.

#### E. Witnessing:

1. The Owner and Engineer reserve the right to observe factory and field testing procedures. The Owner and Engineer shall be notified prior to testing, as specified herein.

### 3.02 PRE-OPERATIONAL TESTING

#### A. Factory Acceptance Test

##### 1. General:

- a. Control system equipment shall be subject to a Factory Acceptance Test with the factory acceptance tests and subsequent retests witnessed by the Owner and/or Engineer. Control system panel programmable logic controllers, operator interface terminals, and/or local panel displays shall be loaded with the PLC software, HMI/SCADA software, and the programming and graphic configuration application software, as provided by the Programmer, at the control system equipment supplier's factory prior to the FAT. The Systems Integrator shall perform an initial wiring check and certify in writing that the panel I/O has been tested prior to the Programmer coming on site. The Systems Integrator shall then perform the I/O check out portion of the FAT in collaboration with the Programmer, who shall be present at the FAT.
- b. Equipment, panel instruments, panels, or cabinets shall be inspected with factory testing performed. Provide written notice to the Owner and Engineer 30 working days before the commencement of the FAT activity and include:
  - 1) Schedule for the FAT.
  - 2) Location of the FAT.
  - 3) Testing equipment used.
  - 4) Detailed test procedure with forms for the recording of test results.
  - 5) Sign-off spaces for the individuals performing and witnessing the tests.

##### 2. Factory Acceptance Test Procedures:

- a. Panels provided shall be interlocked or networked as applicable, operated, and checked-out by the equipment supplier prior to the FAT. Submit certification indicating that the panels are ready for the FAT.
- b. The FAT shall include the following:
  - 1) Visual inspection of equipment, instruments, control panels, and graphic displays.
  - 2) Validation of each input loop and output loop by simulated signals for analog inputs and by shorting discrete inputs.
  - 3) Validation shall include:
    - a) Monitoring state changes on operator interface screens based on the inputs state change.
    - b) Observation of online PLC programming application software with the associated PLC outputs state change.
    - c) Outputs triggered by operator interface software devices (pushbuttons, sliders, manually entered values, etc.)
    - d) Calibration and operation of instruments on or in the control panels.
  - 4) Repair of loops which do not pass validation.
  - 5) Retest of the FAT at no additional cost.
- c. Panels that pass the FAT may be shipped to the site upon shipping schedule and storage accommodation approval by the Engineer.



### 3.03 COMPONENT TESTING

#### A. General Requirements:

1. In general, tests shall be performed in the following order:

#### B. Wiring Tests:

1. Electrical power and signal cable ring-out and resistance testing. Conducted in accordance with Sections 26 05 00. Wiring tests shall not be conducted until cables have been properly terminated, tagged, and inspected.

#### C. Network and Bus Cable Inspection and Testing:

1. Test and verify control and instrumentation bus cabling using the standards that apply to the specific cable and bus type.
2. Pre-Active Testing: Inspect and test cables prior to energizing to verify the following:
  - a. Media type and specifications.
  - b. Physical routing and project-specific cable identification tagging.
  - c. Correct termination installation and connection of conductors to pins at terminations.
  - d. Record cable run length and compare to the manufacturer or industry standards to verify that lengths are within specifications.
  - e. Locations and values of network termination resistance.
  - f. Integrity and grounding of cable shields.
  - g. Values of transient protection (surge) elements.
  - h. Firmware revision level of network devices available prior to energization.
  - i. Settings of dip switches and configuration parameters.
3. Active System Testing: After the cable or network system has been activated for testing, Systems Integrator shall coordinate with Owner and Programmer to provide diagnostic monitoring and signal analysis for the bus network system to evaluate network and bus integrity and data transfer quality. Measure, verify, and record the following parameters:
  - a. Node addressing.
  - b. Signal attenuation before and after a repeater device and at the farthest point in the network.
  - c. Total network trunk voltage and current loading as applicable.
  - d. Baud rate, message traffic rate, percent bandwidth used, error rate, and lost packet count.
  - e. Firmware revision level of the network devices.
  - f. Pre-active and active testing: within the specified range of values established by the referenced standards.
  - g. Correct the functionality of networks and devices connected to the network.

#### D. Loop Testing:

1. Loop Testing shall not commence until the Wiring Testing has been completed and documented to the satisfaction of the Owner.
2. Each I/O point shall be tested as an integrated system from the field device to the termination on the I/O card in the panel, in collaboration with the Programmer.

3. For each discrete I/O point, verify and document contact status value for both the open and closed positions of the contact.
4. For analog points, verify analog value matches local display. Confirm calibration at 0, 25, 75, and 100 percent of value.
5. Check I/O point at the local panel display, if applicable, and at SCADA (via wireless or fiber communication), in coordination with the Programmer.
6. Correct loop circuitry and repeat the test until the instruments operate properly.

### **3.04 FUNCTIONAL TESTING**

#### **A. Process Control Strategy/Functional Testing:**

1. Control Strategy Testing will not commence until the Loop Testing has been completed and documented to the satisfaction of the Owner.
2. Control Strategy Testing is performed by the Programmer in collaboration with the Systems Integrator, and consists of installing and debugging the PLC control logic program, verifying the interface points between the PLCs and field devices and equipment, and exercising the control strategies. Control Strategy Testing will be performed on one PLC at a time. Testing may be witnessed by the Engineer. Contractor to coordinate scheduling requirements including Programmer in accordance with Division 01. The following specific tasks are to be performed as a part of functional testing:
  - a. Loss of remote site power shall have local PLC restart without error or operator intervention.
3. Owner SCADA HMI interface testing, performed by the Programmer, consists of installing and debugging the Owner SCADA HMI graphics, verifying the interface points between the PLC I/O points and programmed tags, and exercising the control strategies. Perform control strategy testing on one PLC at a time.
4. Operation interface terminal (OIT) testing, performed by the Programmer, consists of installing and debugging the OIT graphics, verifying the interface points between the PLC I/O points and programmed tags, and exercising the control strategies. Perform control strategy testing on one PLC at a time.
5. Provide qualified personnel to immediately correct any deficiencies in the Work that may be encountered during Control Strategy Testing. Failure of the Contractor to provide such personnel in a timely manner may prolong the time allotted to complete Control Strategy Testing.

#### **B. Control System Closed Loop Testing:**

1. Closed-Loop Commissioning shall not commence until the Control Strategy Testing has been successfully completed and documented to the satisfaction of the Owner.
2. Closed-loop commissioning tests, performed by the Programmer in collaboration with the Systems Integrator as part of the system tests, shall demonstrate stable operation of each loop under operating conditions. Tests shall include adjustment of loop tuning parameters.
3. Tuning parameters: gain (or proportional band), integral time constant, and derivative time constant for each control loop, adjusted to provide 1/4-amplitude damping, unless otherwise specified.

4. The loop response to a step disturbance shall be provided for each loop. Two graphs shall be made for cascaded control loops, one showing the secondary loop response with its set point in manual, and the second showing overall loop response.
  5. Control loops with "batch" features shall be adjusted to provide optimum response following start-up from an integral action saturation condition.
  6. Graph recording shall be provided showing the response and made at sufficient speed and amplitude to show 1/4 amplitude damping. Label to show loop number and title, and settings of parameters and set point.
  7. Where a loop is controlled under the direction of a programmable logic controller, the Programmer will perform the necessary adjustment of loop tuning parameters and set points; Systems Integrator shall record the loop response, adjusting final elements, and assuring total integrated loop performance as specified.
- C. Functional Checkout:
1. Conducted to verify the operation of discrete and hardwired control devices. Exercise the operable devices and energizing the control circuit. Operate control element, alarm device, and interlocks to verify the specified action occurs.

### **3.05 OPERATIONAL TESTING**

- A. Operational testing shall be performed after Functional Testing has been completed. Operational testing is a demonstration period with the system in full operation. During this time, the Owner operates the system, and the Programmer and Systems Integrator demonstrate that all functional requirements of this specification have been met. The test shall take place over a continuous twenty-one (21) day period as a minimum. During this time, Programmer and Systems Integrator shall be available to provide support to the Owner and to correct any issues noted. Operational testing shall demonstrate the following:
1. Each component of the system operates correctly with all other components of the system.
  2. Analog control loops operate in a stable manner.
  3. Hard-wired and software equipment interlocks perform correctly.
  4. Process control sequences perform correctly.
  5. PLC application program performs monitoring and control functions correctly.
  6. Operator interface graphics represent the monitoring and control functions correctly.

### **3.06 COMMISSIONING**

- A. After completion of the operational testing and agreement on the part of the Owner that the systems did meet all test requirements, commissioning will begin. The commissioning period for each remote site's process system shall be four (4) weeks. The Systems Integrator shall remove all temporary work and other alterations to the permanent systems that may have been needed during the operational or performance testing and shall perform the tasks necessary to make the improvements constructed under this contract fully operational. The Owner shall confirm in writing the date(s) that the system is ready for commissioning and on which actual commissioning activities commence. Activities conducted prior to such written confirmation shall not constitute commissioning.

- B. The Owner's operation and maintenance personnel will be responsible for operation of the systems to be commissioned. The portion of the work to be commissioned shall be fully operational, performing all functions for which it was designed.
- C. The Contractor shall be available at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being constructed. Failure of equipment or facilities where, in the opinion of the Owner, a significant interruption or impact to performance occurs will be grounds for restarting the Commissioning Period. At the end of the commissioning period and when all corrections required by the Owner to assure a reliable and completely operational facility are complete, the Owner shall issue a completion certificate. Each system shall have been issued a completion certificate as a condition precedent to the final acceptance of the work of this contract
- D. During the commissioning period, the Owner shall be responsible for all normal operational costs and the Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the system being commissioned, operational.

**END OF SECTION**

## SECTION 40 61 93

### PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section includes:
1. Input/output (I/O) list showing the following types of points that interface with the control system:
    - a. Points that are hardwired into the control system.
    - b. Points that are interfaced to the control system over a communications link.
  2. The I/O list does not include internal software points generated by the control system and used solely within the control system.
  3. The I/O list does not include individual read/write parameters involved in the data exchange between the PCS and networked devices. Instead, each device that exchanges data with the PCS over a communications link is represented as a single "point" in the I/O list along with a reference to the type of communications link and common equipment type. Refer to Section 40 61 96 for complete listings of the read/write parameters associated with the data exchange between the PCS and these common equipment types.
  4. The I/O list identifies demolition I/O showing the hardwired I/O points associated with control and signal circuits being demolished as part of this project.
- B. Related sections:
1. Section 40 61 13 – Process Control System General Provisions.
  2. Section 40 61 21 – Process Control System Testing.
  3. Section 40 61 96 – Process Control Descriptions.

##### **1.02 SUBMITTALS**

- A. Procedures: Section 01 33 00.
- B. Requirements: Section 40 61 13.
- C. Action Submittal:
1. Submit I/O list with Section 40 67 00 submittal.
- D. Informational Submittal:
1. Provide a copy of the electronic version of the complete list to the Engineer, at least monthly, when requested.
- E. Closeout Submittal:
1. Provide a final copy of the electronic version of the complete list to the Owner at the beginning and at the end of Process Control System Testing – Section 40 61 21.

## PART 2 NOT USED

## PART 3 EXECUTION

### 3.01 FIELD QUALITY CONTROL

- A. Refer to Section 40 61 21.
- B. Maintain a copy of the complete Input/Output List with modifications during construction in Excel format.

### 3.02 ATTACHMENTS

- A. 40 61 93 Attachment A: Input/Output (I/O) List
  1. The I/O List is organized based on site, then by PLC rack, slot, and channel number. The description of headings in I/O List is provided in the table below.

Field or Heading	Example	Comment or Description
Item	1	Row number reference.
Utility	Water	Utility identification.
Site	First Hill Pump Station	Site location of the I/O.
I/O Tag	WA_DST_FHL_PI0110	Unique tag identification.
Division ID	WA	Operational division or department.
Process Area ID	DST	Process area or zone.
Process Code	FHL	Process or site code.
ISA Prefix	PI	Instrument functional identification. Refer to P&ID legend sheets.
Loop Number	0110	Sequential number that is part of a functional "loop".
Suffix	A	Alpha identifier used to differentiate elements that would otherwise share the name tag, as required.
Description	Suction Pressure	Description/function of the I/O tag.
I/O Type	AI	AI, DI, DO, AO, NW (networked)
Panel	WA_DST_FHL_CAB7000	Panel where the I/O is physically wired. For networked I/O, the panel where the network switch resides.
PLC	WA_DST_FHL_PL7001	PLC where the I/O is physically wired. For networked I/O, the PLC that executes the data exchange with the networked device.
Rack	00	Match contract drawing, or if not shown, match to submittal information.
Slot	06	Match contract drawing, or if not shown, match to submittal information.
Channel	00	Match contract drawing, or if not shown, match to submittal information.
Module / Device Type	4-20 mA	4-20 mA, ProfiNet, Profibus, Discrete Contact, etc.

<b>Field or Heading</b>	<b>Example</b>	<b>Comment or Description</b>
Calibration Range	0-100 psig	Applicable primarily to analog instruments. Provides the measured range and applicable engineering units for the instrument.
Wiring Diagram	I-1301	Reference to the typical I/O wiring detail that is relevant to the I/O point.
Application Notes or Comments		Optional, as required for clarification.
Status	Existing	Status of the I/O point: new, demo, existing, spare, future

**END OF SECTION**

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**SECTION 40 61 93\_ PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

**ATTACHMENT A**

**INPUT/OUTPUT LIST**

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**SECTION 40 61 93 ATTACHMENT A  
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
1	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_FQI0120	WA	DST	FHL	FQI	0120		STATION FLOW PULSE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	00	24 VDC	DRY CONTACT	I-1101	PULSE EQUALS 100 GALLONS. FIELD VERIFY.	EXISTING
2	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YA0001	WA	DST	FHL	YA	0001		STATION INTRUSION ALARM	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	01	24 VDC	DRY CONTACT	I-1101		EXISTING
3	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_LAH0002	WA	DST	FHL	LAH	0002		STATION FLOOD ALARM	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	02	24 VDC	DRY CONTACT	I-1101		EXISTING
4	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YI0701	WA	DST	FHL	YI	0701		GENERATOR RUN	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	03	24 VDC	DRY CONTACT	I-1101		EXISTING
5	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YA0701	WA	DST	FHL	YA	0701		GENERATOR TROUBLE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	04	24 VDC	DRY CONTACT	I-1101		EXISTING
6	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_LAL0701	WA	DST	FHL	LAL	0701		GENERATOR LOW FUEL	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	05	24 VDC	DRY CONTACT	I-1101		EXISTING
7	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_NI0702A	WA	DST	FHL	NI	0702	A	ATS IN NORMAL	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	06	24 VDC	DRY CONTACT	I-1101		EXISTING
8	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_NI0702B	WA	DST	FHL	NI	0702	B	ATS IN GENERATOR	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	07	24 VDC	DRY CONTACT	I-1101		EXISTING
9	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_ZIC0140	WA	DST	FHL	ZIC	0140		PRESSURE REDUCING VALVE CLOSED	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	08	24 VDC	DRY CONTACT	I-1101		EXISTING
10	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YI0801	WA	DST	FHL	YI	0801		EXHAUST FAN 1 RUN	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	09	24 VDC	DRY CONTACT	I-1101		EXISTING
11	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YA0801	WA	DST	FHL	YA	0801		EXHAUST FAN 1 OVERLOAD	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	10	24 VDC	DRY CONTACT	I-1101		EXISTING
12	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	11			I-1101		SPARE
13	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	12			I-1101		SPARE
14	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	13			I-1101		SPARE
15	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	14			I-1101		SPARE
16	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	04	15			I-1101		SPARE
17	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_NI7000	WA	DST	FHL	NI	7000		PLC PANEL 120V POWER AVAILABLE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	00	24 VDC	DRY CONTACT	I-1102		NEW
18	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YA7002	WA	DST	FHL	YA	7002		PLC PANEL INTRUSION ALARM	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	01	24 VDC	DRY CONTACT	I-1102		NEW
19	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_NI7003	WA	DST	FHL	NI	7003		PLC PANEL 24V POWER SUPPLY OK	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	02	24 VDC	DRY CONTACT	I-1102		NEW
20	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_NI7004	WA	DST	FHL	NI	7004		UPS ON BATTERY	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	03	24 VDC	DRY CONTACT	I-1102		NEW
21	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_XA7004	WA	DST	FHL	XA	7004		UPS ALARM	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	04	24 VDC	DRY CONTACT	I-1102		NEW
22	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_JAL7004	WA	DST	FHL	JAL	7004		UPS LOW BATTERY	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	05	24 VDC	DRY CONTACT	I-1102		NEW
23	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_XA7005	WA	DST	FHL	XA	7005		NETWORK SWITCH 1 ALARM	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	06	24 VDC	DRY CONTACT	I-1102		NEW
24	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_XA7006	WA	DST	FHL	XA	7006		NETWORK SWITCH 2 ALARM	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	07	24 VDC	DRY CONTACT	I-1102		NEW
25	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YI0901	WA	DST	FHL	YI	0901		EXHAUST FAN 2 RUN	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	08	24 VDC	DRY CONTACT	I-1102		EXISTING
26	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_YA0901	WA	DST	FHL	YA	0901		EXHAUST FAN 2 OVERLOAD	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	09	24 VDC	DRY CONTACT	I-1102		EXISTING
27	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_NI7007	WA	DST	FHL	NI	7007		SURGE PROTECTION DEVICE OK	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	10	24 VDC	DRY CONTACT	I-1102		NEW
28	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	11			I-1102		SPARE
29	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	12			I-1102		SPARE
30	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	13			I-1102		SPARE
31	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	14			I-1102		SPARE
32	WATER	FIRST HILL PUMP STATION	---							SPARE	DI	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	05	15			I-1102		SPARE
33	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	06	00			I-1201		SPARE
34	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	06	01			I-1201		SPARE
35	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	06	02			I-1201		SPARE
36	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	06	03			I-1201		SPARE
37	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	00	06	04			I-1201		SPARE

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PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
38	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	05			I-1201		SPARE
39	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	06			I-1201		SPARE
40	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	07			I-1201		SPARE
41	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	08			I-1201		SPARE
42	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	09			I-1201		SPARE
43	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	10			I-1201		SPARE
44	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	11			I-1201		SPARE
45	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	12			I-1201		SPARE
46	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	13			I-1201		SPARE
47	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	14			I-1201		SPARE
48	WATER	FIRST HILL PUMP STATION	---							SPARE	DO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	06	15			I-1201		SPARE
49	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_PI0110	WA	DST	FHL	PI	0110		SUCTION PRESSURE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	07	00	4-20 mA	0-100 PSIG	I-1301		EXISTING
50	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_PI0130	WA	DST	FHL	PI	0130		DISCHARGE PRESSURE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	07	01	4-20 mA	0-100 PSIG	I-1301		EXISTING
51	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_FI0120	WA	DST	FHL	FI	0120		STATION FLOW	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	07	02	4-20 mA	0-1000 GPM	I-1301		EXISTING
52	WATER	FIRST HILL PUMP STATION	---							SPARE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	07	03			I-1301		SPARE
53	WATER	FIRST HILL PUMP STATION	---							SPARE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	08	00			I-1302		SPARE
54	WATER	FIRST HILL PUMP STATION	---							SPARE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	08	01			I-1302		SPARE
55	WATER	FIRST HILL PUMP STATION	---							SPARE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	08	02			I-1302		SPARE
56	WATER	FIRST HILL PUMP STATION	---							SPARE	AI	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	08	03			I-1302		SPARE
57	WATER	FIRST HILL PUMP STATION	---							SPARE	AO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	09	00			I-1401		SPARE
58	WATER	FIRST HILL PUMP STATION	---							SPARE	AO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	09	01			I-1401		SPARE
59	WATER	FIRST HILL PUMP STATION	---							SPARE	AO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	09	02			I-1401		SPARE
60	WATER	FIRST HILL PUMP STATION	---							SPARE	AO	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	00	09	03			I-1401		SPARE
61	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0101	WA	DST	FHL	U	0101		FIRST HILL PUMP 1 VFD	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS G120 VFD, PROFIBUS NETWORKED I/O. 1.5 HP PUMP. EXISTING FIELD NAMEPLATE: P-301.	EXISTING
62	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0201	WA	DST	FHL	U	0201		FIRST HILL PUMP 2 VFD	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS G120 VFD, PROFIBUS NETWORKED I/O. 1.5 HP PUMP. EXISTING FIELD NAMEPLATE: P-401.	EXISTING
63	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0301	WA	DST	FHL	U	0301		FIRST HILL PUMP 3 VFD	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS G120 VFD, PROFIBUS NETWORKED I/O. 1.5 HP PUMP. EXISTING FIELD NAMEPLATE: P-501.	EXISTING
64	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0401	WA	DST	FHL	U	0401		FIRST HILL PUMP 4 VFD	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS G120 VFD, PROFIBUS NETWORKED I/O. 1.5 HP PUMP. EXISTING FIELD NAMEPLATE: P-601.	EXISTING
65	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0501	WA	DST	FHL	U	0501		FIRST HILL PUMP 5 VFD	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS G120 VFD, PROFIBUS NETWORKED I/O. 40 HP PUMP. EXISTING FIELD NAMEPLATE: P-101.	EXISTING
66	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0601	WA	DST	FHL	U	0601		FIRST HILL PUMP 6 VFD	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS G120 VFD, PROFIBUS NETWORKED I/O. 40 HP PUMP. EXISTING FIELD NAMEPLATE: P-201.	EXISTING
67	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0703	WA	DST	FHL	U	0703		FIRST HILL POWER MONITOR	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	SIEMENS SENTRON 3200, PROFIBUS NETWORKED I/O	EXISTING
68	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_U0150	WA	DST	FHL	U	0150		FIRST HILL WATER QUALITY ANALYZER	NW	WA_DST_FHL_CAB7000	WA_DST_FHL_PL7001	NA	NA	NA	PROFIBUS	N/A	I-1501	ROSEMOUNT 1056 XTMR, PROFIBUS NETWORKED I/O. CL2: 0-5 PPM, PH: 0-14, TEMP: 0-100 DEG F	EXISTING
69	WATER	SPU STATION 171	WA_WS_SPU171_YA0001	WA	WS	SPU171	YA	0001		STATION INTRUSION ALARM	DI	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PL7001	00	03	00	24 VDC	DRY CONTACT	I-2101		EXISTING
70	WATER	SPU STATION 171	WA_WS_SPU171_HS1003A	WA	WS	SPU171	HS	1003	A	FLOW CONTROL VALVE OPEN COMMAND	DI	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PL7001	00	03	01	24 VDC	DRY CONTACT	I-2101	VIA LOCAL CONTROL STATION IN VAULT	EXISTING
71	WATER	SPU STATION 171	WA_WS_SPU171_NI1003	WA	WS	SPU171	NI	1003		FLOW CONTROL VALVE IN AUTO	DI	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PL7001	00	03	02	24 VDC	DRY CONTACT	I-2101	VIA LOCAL CONTROL STATION IN VAULT	EXISTING
72	WATER	SPU STATION 171	WA_WS_SPU171_HS1003B	WA	WS	SPU171	HS	1003	B	FLOW CONTROL VALVE CLOSE COMMAND	DI	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PL7001	00	03	03	24 VDC	DRY CONTACT	I-2101	VIA LOCAL CONTROL STATION IN VAULT	EXISTING
73	WATER	SPU STATION 171	WA_WS_SPU171_LAH0002	WA	WS	SPU171	LAH	0002		STATION FLOOD ALARM	DI	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PL7001	00	03	04	24 VDC	DRY CONTACT	I-2101		EXISTING
74	WATER	SPU STATION 171	WA_WS_SPU171_ZIC1003	WA	WS	SPU171	ZIC	1003		FLOW CONTROL VALVE CLOSED	DI	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PL7001	00	03	05	24 VDC	DRY CONTACT	I-2101		EXISTING

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PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
75	WATER	SPU STATION 171	WA_WS_SPU171_LAH1005	WA	WS	SPU171	LAH	1005		WATER QUALITY ANALYZER PANEL FLOOD ALARM	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	06	24 VDC	DRY CONTACT	I-2101		EXISTING
76	WATER	SPU STATION 171	WA_WS_SPU171_FQI1002	WA	WS	SPU171	FQI	1002		STATION FLOW PULSE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	07	24 VDC	DRY CONTACT	I-2101	PULSE EQUALS 100 GALLONS. FIELD VERIFY.	EXISTING
77	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	08			I-2101		SPARE
78	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	09			I-2101		SPARE
79	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	10			I-2101		SPARE
80	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	11			I-2101		SPARE
81	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	12			I-2101		SPARE
82	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	13			I-2101		SPARE
83	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	14			I-2101		SPARE
84	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	03	15			I-2101		SPARE
85	WATER	SPU STATION 171	WA_WS_SPU171_NI7000	WA	WS	SPU171	NI	7000		PLC PANEL 120V POWER AVAILABLE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	00	24 VDC	DRY CONTACT	I-2102		NEW
86	WATER	SPU STATION 171	WA_WS_SPU171_YA7002	WA	WS	SPU171	YA	7002		PLC PANEL INTRUSION ALARM	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	01	24 VDC	DRY CONTACT	I-2102		NEW
87	WATER	SPU STATION 171	WA_WS_SPU171_NI7003	WA	WS	SPU171	NI	7003		PLC PANEL 24V POWER SUPPLY OK	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	02	24 VDC	DRY CONTACT	I-2102		NEW
88	WATER	SPU STATION 171	WA_WS_SPU171_NI7004	WA	WS	SPU171	NI	7004		UPS ON BATTERY	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	03	24 VDC	DRY CONTACT	I-2102		NEW
89	WATER	SPU STATION 171	WA_WS_SPU171_XA7004	WA	WS	SPU171	XA	7004		UPS ALARM	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	04	24 VDC	DRY CONTACT	I-2102		NEW
90	WATER	SPU STATION 171	WA_WS_SPU171_JAL7004	WA	WS	SPU171	JAL	7004		UPS LOW BATTERY	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	05	24 VDC	DRY CONTACT	I-2102		NEW
91	WATER	SPU STATION 171	WA_WS_SPU171_XA7005	WA	WS	SPU171	XA	7005		NETWORK SWITCH ALARM	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	06	24 VDC	DRY CONTACT	I-2102		NEW
92	WATER	SPU STATION 171	WA_WS_SPU171_NI7006	WA	WS	SPU171	NI	7006		SURGE PROTECTION DEVICE OK	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	07	24 VDC	DRY CONTACT	I-2102		NEW
93	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	08			I-2102		SPARE
94	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	09			I-2102		SPARE
95	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	10			I-2102		SPARE
96	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	11			I-2102		SPARE
97	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	12			I-2102		SPARE
98	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	13			I-2102		SPARE
99	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	14			I-2102		SPARE
100	WATER	SPU STATION 171	---							SPARE	DI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	04	15			I-2102		SPARE
101	WATER	SPU STATION 171	WA_WS_SPU171_ZCO1003	WA	WS	SPU171	ZCO	1003		FLOW CONTROL VALVE OPEN COMMAND	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	00	24 VDC	ENERGIZE TO OPEN	I-2201	TO OPEN SOLENOID VALVE	EXISTING
102	WATER	SPU STATION 171	WA_WS_SPU171_ZCC1003	WA	WS	SPU171	ZCC	1003		FLOW CONTROL VALVE CLOSE COMMAND	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	01	24 VDC	ENERGIZE TO OPEN	I-2201	TO CLOSE SOLENOID VALVE	EXISTING
103	WATER	SPU STATION 171	WA_WS_SPU171_YC1003	WA	WS	SPU171	YC	1003		FLOW CONTROL VALVE CONTROL ENABLE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	02	24 VDC	ENERGIZE TO CLOSE	I-2201	TO ENABLE SOLENOID VALVE	EXISTING
104	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	03			I-2201		SPARE
105	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	04			I-2201		SPARE
106	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	05			I-2201		SPARE
107	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	06			I-2201		SPARE
108	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	07			I-2201		SPARE
109	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	08			I-2201		SPARE
110	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	09			I-2201		SPARE
111	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	10			I-2201		SPARE

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Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
112	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	11			I-2201		SPARE
113	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	12			I-2201		SPARE
114	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	13			I-2201		SPARE
115	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	14			I-2201		SPARE
116	WATER	SPU STATION 171	---							SPARE	DO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	05	15			I-2201		SPARE
117	WATER	SPU STATION 171	WA_WS_SPU171_PI1001	WA	WS	SPU171	PI	1001		UPSTREAM PRESSURE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	06	00	4-20 mA	0-233 PSI	I-2301		EXISTING
118	WATER	SPU STATION 171	WA_WS_SPU171_PI1004	WA	WS	SPU171	PI	1004		DOWNSTREAM PRESSURE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	06	01	4-20 mA	0-248 PSI	I-2301		EXISTING
119	WATER	SPU STATION 171	WA_WS_SPU171_FI1002	WA	WS	SPU171	FI	1002		STATION FLOW	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	06	02	4-20 mA	0-5000 GPM	I-2301		EXISTING
120	WATER	SPU STATION 171	---							SPARE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	06	03			I-2301		SPARE
121	WATER	SPU STATION 171	WA_WS_SPU171_AI1005A	WA	WS	SPU171	AI	1005	A	WATER QUALITY ANALYZER FREE CHLORINE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	07	00	4-20 mA	0-3 PPM	I-2302		EXISTING
122	WATER	SPU STATION 171	WA_WS_SPU171_AH1005B	WA	WS	SPU171	AI	1005	B	WATER QUALITY ANALYZER PH	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	07	01	4-20 mA	0-14	I-2302		EXISTING
123	WATER	SPU STATION 171	WA_WS_SPU171_TI1005	WA	WS	SPU171	TI	1005		WATER QUALITY ANALYZER WATER TEMPERATURE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	07	02	4-20 mA	X - X degF	I-2302		EXISTING
124	WATER	SPU STATION 171	---							SPARE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	07	03			I-2302		SPARE
125	WATER	SPU STATION 171	---							SPARE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	08	00			I-2303		SPARE
126	WATER	SPU STATION 171	---							SPARE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	08	01			I-2303		SPARE
127	WATER	SPU STATION 171	---							SPARE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	08	02			I-2303		SPARE
128	WATER	SPU STATION 171	---							SPARE	AI	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	08	03			I-2303		SPARE
129	WATER	SPU STATION 171	---							SPARE	AO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	09	00			I-2401		SPARE
130	WATER	SPU STATION 171	---							SPARE	AO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	09	01			I-2401		SPARE
131	WATER	SPU STATION 171	---							SPARE	AO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	09	02			I-2401		SPARE
132	WATER	SPU STATION 171	---							SPARE	AO	WA_WS_SPU171_CAB700 0	WA_WS_SPU171_PLC700 1	00	09	03			I-2401		SPARE
133	WATER	SOUTH FIRE STATION	WA_DST_SFS_NI7000	WA	DST	SFS	NI	7000		PLC PANEL 120V POWER AVAILABLE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	00	24 VDC	DRY CONTACT	I-3101		NEW
134	WATER	SOUTH FIRE STATION	WA_DST_SFS_YA7002	WA	DST	SFS	YA	7002		PLC PANEL 24V POWER SUPPLY OK	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	01	24 VDC	DRY CONTACT	I-3101		NEW
135	WATER	SOUTH FIRE STATION	WA_DST_SFS_NI7003	WA	DST	SFS	NI	7003		PLC PANEL INTRUSION ALARM	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	02	24 VDC	DRY CONTACT	I-3101		NEW
136	WATER	SOUTH FIRE STATION	WA_DST_SFS_NI7004	WA	DST	SFS	NI	7004		UPS ON BATTERY	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	03	24 VDC	DRY CONTACT	I-3101		NEW
137	WATER	SOUTH FIRE STATION	WA_DST_SFS_XA7004	WA	DST	SFS	XA	7004		UPS ALARM	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	04	24 VDC	DRY CONTACT	I-3101		NEW
138	WATER	SOUTH FIRE STATION	WA_DST_SFS_JAL7004	WA	DST	SFS	JAL	7004		UPS LOW BATTERY	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	05	24 VDC	DRY CONTACT	I-3101		NEW
139	WATER	SOUTH FIRE STATION	WA_DST_SFS_NI7005	WA	DST	SFS	NI	7005		SURGE PROTECTION DEVICE OK	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	06	24 VDC	DRY CONTACT	I-3101		NEW
140	WATER	SOUTH FIRE STATION	WA_DST_SFS_XA7006	WA	DST	SFS	XA	7006		NETWORK SWITCH ALARM	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	07	24 VDC	DRY CONTACT	I-3101		NEW
141	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	08			I-3101		SPARE
142	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	09			I-3101		SPARE
143	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	10			I-3101		SPARE
144	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	11			I-3101		SPARE
145	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	12			I-3101		SPARE
146	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	13			I-3101		SPARE
147	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	14			I-3101		SPARE
148	WATER	SOUTH FIRE STATION	---							SPARE	DI	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	00	03	15			I-3101		SPARE

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Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
149	WATER	SOUTH FIRE STATION	WA_DST_SFS_PI1001	WA	DST	SFS	PI	1001		SYSTEM PRESSURE	AI	WA_DST_SFS_CAB7000	WA_DST_SFS_PL7001	00	04	00	4-20 mA	X - X PSI	I-3301		EXISTING
150	WATER	SOUTH FIRE STATION	WA_DST_SFS_AI1002A	WA	DST	SFS	AI	1002	A	WATER QUALITY ANALYZER CHLORINE (FUTURE)	AI	WA_DST_SFS_CAB7000	WA_DST_SFS_PL7001	00	04	01	4-20 mA	--	I-3301	RESERVE SPACE FOR FUTURE I/O	FUTURE
151	WATER	SOUTH FIRE STATION	WA_DST_SFS_AI1002B	WA	DST	SFS	AI	1002	B	WATER QUALITY ANALYZER PH (FUTURE)	AI	WA_DST_SFS_CAB7000	WA_DST_SFS_PL7001	00	04	02	4-20 mA	--	I-3301	RESERVE SPACE FOR FUTURE I/O	FUTURE
152	WATER	SOUTH FIRE STATION	---							SPARE	AI	WA_DST_SFS_CAB7000	WA_DST_SFS_PL7001	00	04	03			I-3301		SPARE
153	WATER	NORTH FIRE STATION	WA_DST_NFS_NI7000	WA	DST	NFS	NI	7000		PLC PANEL 120V POWER AVAILABLE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	00	24 VDC	DRY CONTACT	I-4101		NEW
154	WATER	NORTH FIRE STATION	WA_DST_NFS_YA7002	WA	DST	NFS	YA	7002		PLC PANEL 24V POWER SUPPLY OK	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	01	24 VDC	DRY CONTACT	I-4101		NEW
155	WATER	NORTH FIRE STATION	WA_DST_NFS_NI7003	WA	DST	NFS	NI	7003		PLC PANEL INTRUSION ALARM	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	02	24 VDC	DRY CONTACT	I-4101		NEW
156	WATER	NORTH FIRE STATION	WA_DST_NFS_NI7004	WA	DST	NFS	NI	7004		UPS ON BATTERY	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	03	24 VDC	DRY CONTACT	I-4101		NEW
157	WATER	NORTH FIRE STATION	WA_DST_NFS_XA7004	WA	DST	NFS	XA	7004		UPS ALARM	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	04	24 VDC	DRY CONTACT	I-4101		NEW
158	WATER	NORTH FIRE STATION	WA_DST_NFS_JAL7004	WA	DST	NFS	JAL	7004		UPS LOW BATTERY	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	05	24 VDC	DRY CONTACT	I-4101		NEW
159	WATER	NORTH FIRE STATION	WA_DST_NFS_NI7005	WA	DST	NFS	NI	7005		SURGE PROTECTION DEVICE OK	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	06	24 VDC	DRY CONTACT	I-4101		NEW
160	WATER	NORTH FIRE STATION	WA_DST_NFS_XA7006	WA	DST	NFS	XA	7006		NETWORK SWITCH ALARM	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	07	24 VDC	DRY CONTACT	I-4101		NEW
161	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	08			I-4101		SPARE
162	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	09			I-4101		SPARE
163	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	10			I-4101		SPARE
164	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	11			I-4101		SPARE
165	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	12			I-4101		SPARE
166	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	13			I-4101		SPARE
167	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	14			I-4101		SPARE
168	WATER	NORTH FIRE STATION	---							SPARE	DI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	03	15			I-4101		SPARE
169	WATER	NORTH FIRE STATION	WA_DST_NFS_PI1001	WA	DST	NFS	PI	1001		SYSTEM PRESSURE	AI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	04	00	4-20 mA	X - X PSI	I-4301		EXISTING
170	WATER	NORTH FIRE STATION	WA_DST_NFS_AI1002A	WA	DST	NFS	AI	1002	A	WATER QUALITY ANALYZER CHLORINE (FUTURE)	AI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	04	01	4-20 mA	--	I-4301	RESERVE SPACE FOR FUTURE I/O	FUTURE
171	WATER	NORTH FIRE STATION	WA_DST_NFS_AI1002B	WA	DST	NFS	AI	1002	B	WATER QUALITY ANALYZER PH (FUTURE)	AI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	04	02	4-20 mA	--	I-4301	RESERVE SPACE FOR FUTURE I/O	FUTURE
172	WATER	NORTH FIRE STATION	---							SPARE	AI	WA_DST_NFS_CAB7000	WA_DST_NFS_PL7001	00	04	03			I-4301		SPARE
173	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FQI1001	WA	RES	RS	FQI	1001		RESERVOIR INLET 1 FLOW PULSE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	00	24 VDC	DRY CONTACT	I-5101	PULSE EQUALS 1000 GALLONS. FIELD VERIFY.	EXISTING
174	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI1002	WA	RES	RS	NI	1002		RESERVOIR INLET CONTROL VALVE 1 IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	01	24 VDC	DRY CONTACT	I-5101		EXISTING
175	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI1003	WA	RES	RS	NI	1003		SOUTH RESERVOIR INLET ISOLATION VALVE IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	02	24 VDC	DRY CONTACT	I-5101		EXISTING
176	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZIC1003	WA	RES	RS	ZIC	1003		SOUTH RESERVOIR INLET ISOLATION VALVE CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	03	24 VDC	DRY CONTACT	I-5101		EXISTING
177	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI1006	WA	RES	RS	NI	1006		SOUTH RESERVOIR OUTLET ISOLATION VALVE IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	04	24 VDC	DRY CONTACT	I-5101		EXISTING
178	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZIC1006	WA	RES	RS	ZIC	1006		SOUTH RESERVOIR OUTLET ISOLATION VALVE CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	05	24 VDC	DRY CONTACT	I-5101		EXISTING
179	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FQI1007	WA	RES	RS	FQI	1007		SOUTH RESERVOIR OUTLET FLOW PULSE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	06	24 VDC	DRY CONTACT	I-5101	PULSE EQUALS 1000 GALLONS. FIELD VERIFY.	EXISTING
180	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZIC1002	WA	RES	RS	ZIC	1002		RESERVOIR INLET CONTROL VALVE 1 CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	07	24 VDC	DRY CONTACT	I-5101		EXISTING
181	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	08			I-5101		SPARE
182	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	09			I-5101		SPARE
183	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	10			I-5101		SPARE
184	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	11			I-5101		SPARE
185	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PL7001	00	03	12			I-5101		SPARE



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Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
186	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	03	13			I-5101		SPARE
187	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	03	14			I-5101		SPARE
188	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	03	15			I-5101		SPARE
189	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FQI2001	WA	RES	RS	FQI	2001		RESERVOIR INLET 2 FLOW PULSE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	00	24 VDC	DRY CONTACT	I-5102	PULSE EQUALS 1000 GALLONS. FIELD VERIFY.	EXISTING
190	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI2002	WA	RES	RS	NI	2002		RESERVOIR INLET CONTROL VALVE 2 IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	01	24 VDC	DRY CONTACT	I-5102		EXISTING
191	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI2003	WA	RES	RS	NI	2003		NORTH RESERVOIR INLET ISOLATION VALVE IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	02	24 VDC	DRY CONTACT	I-5102		EXISTING
192	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZIC2003	WA	RES	RS	ZIC	2003		NORTH RESERVOIR INLET ISOLATION VALVE CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	03	24 VDC	DRY CONTACT	I-5102		EXISTING
193	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI2006	WA	RES	RS	NI	2006		NORTH RESERVOIR OUTLET ISOLATION VALVE IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	04	24 VDC	DRY CONTACT	I-5102		EXISTING
194	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZIC2006	WA	RES	RS	ZIC	2006		NORTH RESERVOIR OUTLET ISOLATION VALVE CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	05	24 VDC	DRY CONTACT	I-5102		EXISTING
195	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FQI2007	WA	RES	RS	FQI	2007		NORTH RESERVOIR OUTLET FLOW PULSE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	06	24 VDC	DRY CONTACT	I-5102	PULSE EQUALS 1000 GALLONS. FIELD VERIFY.	EXISTING
196	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZIC2002	WA	RES	RS	ZIC	2002		RESERVOIR INLET CONTROL VALVE 2 CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	07	24 VDC	DRY CONTACT	I-5102		EXISTING
197	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	08			I-5102		SPARE
198	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	09			I-5102		SPARE
199	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	10			I-5102		SPARE
200	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	11			I-5102		SPARE
201	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	12			I-5102		SPARE
202	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	13			I-5102		SPARE
203	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	14			I-5102		SPARE
204	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	04	15			I-5102		SPARE
205	WATER	RESERVOIR PUMP STATION	WA_RES_RS_TAL0801	WA	RES	RS	TAL	0801		EMERGENCY WELL LOW TEMPERATURE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	00	24 VDC	DRY CONTACT	I-5103		EXISTING
206	WATER	RESERVOIR PUMP STATION	WA_RES_RS_LAH0801	WA	RES	RS	LAH	0801		EMERGENCY WELL HIGH WATER	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	01	24 VDC	DRY CONTACT	I-5103		EXISTING
207	WATER	RESERVOIR PUMP STATION	WA_RES_RS_YA0801	WA	RES	RS	YA	0801		EMERGENCY WELL INTRUSION	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	02	24 VDC	DRY CONTACT	I-5103		EXISTING
208	WATER	RESERVOIR PUMP STATION	WA_RES_RS_GA0801	WA	RES	RS	GA	0801		EMERGENCY WELL SMOKE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	03	24 VDC	DRY CONTACT	I-5103		EXISTING
209	WATER	RESERVOIR PUMP STATION	WA_RES_RS_YI0701A	WA	RES	RS	YI	0701	A	GENERATOR RUN	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	04	24 VDC	DRY CONTACT	I-5103		EXISTING
210	WATER	RESERVOIR PUMP STATION	WA_RES_RS_YA0701	WA	RES	RS	YA	0701		GENERATOR FAIL	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	05	24 VDC	DRY CONTACT	I-5103		EXISTING
211	WATER	RESERVOIR PUMP STATION	WA_RES_RS_LAL0701	WA	RES	RS	LAL	0701		GENERATOR LOW FUEL	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	06	24 VDC	DRY CONTACT	I-5103		EXISTING
212	WATER	RESERVOIR PUMP STATION	WA_RES_RS_YI0701B	WA	RES	RS	YI	0701	B	GENERATOR DAY TANK PUMP RUN	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	07	24 VDC	DRY CONTACT	I-5103		EXISTING
213	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI0701A	WA	RES	RS	NI	0701	A	GENERATOR READY (FUTURE)	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	08	24 VDC	DRY CONTACT	I-5103	RESERVE FOR FUTURE GENERATOR MONITORING	FUTURE
214	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI0701B	WA	RES	RS	NI	0701	B	GENERATOR SPARE 1 (FUTURE)	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	09	24 VDC	DRY CONTACT	I-5103	RESERVE FOR FUTURE GENERATOR MONITORING	FUTURE
215	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI0702A	WA	RES	RS	NI	0702	A	ATS IN NORMAL (FUTURE)	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	10	24 VDC	DRY CONTACT	I-5103	RESERVE FOR FUTURE ATS MONITORING	FUTURE
216	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI0702B	WA	RES	RS	NI	0702	B	ATS IN GENERATOR (FUTURE)	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	11	24 VDC	DRY CONTACT	I-5103	RESERVE FOR FUTURE ATS MONITORING	FUTURE
217	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI0702C	WA	RES	RS	NI	0702	C	UTILITY POWER STATUS (FUTURE)	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	12	24 VDC	DRY CONTACT	I-5103	RESERVE FOR FUTURE ATS MONITORING	FUTURE
218	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	13			I-5103		SPARE
219	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	14			I-5103		SPARE
220	WATER	RESERVOIR PUMP STATION	---							SPARE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	05	15			I-5103		SPARE
221	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI7000	WA	RES	RS	NI	7000		PLC PANEL 120V POWER AVAILABLE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	00	24 VDC	DRY CONTACT	I-5104		NEW
222	WATER	RESERVOIR PUMP STATION	WA_RES_RS_YA7002	WA	RES	RS	YA	7002		PLC PANEL INTRUSION ALARM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	01	24 VDC	DRY CONTACT	I-5104		NEW



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PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/ Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
223	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI7003	WA	RES	RS	NI	7003		PLC PANEL 24V POWER SUPPLY OK	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	02	24 VDC	DRY CONTACT	I-5104		NEW
224	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI7004	WA	RES	RS	NI	7004		UPS ON BATTERY	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	03	24 VDC	DRY CONTACT	I-5104		NEW
225	WATER	RESERVOIR PUMP STATION	WA_RES_RS_XA7004	WA	RES	RS	XA	7004		UPS ALARM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	04	24 VDC	DRY CONTACT	I-5104		NEW
226	WATER	RESERVOIR PUMP STATION	WA_RES_RS_JAL7004	WA	RES	RS	JAL	7004		UPS LOW BATTERY	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	05	24 VDC	DRY CONTACT	I-5104		NEW
227	WATER	RESERVOIR PUMP STATION	WA_RES_RS_XA7005	WA	RES	RS	XA	7005		NETWORK SWITCH 1 ALARM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	06	24 VDC	DRY CONTACT	I-5104		NEW
228	WATER	RESERVOIR PUMP STATION	WA_RES_RS_XA7006	WA	RES	RS	XA	7006		NETWORK SWITCH 2 ALARM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	07	24 VDC	DRY CONTACT	I-5104		NEW
229	WATER	RESERVOIR PUMP STATION	WA_RES_BP_ZIC0150	WA	RES	BP	ZIC	0150		HIGH ZONE PRV CLOSED	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	08	24 VDC	DRY CONTACT	I-5104		EXISTING
230	WATER	RESERVOIR PUMP STATION	WA_RES_BP_NI0150	WA	RES	BP	NI	0150		HIGH ZONE PRV IN AUTO	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	09	24 VDC	DRY CONTACT	I-5104		EXISTING
231	WATER	RESERVOIR PUMP STATION	WA_RES_BP_FQI0140	WA	RES	BP	FQI	0140		HIGH ZONE FLOW PULSE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	10	24 VDC	DRY CONTACT	I-5104	PULSE EQUALS 1000 GALLONS. FIELD VERIFY.	EXISTING
232	WATER	RESERVOIR PUMP STATION	WA_RES_BP_PAL0120	WA	RES	BP	PAL	0120		LOW SUCTION PRESSURE	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	11	24 VDC	DRY CONTACT	I-5104		EXISTING
233	WATER	RESERVOIR PUMP STATION	WA_RES_BP_LAH0002	WA	RES	BP	LAH	0002		RESERVOIR PUMP STATION FLOOD	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	12	24 VDC	DRY CONTACT	I-5104		EXISTING
234	WATER	RESERVOIR PUMP STATION	WA_RES_RS_LQI0005	WA	RES	RS	LQI	0005		RAIN GAUGE COUNTER	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	13	24 VDC	DRY CONTACT	I-5104	1/100 INCH COUNT	EXISTING
235	WATER	RESERVOIR PUMP STATION	WA_RES_RS_MA0006	WA	RES	RS	MA	0006		SEISMIC ALARM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	14	24 VDC	DRY CONTACT	I-5104		EXISTING
236	WATER	RESERVOIR PUMP STATION	WA_RES_RS_NI7007	WA	RES	RS	NI	7007		SURGE PROTECTION DEVICE OK	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	06	15	24 VDC	DRY CONTACT	I-5104		NEW
237	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	00			I-5105		FUTURE
238	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	01			I-5105		FUTURE
239	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	02			I-5105		FUTURE
240	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	03			I-5105		FUTURE
241	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	04			I-5105		FUTURE
242	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	05			I-5105		FUTURE
243	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	06			I-5105		FUTURE
244	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	07			I-5105		FUTURE
245	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	08			I-5105		FUTURE
246	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	09			I-5105		FUTURE
247	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	10			I-5105		FUTURE
248	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	11			I-5105		FUTURE
249	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	12			I-5105		FUTURE
250	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	13			I-5105		FUTURE
251	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	14			I-5105		FUTURE
252	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	07	15			I-5105		FUTURE
253	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	00			I-5106		FUTURE
254	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	01			I-5106		FUTURE
255	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	02			I-5106		FUTURE
256	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	03			I-5106		FUTURE
257	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	04			I-5106		FUTURE
258	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	05			I-5106		FUTURE
259	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	06			I-5106		FUTURE

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PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
260	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	07			I-5106		FUTURE
261	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	08			I-5106		FUTURE
262	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	09			I-5106		FUTURE
263	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	10			I-5106		FUTURE
264	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	11			I-5106		FUTURE
265	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	12			I-5106		FUTURE
266	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	13			I-5106		FUTURE
267	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	14			I-5106		FUTURE
268	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	08	15			I-5106		FUTURE
269	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	00			I-5107		FUTURE
270	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	01			I-5107		FUTURE
271	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	02			I-5107		FUTURE
272	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	03			I-5107		FUTURE
273	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	04			I-5107		FUTURE
274	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	05			I-5107		FUTURE
275	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	06			I-5107		FUTURE
276	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	07			I-5107		FUTURE
277	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	08			I-5107		FUTURE
278	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	09			I-5107		FUTURE
279	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	10			I-5107		FUTURE
280	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	11			I-5107		FUTURE
281	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	12			I-5107		FUTURE
282	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	13			I-5107		FUTURE
283	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	14			I-5107		FUTURE
284	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	09	15			I-5107		FUTURE
285	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	00			I-5108		FUTURE
286	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	01			I-5108		FUTURE
287	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	02			I-5108		FUTURE
288	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	03			I-5108		FUTURE
289	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	04			I-5108		FUTURE
290	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	05			I-5108		FUTURE
291	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	06			I-5108		FUTURE
292	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	07			I-5108		FUTURE
293	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	08			I-5108		FUTURE
294	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	09			I-5108		FUTURE
295	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	10			I-5108		FUTURE
296	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	11			I-5108		FUTURE

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PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
297	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	12			I-5108		FUTURE
298	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	13			I-5108		FUTURE
299	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	14			I-5108		FUTURE
300	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	10	15			I-5108		FUTURE
301	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO1002	WA	RES	RS	ZCO	1002		RESERVOIR INLET CONTROL VALVE 1 OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	00	24 VDC	ENERGIZE TO OPEN	I-5201	TO OPEN SOLENOID VALVE	EXISTING
302	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCC1002	WA	RES	RS	ZCC	1002		RESERVOIR INLET CONTROL VALVE 1 CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	01	24 VDC	ENERGIZE TO OPEN	I-5201	TO CLOSE SOLENOID VALVE	EXISTING
303	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCC1003	WA	RES	RS	ZCC	1003		SOUTH RESERVOIR INLET ISOLATION VALVE CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	02	24 VDC	ENERGIZE TO CLOSE	I-5201		EXISTING
304	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCC1006	WA	RES	RS	ZCC	1006		SOUTH RESERVOIR OUTLET ISOLATION VALVE CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	03	24 VDC	ENERGIZE TO CLOSE	I-5201		EXISTING
305	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO0004A	WA	RES	RS	ZCO	0004	A	RESERVOIR INLET 1 SAMPLE SOLENOID OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	04	24 VDC	ENERGIZE TO OPEN	I-5201	SAMPLE SOLENOID VALVE FOR WATER QUALITY ANALYZER 2	EXISTING
306	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO0004B	WA	RES	RS	ZCO	0004	B	RESERVOIR INLET 2 SAMPLE SOLENOID OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	05	24 VDC	ENERGIZE TO OPEN	I-5201	SAMPLE SOLENOID VALVE FOR WATER QUALITY ANALYZER 2	EXISTING
307	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO0003A	WA	RES	RS	ZCO	0003	A	NORTH RESERVOIR OUTLET SAMPLE SOLENOID OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	06	24 VDC	ENERGIZE TO OPEN	I-5201	SAMPLE SOLENOID VALVE FOR WATER QUALITY ANALYZER 1	EXISTING
308	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO0003B	WA	RES	RS	ZCO	0003	B	SOUTH RESERVOIR OUTLET SAMPLE SOLENOID OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	07	24 VDC	ENERGIZE TO OPEN	I-5201	SAMPLE SOLENOID VALVE FOR WATER QUALITY ANALYZER 1	EXISTING
309	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO0003C	WA	RES	RS	ZCO	0003	C	HIGH ZONE SAMPLE SOLENOID OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	08	24 VDC	ENERGIZE TO OPEN	I-5201	SAMPLE SOLENOID VALVE FOR WATER QUALITY ANALYZER 1	EXISTING
310	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	09			I-5201		SPARE
311	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	10			I-5201		SPARE
312	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	11			I-5201		SPARE
313	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	12			I-5201		SPARE
314	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	13			I-5201		SPARE
315	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	14			I-5201		SPARE
316	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	11	15			I-5201		SPARE
317	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCO2002	WA	RES	RS	ZCO	2002		RESERVOIR INLET CONTROL VALVE 2 OPEN COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	00	24 VDC	ENERGIZE TO OPEN	I-5202	TO OPEN SOLENOID VALVE	EXISTING
318	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCC2002	WA	RES	RS	ZCC	2002		RESERVOIR INLET CONTROL VALVE 2 CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	01	24 VDC	ENERGIZE TO OPEN	I-5202	TO CLOSE SOLENOID VALVE	EXISTING
319	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCC2003	WA	RES	RS	ZCC	2003		NORTH RESERVOIR INLET ISOLATION VALVE CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	02	24 VDC	ENERGIZE TO CLOSE	I-5202		EXISTING
320	WATER	RESERVOIR PUMP STATION	WA_RES_RS_ZCC2006	WA	RES	RS	ZCC	2006		NORTH RESERVOIR OUTLET ISOLATION VALVE CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	03	24 VDC	ENERGIZE TO CLOSE	I-5202		EXISTING
321	WATER	RESERVOIR PUMP STATION	WA_RES_BP_ZCC0150	WA	RES	BP	ZCC	0150		HIGH ZONE PRV CLOSE COMMAND	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	04	24 VDC	ENERGIZE TO OPEN	I-5202		EXISTING
322	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	05			I-5202		SPARE
323	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	06			I-5202		SPARE
324	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	07			I-5202		SPARE
325	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	08			I-5202		SPARE
326	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	09			I-5202		SPARE
327	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	10			I-5202		SPARE
328	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	11			I-5202		SPARE
329	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	12			I-5202		SPARE
330	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	13			I-5202		SPARE
331	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	14			I-5202		SPARE
332	WATER	RESERVOIR PUMP STATION	---							SPARE	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	12	15			I-5202		SPARE
333	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	00			I-5203		FUTURE

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Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
334	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	01			I-5203		FUTURE
335	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	02			I-5203		FUTURE
336	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	03			I-5203		FUTURE
337	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	04			I-5203		FUTURE
338	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	05			I-5203		FUTURE
339	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	06			I-5203		FUTURE
340	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	07			I-5203		FUTURE
341	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	08			I-5203		FUTURE
342	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	09			I-5203		FUTURE
343	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	10			I-5203		FUTURE
344	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	11			I-5203		FUTURE
345	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	12			I-5203		FUTURE
346	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	13			I-5203		FUTURE
347	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	14			I-5203		FUTURE
348	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	13	15			I-5203		FUTURE
349	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	00			I-5204		FUTURE
350	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	01			I-5204		FUTURE
351	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	02			I-5204		FUTURE
352	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	03			I-5204		FUTURE
353	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	04			I-5204		FUTURE
354	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	05			I-5204		FUTURE
355	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	06			I-5204		FUTURE
356	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	07			I-5204		FUTURE
357	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	08			I-5204		FUTURE
358	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	09			I-5204		FUTURE
359	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	10			I-5204		FUTURE
360	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	11			I-5204		FUTURE
361	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	12			I-5204		FUTURE
362	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	13			I-5204		FUTURE
363	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	14			I-5204		FUTURE
364	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	DO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	14	15			I-5204		FUTURE
365	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FI1001	WA	RES	RS	FI	1001		RESERVOIR INLET 1 FLOW	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	15	00	4-20 mA	0-5000 GPM	I-5301		EXISTING
366	WATER	RESERVOIR PUMP STATION	WA_RES_RS_LI1004	WA	RES	RS	LI	1004		SOUTH RESERVOIR LEVEL	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	15	01	4-20 mA	0-30 FT	I-5301		EXISTING
367	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FI1007	WA	RES	RS	FI	1007		SOUTH RESERVOIR OUTLET FLOW	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	15	02	4-20 mA	0-3000 GPM	I-5301		EXISTING
368	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	15	03			I-5301		SPARE
369	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FI2001	WA	RES	RS	FI	2001		RESERVOIR INLET 2 FLOW	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	16	00	4-20 mA	0-5000 GPM	I-5302		EXISTING
370	WATER	RESERVOIR PUMP STATION	WA_RES_RS_LI2004	WA	RES	RS	LI	2004		NORTH RESERVOIR LEVEL	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	16	01	4-20 mA	0-30 FT	I-5302		EXISTING



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Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
371	WATER	RESERVOIR PUMP STATION	WA_RES_RS_FI2007	WA	RES	RS	FI	2007		NORTH RESERVOIR OUTLET FLOW	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	16	02	4-20 mA	0-3000 GPM	I-5302		EXISTING
372	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	16	03			I-5302		SPARE
373	WATER	RESERVOIR PUMP STATION	WA_RES_RS_Pi0110	WA	RES	RS	PI	0110		STATION INLET PRESSURE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	17	00	4-20 mA	0-150 PSI	I-5303		EXISTING
374	WATER	RESERVOIR PUMP STATION	WA_RES_BP_Fi0140	WA	RES	BP	FI	0140		HIGH ZONE FLOW	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	17	01	4-20 mA	0-5000 GPM	I-5303		EXISTING
375	WATER	RESERVOIR PUMP STATION	WA_RES_BP_Pi0130	WA	RES	BP	PI	0130		HIGH ZONE PRESSURE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	17	02	4-20 mA	0-100 PSI	I-5303		EXISTING
376	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	17	03			I-5303		SPARE
377	WATER	RESERVOIR PUMP STATION	WA_RES_CL2_Ai0003A	WA	RES	CL2	AI	0003	A	WATER QUALITY ANALYZER 1 CHLORINE RESIDUAL	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	18	00	4-20 mA	0-2 MG/L	I-5304	WATER QUALITY ANALYZER 1 SAMPLES FROM NORTH RES. OUTLET, SOUTH RES. OUTLET, AND PUMPED ZONE	EXISTING
378	WATER	RESERVOIR PUMP STATION	WA_RES_CL2_Ai0003B	WA	RES	CL2	AI	0003	B	WATER QUALITY ANALYZER 1 PH	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	18	01	4-20 mA	0-14.00	I-5304	WATER QUALITY ANALYZER 1 SAMPLES FROM NORTH RES. OUTLET, SOUTH RES. OUTLET, AND PUMPED ZONE	EXISTING
379	WATER	RESERVOIR PUMP STATION	WA_RES_CL2_Ti0003	WA	RES	CL2	TI	0003		WATER QUALITY ANALYZER 1 TEMPERATURE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	18	02	4-20 mA	0-130 DegF	I-5304	WATER QUALITY ANALYZER 1 SAMPLES FROM NORTH RES. OUTLET, SOUTH RES. OUTLET, AND PUMPED ZONE	EXISTING
380	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	18	03			I-5304		SPARE
381	WATER	RESERVOIR PUMP STATION	WA_RES_CL2_Ai0004A	WA	RES	CL2	AI	0004	A	WATER QUALITY ANALYZER 2 CHLORINE RESIDUAL	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	19	00	4-20 mA	0-2 MG/L	I-5305	WATER QUALITY ANALYZER 2 SAMPLES FROM RESERVOIR INLET 1 AND RESERVOIR INLET 2	EXISTING
382	WATER	RESERVOIR PUMP STATION	WA_RES_CL2_Ai0004B	WA	RES	CL2	AI	0004	B	WATER QUALITY ANALYZER 2 PH	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	19	01	4-20 mA	0-14.00	I-5305	WATER QUALITY ANALYZER 2 SAMPLES FROM RESERVOIR INLET 1 AND RESERVOIR INLET 2	EXISTING
383	WATER	RESERVOIR PUMP STATION	WA_RES_RS_Li0701A	WA	RES	RS	LI	0701	A	GENERATOR FUEL LEVEL (FUTURE)	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	19	02	4-20 mA	X - X FT	I-5305	RESERVE FOR FUTURE GENERATOR MONITORING	FUTURE
384	WATER	RESERVOIR PUMP STATION	WA_RES_RS_Li0701B	WA	RES	RS	LI	0701	B	GENERATOR BATTERY LEVEL (FUTURE)	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	19	03			I-5305	RESERVE FOR FUTURE GENERATOR MONITORING	FUTURE
385	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	20	00			I-5306		SPARE
386	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	20	01			I-5306		SPARE
387	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	20	02			I-5306		SPARE
388	WATER	RESERVOIR PUMP STATION	---							SPARE	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	20	03			I-5306		SPARE
389	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	21	00			I-5307		FUTURE
390	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	21	01			I-5307		FUTURE
391	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	21	02			I-5307		FUTURE
392	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	21	03			I-5307		FUTURE
393	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	22	00			I-5308		FUTURE
394	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	22	01			I-5308		FUTURE
395	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	22	02			I-5308		FUTURE
396	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	22	03			I-5308		FUTURE
397	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	23	00			I-5309		FUTURE
398	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	23	01			I-5309		FUTURE
399	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	23	02			I-5309		FUTURE
400	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	23	03			I-5309		FUTURE
401	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	24	00			I-5310		FUTURE
402	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	24	01			I-5310		FUTURE
403	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	24	02			I-5310		FUTURE
404	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	24	03			I-5310		FUTURE
405	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	25	00			I-5311		FUTURE
406	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	25	01			I-5311		FUTURE
407	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	25	02			I-5311		FUTURE

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Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
408	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	25	03			I-5311		FUTURE
409	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	26	00			I-5312		FUTURE
410	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	26	01			I-5312		FUTURE
411	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	26	02			I-5312		FUTURE
412	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AI	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	26	03			I-5312		FUTURE
413	WATER	RESERVOIR PUMP STATION	---							SPARE	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	27	00			I-5401		SPARE
414	WATER	RESERVOIR PUMP STATION	---							SPARE	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	27	01			I-5401		SPARE
415	WATER	RESERVOIR PUMP STATION	---							SPARE	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	27	02			I-5401		SPARE
416	WATER	RESERVOIR PUMP STATION	---							SPARE	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	27	03			I-5401		SPARE
417	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	28	00			I-5402		FUTURE
418	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	28	01			I-5402		FUTURE
419	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	28	02			I-5402		FUTURE
420	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	28	03			I-5402		FUTURE
421	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	29	00			I-5403		FUTURE
422	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	29	01			I-5403		FUTURE
423	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	29	02			I-5403		FUTURE
424	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	AO	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	00	29	03			I-5403		FUTURE
425	WATER	RESERVOIR PUMP STATION	WA_RES_BP_U0101	WA	RES	BP	U	0101		RESERVOIR BOOSTER PUMP 1 VFD NETWORKED I/O	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA	PROFINET	N/A	I-5501	PROFINET NETWORKED I/O. EXISTING FIELD NAMEPLATE: VFD 1.	NEW
426	WATER	RESERVOIR PUMP STATION	WA_RES_BP_U0201	WA	RES	BP	U	0201		RESERVOIR BOOSTER PUMP 2 VFD NETWORKED I/O	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA	PROFINET	N/A	I-5501	PROFINET NETWORKED I/O. EXISTING FIELD NAMEPLATE: VFD 2.	NEW
427	WATER	RESERVOIR PUMP STATION	WA_RES_BP_U0301	WA	RES	BP	U	0301		RESERVOIR BOOSTER PUMP 3 VFD NETWORKED I/O	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA	PROFINET	N/A	I-5501	PROFINET NETWORKED I/O. EXISTING FIELD NAMEPLATE: VFD 3.	NEW
428	WATER	RESERVOIR PUMP STATION	WA_RES_BP_U0401	WA	RES	BP	U	0401		RESERVOIR BOOSTER PUMP 4 VFD NETWORKED I/O	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA	PROFINET	N/A	I-5501	PROFINET NETWORKED I/O. EXISTING FIELD NAMEPLATE: VFD 4.	NEW
429	WATER	RESERVOIR PUMP STATION	WA_RES_BP_U0501	WA	RES	BP	U	0501		RESERVOIR BOOSTER PUMP 5 VFD NETWORKED I/O	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA	PROFINET	N/A	I-5501	PROFINET NETWORKED I/O. EXISTING FIELD NAMEPLATE: VFD 5.	NEW
430	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA		N/A	I-5501		FUTURE
431	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA		N/A	I-5501		FUTURE
432	WATER	RESERVOIR PUMP STATION	---							SPARE - RESERVED FOR FUTURE BOOSTER CHLORINATION SYSTEM	NW	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	NA	NA	NA		N/A	I-5501		FUTURE
433	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 1 CALL TO RUN	DO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
434	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 1 READY	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
435	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 1 RUN	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
436	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 1 FAULT	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
437	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 1 SPEED SETPOINT	AO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
438	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 2 CALL TO RUN	DO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
439	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 2 READY	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
440	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 2 RUN	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
441	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 2 FAULT	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
442	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 2 SPEED SETPOINT	AO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
443	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 3 CALL TO RUN	DO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
444	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 3 READY	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO

**SECTION 40 61 93 ATTACHMENT A  
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST**

Item	Utility	Site	IO Tag	Division ID	Process Area ID	Process Code	ISA Prefix	Loop Number	Suffix	Description	IO Type	Panel	PLC	Rack	Slot	Channel	Module/Device Type	Calibration Range	Wiring Diagram	Application Notes or Comments	STATUS
445	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 3 RUN	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
446	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 3 FAULT	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
447	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 3 SPEED SETPOINT	AO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
448	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 4 CALL TO RUN	DO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
449	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 4 READY	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
450	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 4 RUN	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
451	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 4 FAULT	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
452	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 4 SPEED SETPOINT	AO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
453	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 5 CALL TO RUN	DO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
454	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 5 READY	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
455	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 5 RUN	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
456	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 5 FAULT	DI	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO
457	WATER	RESERVOIR PUMP STATION	N/A	--	--	--	--	--	--	RESERVOIR BOOSTER PUMP 5 SPEED SETPOINT	AO	EXISTING PLC PANEL	EXISTING PLC	NA	NA	NA	N/A	N/A	N/A	DEMO EXISTING HARDWIRED SIGNAL. VFD TO BE NETWORKED. REFER TO DRAWING I-5701.	DEMO

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SECTION 40 61 96  
PROCESS CONTROL DESCRIPTIONS

**PART 1-GENERAL**

**1.01 SUMMARY**

- A. This Section provides the integrated automation control descriptions for the Water Distribution SCADA Equipment Replacement project, including common function requirements and specific equipment operational function requirements.

**1.02 SCOPE**

- A. The Programmer will provide all programmable logic controller (PLC) and process control system (PCS) based software modifications to incorporate the controls indicated within this Section. This Section is provided as Information Only for the Contractor for coordination with process control system testing specified in Section 40 61 21.

**PART 2 PRODUCTS**

**2.01 PROCESS CONTROL DESCRIPTION DOCUMENTATION**

- A. Refer to Section 40 61 96 Attachment A for the process control descriptions.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. The process control descriptions are for reference in the modification of the process controller and SCADA software programs in support of the new control system installed under this project.

**3.02 TESTING**

- A. Refer to Section 40 61 21.

**3.03 ATTACHMENTS**

- A. 40 61 96 Attachment A: Water Site Control Strategies.

**END OF SECTION**

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**SECTION 40 61 96\_ PROCESS CONTROL DESCRIPTIONS**  
**ATTACHMENT A**  
**WATER SITE CONTROL STRATEGIES**

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# Water Site Control Strategies

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Prepared for  
City of Mercer Island, Washington  
December 2020



701 Pike Street, Suite 1200  
Seattle, WA 98101

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# Revision History

Revision History						
Revision	Status	Date	Prepared By			Description
			Name	Organization	Role	
1.0	Draft	12/23/2019	Caitlin Bliesner	BC	Consultant	Pilot sites draft for review
2.0	Draft	7/2/2020	Caitlin Bliesner	BC	Consultant	Water sites draft for review
3.0	Final Draft	9/16/2020	Caitlin Bliesner	BC	Consultant	Water sites final draft for Construction package review
4.0	Final	12/2020	Caitlin Bliesner	BC	Consultant	Bid Set

## List of Abbreviations

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ATS	automatic transfer switch
BC	Brown and Caldwell
City	City of Mercer Island
DNP3	Distributed Network Protocol 3
gpm	gallons per minute
HIM	human interface module
HMI	human machine interface
HOA	hand-off-auto
I/O	input/output
ISA	International Society of Automation
MCC	motor control center
NEC	National Electrical Code
O&M	operation and maintenance
OHCA	open-hold-close-auto
OIT	operator interface terminal
PID	proportional-integral-derivative
PLC	programmable logic controller
PM	power monitor
PRV	pressure-reducing valve / pressure relief valve
PS	pump station
PZ	pressure zone
SCADA	supervisory control and data acquisition
SI	system integrator
SPU	Seattle Public Utilities
THD	total harmonic distortion
UPS	uninterruptible power supply
VFD	variable frequency drive
Vac	volts alternating current
Vdc	volts direct current
WQA	water quality analyzer

## Section 1

# Development and Approach

The control strategies describe the requirements for supervisory control and data acquisition (SCADA) operation with the programmable logic controller (PLC) and graphical user displays to be implemented by the Project Programmer. The control strategies describe control operation for the City's water system, including common function requirements and specific equipment operational requirements. The control strategies described in this document will be incorporated into the PLC and process control system SCADA software. The control strategies are based on BC's understanding of the City's objectives for control and monitoring, as well as recommendations for improvement based on industry best practices.

All control functions are programmed in the PLCs, and the SCADA system performs supervisory functions through the human machine interface (HMI) screens. The *SCADA and Smart Utility Standards*<sup>1</sup> document provides details on the PLC and SCADA programming standards and implementation. As a result, the control strategies describe how the system is to operate, and do not necessarily describe every software component required to make the system function.

## 1.1 Background

These control strategies are part of the City's SCADA Equipment Replacement project (Project). The Project will replace the City's legacy water SCADA system with a new unified, secure control system to meet operational needs. The City has standardized on the Siemens WinCC OA platform for SCADA application programming and on the Siemens ET200SP hardware platform. The project will address near-term risk from aging automation infrastructure and obsolete technology. The project's objectives are to implement a consistent, standards-based, fully integrated water SCADA system with improved reliability and ease of operations.

## 1.2 Format

The control strategy format is divided into four main sections:

**System Overview.** This section provides an overview of the City's water system, including site types and their functions.

**Common Functions.** This section describes common functions that apply to all sites. These common functions are described in this upfront section and allow for standardization between sites and to limit repetition within individual site control strategies.

**Water Site Control Strategies.** This section includes the control strategies for the following water sites: First Hill Pump Station, SPU Station 171, North Fire Station, South Fire Station, and Reservoir Pump Station. The control strategy for the Reservoir Pump Station reflects the current configuration at the site. The control strategies will be updated once the Booster Chlorination System project is constructed, which may include piping rearrangements and updates to the overall control scheme. SPU Station 68 will also be constructed as part of the Booster Chlorination System project and will be added to the control strategies at that time.

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<sup>1</sup> *SCADA and Smart Utility Standards*, City of Mercer Island, 2020 (draft).

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## Section 2

# System Overview

An overview of the City's water system is provided below.

## 2.1 Water System

The City's water system comprises two storage reservoirs, two booster pump stations, and pressure-reducing valves (PRVs) throughout the distribution system. The City receives its potable water supply from Seattle Public Utilities (SPU) through three separate metered connections.

The objectives of water system operations are to monitor water quality and maintain adequate system pressure. Because water is supplied to Mercer Island through piping and then distributed throughout the City, monitoring of water quality is critical to safe distribution of water to customers. Hydraulically, two reservoirs provide long-term reserve to the distribution for both domestic use and fire protection. This storage must be monitored and maintained to continuously balance the reserve while maintaining water quality.

The City's water system consists of five (5) main pressure zones (PZ) and 30 smaller 'low' pressure zones. The smaller pressure zones are supplied by PRVs branched from the main pressure zones. The main pressure zones include:

**Gravity PZ:** supplied by the North and South reservoirs at Reservoir Pump Station.

**High PZ:** supplied by the booster pumps at Reservoir Pump Station.

**First Hill PZ:** supplied by the booster pumps at First Hill Pump Station, via the Gravity PZ.

**Intermediate PZ:** supplied by PRVs via the Gravity PZ, High PZ or directly from an SPU metered connection.

**Freeway PZ:** supplied by PRVs via the Gravity PZ, High PZ or directly from an SPU metered connection.

The City's water distribution system includes the following remote site types:

**SPU Meters:** The City receives water through three metered connections. Due to site proximity, SPU Station 67 ties into the SCADA system through the Reservoir Pump Station:

- SPU Station 67 located at SE 43rd St & 89th Ave SE
- SPU Station 68 located at SE 40th St & 97th Ave SE
- SPU Station 171 located at the Boat Ramp

**Reservoirs:** The City has two reservoirs (North and South) located at the Reservoir Pump Station, which supply the Gravity PZ and the suction side of the booster pumps. The function of the reservoirs is to store and protect water until it is needed. Reservoirs are considered high-priority sites in terms of operational strategy as the storage capacity ranges are continually monitored and modulated to both maintain operational and fire storage ranges and provide sufficient turnover to mitigate water quality issues.

**Emergency well:** The City has an emergency well located at the Reservoir Pump Station site that provides emergency water supply to the City. This source is not connected to the water distribution system. The Emergency well is self-contained and utilizes standby power from the reservoir site. The emergency well is monitored by SCADA for alarm conditions. Control of the emergency well is not available from SCADA.

**Booster pump stations:** Booster pump stations comprise a set of pumps that provide an increase in pressure to the system—typically to a higher elevation. There are two booster pump stations within the system:

- Reservoir Pump Station, which supplies the High PZ.
- First Hill Pump Station, which supplies the First Hill PZ.

**Control valves:** Control valves at the metering sites and Reservoir Pump Station are operated hydraulically to maintain an operator-adjustable flow set point. At SPU Station 171, the City can control the amount of water that is supplied by SPU and monitor pressure from SCADA. At SPU Station 68, the control valve is currently controlled using local setting on the valve. SCADA control capability is being added to SPU Station 68 as part of the Booster Chlorination System project.

**Pressure sensors:** The SCADA system monitors pressure in the water distribution system at two remote sites:

- North Fire Station (within the Gravity PZ)
- South Fire Station (within the High PZ)

**PRV stations:** The City has approximately 86 PRV stations that are used throughout the distribution system to regulate pressure to the lower pressure zones. PRV stations are not monitored or controlled by SCADA. In the future, the City may monitor these sites using an automated meter infrastructure (AMI) system.

**Booster chlorination system:** The City is in the design phase of a booster chlorination system to be located at the Reservoir Pump Station. The chlorine booster improvements at the Reservoir pump station will allow the City to monitor and maintain adequate disinfection levels in the water distribution system.



## Section 3

# Common Functions

This section describes common function requirements for the application programming of the City's water distribution system. These common functions are described in this upfront section and allow for standardization between sites. The common functions apply to individual sites, as applicable. Refer to the control strategy for a particular site.

In addition, an input/output (I/O) list details the hardwired points that interface with the control system. The list includes set points and ranges for status monitoring, control, and alarm parameters.

### 3.1 Common Analog I/O Functions

The following subsections describe common analog I/O functions, which can be hardwired to the PLC or data communicated over a network bus.

#### 3.1.1 I/O Conditioning

- A. Where necessary, digital filtering is used to smooth out noise that is part of an analog signal used for process control.
- B. Engineering units are computed based on the 0 to 100 percent range assigned for each analog input.

#### 3.1.2 I/O Alarming

- A. Signal Out-of-Range Alarm
  - a. A signal out-of-range alarm is detected by the PLC and alarmed at the human-machine interface (HMI). The PLC will automatically reset the active alarm when the analog input returns to within a valid signal range of -5 to +105 percent.
- B. High-High, High, Low-Low and Low Alarms
  - a. The instrument alarms require an adjustable deadband for reset (default is 2 percent) and operator adjustable delay timer (default is 3 seconds) to prevent nuisance alarms.
  - b. Analog points are programmed to have their low-low limit and low limit set to the low engineering units range (manually set to a value of 0 and 5 percent of the engineering units range), and their high and high-high limits set to the high engineering units range (manually set to a value of 95 and 100 percent of the engineering units range), unless specified otherwise in the control strategy for a particular site.
  - c. Analog alarms have an option for latching the alarm state until reset by the operator.
  - d. Refer to Section 3.9.1 for alarm priorities.

#### 3.1.3 Output Value Hold

- A. The operator can select to hold the output of the analog input processing to allow for maintenance or calibration of the instrument. When the hold is released processing returns to normal with the output updating every scan cycle.

- B. Output in Hold Alarm
  - a. If an output value is still in hold after an adjustable period of time, generate an alarm. This alarm is intended to alert operations if an output value is left in hold for an extended period of time.

### 3.1.4 Rate Variable Totalization

- A. Selected “rate” variables (flows, power, etc.) are totalized in the PLC on a continuous basis. Totalizers can be reset through the HMI. Totalizers include an ongoing total and daily total values for the last week.

### 3.1.5 Calculated Analog Values

- A. Calculated analog values are values that are computed by PLCs or HMI programming, such as flow rates calculated as the sum or difference of other flows, loading rates, and volumes based on level.
- B. Values calculated by PLCs have the same features as “real” analog inputs with respect to alarming, totalizing, trending, and historical data.

## 3.2 Common Discrete I/O Functions

The following subsections describe common discrete I/O functions, which can be hardwired to the PLC or data communicated over a network bus.

### 3.2.1 Discrete Input with Alarm

- A. Processing for discrete inputs includes a normal/reverse acting option to adjust for normally open/closed or normally energized/de-energized inputs.
- B. Alarm Configuration
  - a. Discrete inputs can optionally include an alarm. Alarm state can be configured for normally open or normally closed
  - b. Refer to Section 3.9.1 for alarm priorities.
  - c. Discrete alarms include an option to alarm on open or closed state.
  - d. Discrete alarms have an option for latching the alarm state until reset by the operator.
- C. Nuisance Tripping
  - a. To prevent nuisance tripping by “noisy” signals, an operator adjustable time period must elapse before the alarm condition is activated in the HMI as an alarm. The default value for the pre-set alarm delay is 3 seconds but should be confirmed by the programmer based on the requirements of the application. This alarm delay is programmed in the PLC.
  - b. Pre-set delay times should only be used where a signal is known to cause nuisance tripping.
- D. Alarm Flooding
  - a. To prevent alarm flooding, or excess alarms, which typically result during equipment failures, start-ups, and shutdowns, excess alarms will be suppressed (inhibited). For example, a “loss of power” alarm may trigger unnecessary or redundant alarms, such as pump “fail to run.”
  - b. The effort to minimize alarm flooding will be started as a baseline during software development, updated during testing, and finalized during commissioning.

### 3.2.2 Equipment Run Times

- A. Equipment run times are computed for all equipment in the PLC, displayed on the HMI, and logged to the data historian. Run-time totals can be reset by the operator from an HMI display, when applicable. Run times for constant speed and variable speed motors are displayed on the popup windows for the motors.
- B. For VFDs, run times displayed at local HIM can be reset at the equipment HIM.

### 3.2.3 Equipment Starts

- A. The number of equipment starts are computed for all equipment in the PLC, displayed on the HMI, and logged to the data historian. Equipment start-counts can be reset by the operator from an HMI display, when applicable.

### 3.2.4 Flow Pulse Totalization

- A. For flow meters with separate flow pulse inputs, flow is totalized in the PLC on a continuous basis. Each pulse signal is associated with a specific volume of flow. Totalizers can be reset through the HMI. Totalizers include an ongoing total and daily total values for the last week.

## 3.3 Common Control Functions – General

The following subsections describe common control functions for general equipment.

### 3.3.1 Bumpless Transfer from SCADA Manual to/from SCADA Auto

- A. When equipment is in SCADA Manual mode (i.e., operator is controlling via SCADA) or SCADA Auto mode, the PLC and HMI track the equipment's status (on, off, opened, closed, speed, position, etc.) and adjust the PLC outputs to match the status. The purpose is to prevent any change in the equipment's status when it is switched from SCADA Manual to SCADA Auto or vice versa.
- B. Where backup closed loop control is implemented (vendor-supplied package systems) and the control is in the Local mode, the PLC tracks the local control output and adjusts the PLC output to match to prevent introduction of any unnecessary bump in the process when it is switched back to Remote from Local.

### 3.3.2 Equipment Speed

- A. Speed control and feedback signals are configured as a percentage value based on the equipment's allowable operating range (AOR) upper threshold. The AOR upper threshold is determined by the more restrictive of the VFD, motor, and driven-equipment manufacturer operating limits.

## 3.4 Proportional Integral Derivative (PID) Control

A Proportional-Integral-Derivative controller (PID controller) is a generic control loop feedback controller.

- A. A PID controller attempts to correct the error between a measured process variable and a desired set point by calculating and then outputting a corrective action that can adjust the process accordingly and rapidly, to keep the error within the control deadband.
- B. PID control (or any combination of these PID, PI, I, D, etc.) is only implemented within PLC application programming. The HMI provides faceplate displays and access to PID parameters, but not actual control algorithms.

- C. PID control includes the option for one PID controller to receive its setpoint from another controller in Cascade control mode. For example, the reservoir level controller may set the flow setpoint to the reservoir incoming flow control. This allows the operator the option to operate with either local flow control or cascade control.

## 3.5 Common Valve Control Functions

The following subsections describe common valve control functions for automated flow control valves and isolation valves.

### 3.5.1 Valve Control Interfaces – Flow Control Valve (with solenoid operators)

The water distribution system uses Cla-Val™ type control valves to regulate water supply and system pressure. The Cla-Val™ consists of a diaphragm valve with dome cover and pilot control system. A set of solenoid valve operators – an open solenoid, a close solenoid, and sometimes an enable solenoid – allow valve control from the local PLC and SCADA.

The position of the FCV is adjusted to maintain a flow set point using the solenoid valves. The close solenoid allows upstream flow into the valve dome to move it in the closed direction. The open solenoid allows flow to leave the valve dome to move it in the open direction. The enable solenoid, if present, needs to be energized to allow valve control by the open and close solenoids. If the enable solenoid is de-energized (either by operator selection or power loss), the valve operates hydraulically based on the local pilot settings on the valve.

Flow control valves are supplied with control capability from multiple locations. Normally, the flow control valves are controlled from SCADA, but they can also be controlled from OPEN/HOLD/CLOSE/AUTO (OHCA) selector switches located in the field.

- A. When the OHCA is in the OPEN position, the valve modulates in the open direction. When the OHCA is in the HOLD position, the valve holds its current position. When the OHCA is in the CLOSE position, the valve modulates in the closed direction. When in the AUTO position, the valve is modulated via SCADA, based on parameters programmed in the control sequence or manually as directed by the operator from the HMI. In all cases, the enable solenoid must be energized to allow valve control via the open or close solenoids.
  - a. Hardwired interlocks override all controls regardless of control location (local or SCADA). These interlocks are typically for personnel safety and equipment protection.
  - b. Software interlocks override all SCADA Auto or SCADA Manual control but are ignored when valves are controlled locally (OHCA in OPEN/HOLD/CLOSE positions) or a hardwire interlock is active.
  - c. If the valve has an enable solenoid, in the event of power loss, the valve operates hydraulically based on the local pilot settings on the valve.
  - d. If the valve does not have an enable solenoid, in the event of power loss, the valve holds its last position.
  - e. When the OHCA is in the OPEN or CLOSE position, the PLC tracks the status of the OPEN or CLOSE position selection in order to track the valve position.

### 3.5.2 Valve Status, Output, Alarms – Flow Control Valve (with solenoid operators)

- A. The following hardwired status and output parameters are continuously monitored for each flow control valve:
  - a. Valve in auto status
  - b. Valve open command
  - c. Valve close command
  - d. Valve enable command, if applicable
  - e. Valve closed feedback
- B. Flow control valves include various alarm options. Each alarm has the same options as the discrete input alarms, optional latching configuration, time delay, normally open/closed option, and alarm priority level of 4-1, as described in Section 3.9.1. Alarm options include:
  - a. Valve fail to open
  - b. Valve fail to close
  - c. Valve not in auto
  - d. I/O health fault, which identifies if any of the I/O associated with the valve is faulty.

### 3.5.3 Valve Control Interfaces – Isolation Valve

Isolation valves are supplied with control capability from multiple locations. Normally, the valves are controlled from SCADA, but they can also be controlled from OPEN/CLOSE/AUTO (OCA) selector switches located in the field.

- A. When the OCA is in the OPEN position, the valve opens. When the OCA is in the CLOSE position, the valves closes. When in the AUTO position, the valve is controlled by SCADA, based on parameters programmed in the control sequence or manually as directed by the operator from the HMI.
  - a. Hardwired interlocks override all controls regardless of control location (local or SCADA). These interlocks are typically for personnel safety and equipment protection.
  - b. Software interlocks override all SCADA Auto or SCADA Manual control but are ignored when valves are controlled locally (OCA in OPEN/CLOSE positions) or a hardwire interlock is active.
  - c. In the event of power loss, the valve fails in its last position.

### 3.5.4 Valve Status, Output, and Alarms – Isolation Valve

- A. The following hardwired status and output parameters are continuously monitored for each valve:
  - a. Valve in auto status
  - b. Valve close command
  - c. Valve closed feedback
- B. Isolation valves include various alarm options. Each alarm has the same options as the discrete input alarms, optional latching configuration, time delay, normally open/closed option, and alarm priority level of 4-1, as described in Section 3.9.1. Alarm options include:
  - a. Valve fail, determined by a valve being commanded to open, and closed feedback (via limit switch) is still received after a set time frame.

- b. Valve fail to close
- c. Valve not in auto
- d. I/O health fault, which identifies if any of the I/O associated with the valve is faulty.

## 3.6 Common Pump Control Functions

The following subsections describe common pump control functions for constant speed and variable speed applications.

### 3.6.1 Pump Control Interfaces – Constant Speed Pumps

All pumps are supplied with control capability from multiple locations. Normally the constant speed pumps are controlled from SCADA, but they can also be controlled from HAND/OFF/AUTO (HOA) selector switches located at the motor starter panel.

- A. When the HOA is in the HAND position, the pump starts and runs continuously. When the HOA is placed in the OFF position, the pump stops and is prevented from starting. When in the AUTO position, the pumps are started and stopped via SCADA, based on parameters programmed in the control sequence or manually as directed by the operator from the HMI.
  - a. If the motor on/off state does not agree with the commanded position for an operator-defined time, a fault is declared at the HMI.
  - b. Hardwired interlocks override all controls regardless of control location (local or SCADA). These interlocks are typically for personnel safety and equipment protection.
  - c. Software interlocks override all SCADA Auto or SCADA Manual control but are ignored when pumps are controlled locally (HOA in HAND or OFF positions) or a hardwire interlock is active.
- B. The control strategy for a particular site may identify variations to this standard pump control interface.

### 3.6.2 Pump Status, Output, and Alarms – Constant Speed Pumps

- A. The following hardwired status and output parameters are continuously monitored for each constant speed pump:
  - a. Pump run status
  - b. Pump in auto status
  - c. Pump in remote status
  - d. Pump amps (where provided)
  - e. Pump check valve open (where provided)
  - f. Pump call to run
  - g. Pump interlock status (where provided)
- B. Constant speed motor control includes various alarm options. Each alarm has the same options as the discrete input alarms, optional latching configuration, time delay, normally open/closed option, and alarm priority level of 4-1, as described in Section 3.9.1. Alarm options include:
  - a. Fail to start
  - b. Fail to stop

- c. Check valve fault
- d. MCC HOA not in auto (where provided)
- e. Field HOA not in auto (where provided)
- f. Interlocks active, which identifies if there are interlocks active, causing the motor to not be in the ready state.
- g. I/O health fault, which identifies if any of the I/O associated with the motor is faulty.

### 3.6.3 Pump Control Interfaces – Variable Speed Pumps

All pumps are supplied with control capability from multiple locations. Variable speed pumps have a human-interface module (HIM) mounted on the front of the VFD enclosure. In addition, some VFDs have a separate HOA selector switch on the front of the VFD enclosure. This applies to both hardwired and networked equipment.

- A. Under normal conditions, the LOCAL/REMOTE selection at the HIM is set to REMOTE. When in REMOTE, control of the pump is based on the position of the HOA switch local to the motor as described below. Operators can override the field HOA by setting the HIM to LOCAL. While in LOCAL, the operator can start and stop the pump via the buttons on the HIM, regardless of HOA position (unless in OFF position). The operator can also adjust the pump speed via the HIM while in LOCAL.

*Note: The control interface at the VFD is a function of the VFD manufacturer and the VFD's initial configuration.*

- B. When the HOA is in the HAND position, the pump starts and runs continuously. The speed of VFD driven pumps can also be adjusted from the local HIM while the HOA is in the HAND position. When the HOA is placed in the OFF position, the pump stops and is prevented from starting. When in the AUTO position, the pumps are started and stopped and their speed is adjusted via SCADA, based on parameters programmed in the control sequence or manually as directed by the operator from the HMI.
  - a. If the motor on/off state does not agree with the commanded position for an operator-defined time, a fault is declared at the HMI.
  - b. Hardwired interlocks override all controls regardless of control location (local or remote). These interlocks are typically for personnel safety and equipment protection.
  - c. Software interlocks override all SCADA Auto or SCADA Manual control but are ignored when pumps are controlled locally (HIM in LOCAL mode or HOA in HAND or OFF positions) or a hardwire interlock is active.
- C. The control strategy for a particular site may identify variations to this standard pump control interface.

### 3.6.4 Pump Status, Output, and Alarms – Variable Speed Pumps

- A. The following hardwired status and output parameters are continuously monitored for hardwired variable speed pumps:
  - a. Pump run status
  - b. Pump in auto status
  - c. Pump in remote status
  - d. Pump amps (where provided)
  - e. Pump check valve open (where provided)



- f. Pump call to run
  - g. Pump interlock status (where provided)
- B. Variable speed motor control includes various alarm options. Each alarm has the same options as the discrete input alarms, optional latching configuration, time delay, normally open/closed option, and alarm priority level of 4–1, as described in Section 3.9.1. Alarm options include:
- a. Fail to start
  - b. Fail to stop
  - c. E-stop active (where provided)
  - d. Check valve fault (where provided)
  - e. MCC HOA not in auto
  - f. HIM not in auto (where provided)
  - g. Local disconnect open (where provided)
  - h. Interlocks active, which identifies if there are interlocks active, causing the motor to not be in the ready state.
  - i. I/O health fault, which identifies if any of the I/O associated with the motor is faulty.
  - j. External trip active

### 3.6.5 VFD Motor Control

Variable frequency drives (VFDs) are programmed to ensure proper minimum and maximum speed values are achieved.

- A. When a pump is commanded to start, it is brought online to the minimum speed set at the VFD and set to the commanded speed using a ramp rate configured at the VFD.
- Note: Pump minimum and maximum values and VFD ramp rate are based on the VFD's initial configuration.*
- B. When a VFD is connected to a PID loop, the pump speed is determined by scaling the PID output (0 – 100%) to the minimum and maximum pump speeds. For example, if the pump minimum and maximum speeds are 50% and 100% respectively, a PID output of 50% would correspond to a pump speed of 75%.
- C. When a pump is commanded to stop, it ramps down to the minimum speed based on a ramp rate configured at the VFD. Once the pump speed is below the minimum, it is stopped.

### 3.6.6 Multiple Pump Variable Speed PID Control

Multiple pump variable speed applications are programmed to sequence pumps and adjust speed based on the output of a PID controller. The PID controller is used to maintain a desired process set point, such as flow, level, or pressure within a control deadband. A measured process variable provides feedback to the PID controller. The PID controller attempts to correct the error between the measured process variable and set point by calculating and determining a corrective action for the process. For multiple pump variable speed applications, the corrective action is adjusting pump speed and the number of pumps in operation. Pump start and stop transitions are handled using a transition algorithm as described below.



The lead pump starts if the error between the measured process variable and the set point are outside of the control deadband for an adjustable time delay. The speed of the lead pump is adjusted through the PLC's PID algorithm to maintain the set point, using the measured process variable as feedback.

If the current pump(s) are operating at maximum speed, and the process variable remains outside the control deadband for an adjustable amount of time, the next pump (e.g. lag pump 1) is called to run.

Similarly, if the current pump(s) are operating at minimum speed, and the process variable remains outside the control deadband for an adjustable amount of time, the last pump on (e.g. lag pump 1) is called to stop.

During pump start/stop transitions, pumps are programmed using a transition algorithm to help minimize system disruptions with bringing on/off another pump. During this transition period, the PID control algorithm is temporarily bypassed, and the speed set point of the pump(s) in operation undergoes an operator adjustable step adjustment (as a percent of speed). This step adjustment is meant to anticipate the system impact of bringing on/off another pump. The initial step adjustments will be determined in the field during start up. The step adjustments may vary if going from 1-to-2 pumps, 2-to-3 pumps, and so on.

Once all pumps are operating at the step-adjusted speed, control resumes using the PID algorithm. All pumps then have their speed adjusted based on the output of the PID controller as previously described.

For example, if the current speed control output is 80% for one pump running, and a step transition from 1-to-2 pumps is set at 10%, when a second pump is called to run, the first pump ramps down to 70% speed, while the second pump is brought up to 70% speed. Once both pumps are running at 70% speed, after an adjustable time delay, the PID algorithm resumes.

The control strategy for a particular site may define additional functions and restrictions that affect the implementation of this control function.

### 3.6.7 Pump Alternation Sequence

Pump alternation is determined by the PLC, which is programmed to alternate pumps as Lead/Lag 1/Lag 2 and so forth, after each run cycle. Each pump is assigned a position in the sequence (Lead/Lag 1/Lag 2, etc.). Any pump that is out of service is removed from the pump alternation sequence.

If a pump is called to start and does not start after an adjustable time, then the following occurs:

- A. A pump fail alarm is issued.
- B. The next available pump, including any standby pumps, is called to start.
- C. The failed pump is taken out of the pump alternation sequence and designated as 'out of service' until the pump fail alarm is manually reset by the operator.

For a lead pump that runs continuously, lead pump alternates after an operator adjustable time (number of hours between lead change). During the lead pump transition, the two pumps will overlap in the transition, such that in the event the pump called to run fails, the old lead pump continues to run.

In addition, the operator has the option to disable the pump alternation sequence or to manually alternate the lead pump by entering the desired lead pump number.

In the pump alternation sequence, the number of pumps allowed to run may be limited based on power availability. The control strategy for a particular site may define additional functions and restrictions for the pump alternation sequence.

## 3.7 Common Monitoring Functions

The following subsections describe common monitoring functions. The control strategy for a particular site may define additional monitoring functions.

### 3.7.1 Communication Interfaces

All communication interfaces are monitored for their current status. An alarm is activated when there is a failure of communications. The calculation and/or logic used to identify communications varies depending on the network interface and available parameters. The following network interfaces are continuously monitored for each network segment (DNP3, Profinet, Modbus TCP, Profibus, etc.):

- A. Communications status
- B. Communications failure alarm
- C. Power supply failure

### 3.7.2 Site PLC Monitoring

The site PLCs are monitored for various fault conditions. The following site PLC monitoring alarms are monitored:

- A. Processor stopped or program mode
- B. I/O module status (individual for each I/O module)

### 3.7.3 Common Panel Hardwired Status/Alarm Points

The following hardwired status and alarm parameters are continuously monitored at each panel:

- A. PLC panel 120 VAC power available
- B. PLC panel 24 VDC power supply OK
- C. Network switch alarm (per switch, where provided)
- D. UPS on battery
- E. UPS alarm
- F. UPS low battery
- G. Surge protection device OK
- H. Panel intrusion

### 3.7.4 Common Remote Site Hardwired Status/Alarm Points

The following hardwired status and alarm parameters are continuously monitored at each remote site:

- A. Intrusion alarm
  - a. An intrusion alarm delay function is provided to allow enough time for the operator to disable prior to alarm initiation, or to allow enough time for operator to enable the alarm and exit prior to alarm initiation.
- B. Flood alarm (where provided)

### 3.7.5 Loss of Power

- A. Sites with generator
  - a. Loss of power is determined by the status of 'PLC panel 120 Vac power available' in the panel and 'generator run' status. If PLC panel 120 Vac power is not available and generator run status is not received after a time delay, alarm for 'loss of power.'
- B. Sites without generator
  - a. Loss of power is determined by the status of 'PLC panel 120 Vac power available' in the panel. If PLC panel 120 Vac power is not available after a time delay, alarm for 'loss of power.'

## 3.8 Additional Equipment Hardwired Status/Alarm Points

The following subsections describe hardwired status and alarm points for additional equipment. The control strategy for a particular site may define additional functions and restrictions that affect the implementation of this control function.

### 3.8.1 Generator Hardwired Status/Alarm Points

- A. Generator monitoring varies by site. Below are some of the parameters monitored at sites. Refer to the I/O list.
  - a. Generator run
  - b. Generator fail
  - c. Generator fuel tank low level alarm
  - d. Generator vault flood, if applicable
  - e. Automatic Transfer Switch (ATS) in normal
  - f. ATS in generator
- B. Generator runtime since last service
  - a. Generator runtime since last service (i.e. fueling) is calculated and displayed at SCADA. The value can be reset at SCADA.
- C. Overall generator runtime
  - a. Overall generator runtime is calculated and displayed at SCADA.

## 3.9 Standard Alarm Management

The following subsections describe the approach for standard alarm management. The control strategy for a particular site may define additional functions and restrictions that affect the implementation of this.

### 3.9.1 Alarm Priority

Alarms are programmed to have a priority level of 4-1. The alarm priority level indicates the importance/urgency of the alarm. The assigned alarm priority dictates how the alarm is displayed on the SCADA HMI screens through color, shape, and annunciation protocol (animation, sound, and remote alarm notification). A preliminary alarm list will be developed at a later date. This list will be started as a baseline alarm list, to be modified during testing and finalized during commissioning. Alarms should have an audit lifecycle. The SCADA and Smart Utility Standards document will provide more details on the definition of alarm priorities and how they are implemented. The four priorities are summarized as follows:

- 4 = Critical
- 3 = High
- 2 = Medium
- 1 = Low

### 3.9.2 No Response Alarm

If an equipment unit is in the SCADA control mode (either SCADA Manual or SCADA Automatic) and is called to operate (start, stop, open, close, etc.) and the appropriate response (on, off, opened, closed, etc.) is not received after an adjustable time delay (typically 5 seconds for motors and 15 seconds for valves), then:

- A. Generate an alarm.
- B. If the output was generated by an automatic control sequence, suspend or abort the sequence and hold until reset command from the HMI is generated.

### 3.9.3 Insufficient Number of Pumps in Ready State

A ready state is defined as follows: the pump has not failed, the pump control interface is in AUTO at the local interface, and the pump control interface in SCADA AUTO at the HMI. If an insufficient number of pumps are not in the ready state after an adjustable period of time, generate an alarm for 'Minimum Pumps Not Ready.' This alarm is intended to alert operations if equipment is left in the HAND or OFF positions (i.e. not in AUTO) for an extended period of time. The minimum number of pumps required to be in the ready state varies by site. The minimum number is operator adjustable from the SCADA HMI. Refer to the control strategy for a particular site for the minimum number of pumps required to be in the ready state.

When alternation logic calls for more pumps to run than are in the ready state, an alarm will also be generated for 'More Pumps Called than Available.'

### 3.9.4 Unexpected Status Change Alarm

If a device in SCADA control mode changes its run/stop or open/closed status without being commanded to do so, generate an alarm.

### 3.9.5 Sequence Fail Alarm

If a control sequence cannot proceed to the next step because the current step's completion criteria has not been met, after a step-specific, adjustable time delay, an alarm is generated. This alarm condition inhibits running the sequence until it is manually reset by operator action.

### 3.9.6 Alarm Reset

For discrete and analog alarms, the operator is required to reset the alarm in order for the alarm to return to normal and any automated permissive to continue. Reset selection is provided on the local OIT, if applicable, to reset the site alarms. A PLC reset is also provided on the SCADA screen for each individual site.

### 3.9.7 Set Points, Alarm limits, Timer Presets, Control Modes, and Lead/Lag Status

All set points, control limits, alarm limits, timer presets, control modes, and lead/lag status used by PLCs, vendor-supplied package system PLCs, are monitored by and adjusted through the HMI.

## 3.10 Network Data Exchange Requirements for Common Equipment Types

The following subsections describe the minimum data exchange requirements between the PLC/SCADA and common types of networked equipment.

### 3.10.1 Variable Frequency Drives (VFD) – Profibus or Profinet

The following table provides minimum requirements for monitoring and control parameters exchanged between the PLC/SCADA and the VFD via Profibus or Profinet. Data exchange may vary by VFD manufacturer. The table below is provided as a baseline.

Table 3-1. Data Exchange Requirements - VFD	
Read/Write	Parameter
Read	In LOCAL (HIM status)
Read	In REMOTE (HIM status)
Read	Ready
Read	Running
Read	Output frequency
Write	Frequency reference
Read	Motor RPM
Read	Motor current
Read	Motor torque
Read	Motor power
Read	Motor voltage
Read	DC-link voltage
Read	Fault
Write	Run command
Write	Reset

### 3.10.2 Power Monitors (PM) - Profibus

The following table provides minimum requirements for monitoring and control parameters exchanged between the PLC/SCADA and the power monitor via Profibus. Data exchange may vary by power monitor manufacturer. The table below is provided as a baseline.

Table 3-2. Data Exchange Requirements – Power Monitor	
Read/Write	Parameter
Read	Phase current (A, B, C, and average)
Read	Line-to-line voltage (AB, BC, CA, and average)
Read	Line-to-neutral voltage (A, B, C, and average)
Read	Watts (A, B, C, and total)
Read	Volt-ampere (VA) total

<b>Table 3-2. Data Exchange Requirements – Power Monitor</b>	
<b>Read/Write</b>	<b>Parameter</b>
Read	Volt-ampere reactive (VAR) total
Read	Power factor (A, B, C, and total)
Read	Phase current (A, B, and C) total harmonic distortion (THD)

### 3.10.3 Water Quality Analyzers - Profibus

The following table provides minimum requirements for monitoring and control parameters exchanged between the PLC/SCADA and the water quality analyzer via Profibus. Data exchange may vary by water quality analyzer. The table below is provided as a baseline.

<b>Table 3-3. Data Exchange Requirements – Water Quality Analyzer</b>	
<b>Read/Write</b>	<b>Parameter</b>
Read	Chlorine
Read	pH
Read	Water temperature

## Section 4

# Water Site Control Strategies

This section includes control strategies for individual water sites:

- First Hill Pump Station
- SPU Station 171
- North Fire Station
- South Fire Station
- Reservoir Pump Station\*

\*The control strategy for the Reservoir Pump Station reflects the current configuration at the site. The control strategy will be updated once the Booster Chlorination System project is constructed, which may include piping rearrangements and updates to the overall control scheme. SPU Station 68 will also be constructed as part of the Booster Chlorination System project and will be added to the control strategies at that time.

### 4.1 First Hill Pump Station

First Hill Pump Station serves the First Hill 456 Pressure Zone, providing domestic flow and fire suppression flow to the zone. The station consists of six pumps: four 1.5 HP pumps and two 40 HP pumps, all operating on variable frequency drives (VFDs). The purpose of the station is to boost the system pressure to an acceptable level for customers in the First Hill zone and provide fire suppression supply to the zone. The four 1.5 HP pumps operate to maintain system pressure during normal operation. The two 40 HP pumps are intended to operate during high season demand and to meet fire flow demand.

**Control Overview.** The variable speed pumps are started and stopped and have their speed adjusted to maintain an operator adjustable discharge pressure set point. The VFDs communicate to the PLC panel through a Profibus network link.

**Suction and Discharge Pressure Transmitters.** Station suction and discharge pressures are monitored by two pressure transmitters. The discharge pressure signal provides feedback for pump control.

**Pressure Reducing Valve.** A pressure reducing valve (PRV) is located on the discharge header for the pumps and opens on high pressure. The PRV is intended to provide pressure reduction when the pumps are running at minimum operating speed, and the discharge pressure is still too high. The PRV recirculates flow to the suction side of the pumps. A limit switch monitors the position of the PRV.

**Magnetic Flow Meter.** A magnetic flow meter measures the inlet flow to the four 1.5 HP pumps. The flow meter has a pulse output signifying 100 gallons of water through the meter. This pulse output is used for a flow totalization calculation in the PLC. Based on the piping arrangement, any recirculation flow from the PRV is also measured by the flow meter. However, flows through the two 40 HP pumps are not measured by the flow meter.

**Water Quality Analyzer.** An analyzer panel monitors chlorine, pH, and water temperature. The data from the analyzer panel is communicated to the PLC panel through a Profibus network link.

**Standby Generator.** First Hill Pump Station has a 35-kW standby generator to supply backup power to the station. The generator has capacity to supply power to either four 1.5 HP pumps or one 40 HP pump. The generator and associated automatic transfer switch (ATS) are monitored by SCADA.

**Exhaust Fans.** Two Exhaust Fans at the station provide ventilation and cooling for the vault. The fans are operated locally from the motor starter panel: Fan 1 has an OFF-AUTO-SLOW-FAST selector switch, and Fan 2 has a HAND-OFF-AUTO local selector switch. SCADA/PLC control is not provided.

**Power Monitor.** Data from a power monitor is communicated to the PLC panel through a Profibus network link.

#### 4.1.1 Equipment

Table 4-1. First Hill PS Equipment	
Tag Number	Description
WA_DST_FHL_BP0101	First Hill Pump 1
WA_DST_FHL_BP0201	First Hill Pump 2
WA_DST_FHL_BP0301	First Hill Pump 3
WA_DST_FHL_BP0401	First Hill Pump 4
WA_DST_FHL_BP0501	First Hill Pump 5
WA_DST_FHL_BP0601	First Hill Pump 6
WA_DST_FHL_PRV0140	First Hill Pressure Reducing Valve
WA_DST_FHL_GEN0701	First Hill Standby Generator
WA_DST_FHL_ATS0702	First Hill Automatic Transfer Switch (ATS)
WA_DST_FHL_EF0801	First Hill Exhaust Fan 1
WA_DST_FHL_EF0901	First Hill Exhaust Fan 2

#### 4.1.2 Instruments

Table 4-2. First Hill PS Instruments	
Tag Number	Description
WA_DST_FHL_PIT0110	First Hill Suction Pressure Transmitter
WA_DST_FHL_FIT0120	First Hill Station Flow Meter/Transmitter
WA_DST_FHL_PIT0130	First Hill Discharge Pressure Transmitter
WA_DST_FHL_ZSC0140	First Hill Pressure Reducing Valve Limit Switch
WA_DST_FHL_AIT0150	First Hill Water Quality Analyzer/Transmitter
WA_DST_FHL_YS0001	First Hill Intrusion Switch
WA_DST_FHL_LSH0002	First Hill Flood Switch
WA_DST_FHL_PM0703	First Hill Power Monitor



### 4.1.3 Operation

- A. The local human interface module (HIM) at each of the VFD panels for First Hill Pumps 1 – 6 includes HAND/AUTO selection and operates as follows:
- a. Local Manual Control:
    - i. HAND allows local control from the VFD's human interface module (HIM), and AUTO enables SCADA to control via a Profibus network communication link. The HIM at the VFD panel sets the pump speed when running in HAND.
  - b. SCADA Manual Control:
    - i. When the VFD panel HIM is in AUTO, SCADA control is enabled via a Profibus network communication link. The operator can then select between SCADA Manual and SCADA Auto control of the equipment at the SCADA HMI.
    - ii. When SCADA Manual control is selected, the pumps operate as follows:
      1. The operator can manually start and stop the pump and manually adjust the pump speed via the SCADA HMI.
  - c. SCADA Auto Control:
    - i. When SCADA Auto control is selected, the pumps operate as follows:
      1. Pressure is monitored by a pressure transmitter (WA\_DST\_FHL\_PIT0130) on the discharge header of the pump station. The pumps operate to maintain an operator adjustable pressure set point within the control deadband (initially set at 53 PSI).
      2. While in SCADA Auto, pump alternation is determined by the PLC, which is programmed to alternate pumps as described in Section 3.6.7. For normal demand, the four 1.5 HP pumps (WA\_DST\_FHL\_BP0101/0201/0301/0401) are assigned Lead/Lag 1/Lag 2/Lag 3. The lead pump alternates after an operator adjustable runtime. For high demand, the two 40 HP pumps (WA\_DST\_FHL\_BP0501/0601) operate as Duty/Standby and alternate after each run cycle.
      3. The number of pumps in operation and pump speed is determined by the Multiple Pump Variable Speed PID Control function described in Section 3.6.6. Modifications to the control function for First Hill Pump Station are as follows:
        - a. The lead pump runs continuously under normal operation. When one pump is running at minimum operating speed, and discharge pressure continues to increase above the set point, a pressure reducing valve with local settings operates to provide recirculation.
        - b. The four 1.5 HP pumps operate as Lead/Lag 1/Lag 2/Lag 3. When all four pumps are operating at maximum speed and the discharge pressure remains less than the set point for an adjustable amount of time, the 40 HP pump is called to run. During the transition from four 1.5 pumps to one 40 HP pump, the four smaller pumps are stepped down before they are called to stop.

- c. The two 40 HP pumps operate as Duty/Standby.
- d. Pump transition steps are detailed in the tables below for normal and high demand scenarios, respectively. Initial step up/down set points will be determined in the field during start up. Time delay setpoints are also adjustable and will be determined in the field during startup.

Table 4-3. First Hill PS - Normal Demand Pump Transition Steps			
Pump Transition	Step Up (% of Speed)	Step Down (% of Speed)	Notes
1-to-2	FIELD DETERMINE	FIELD DETERMINE	
2-to-3	FIELD DETERMINE	FIELD DETERMINE	
3-to-4	FIELD DETERMINE	FIELD DETERMINE	

Table 4-4. First Hill PS - High Demand Pump Transition Steps			
Pump Transition	Step Up (% of Speed)	Step Down (% of Speed)	Notes
4-1.5 HP pumps to 1-40 HP pump	FIELD DETERMINE	FIELD DETERMINE	Four 1.5 HP pumps are stepped down and stopped during transition to one 40 HP pump

#### 4.1.4 Hardwired Interlocks

- A. The following are hardwired interlocks active in LOCAL or SCADA control:
  - a. VFD fault causes pump to stop or prohibit start until the alarm resets.

#### 4.1.5 Software Interlocks

- A. The following are PLC logic interlocks active in SCADA control:
  - a. High-high discharge pressure causes the pumps to shutdown or prohibit start. The interlock automatically resets after the high-high discharge pressure condition clears.
  - b. While on standby generator power, restrict pump operation to four 1.5 HP pumps or one 40 HP pump.
  - c. In the event of a signal of discharge pressure out-of-range alarm, the pumps maintain their current speed until the signal returns.
  - d. In the event of loss of network communication, the VFD maintains its current speed until communication returns.

#### 4.1.6 Monitoring

- A. The following statuses are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. First Hill Suction Pressure Transmitter
      - 1. Suction Pressure
    - ii. First Hill Discharge Pressure Transmitter
      - 1. Discharge Pressure

- iii. First Hill Flow Meter/Transmitter
  - 1. Flow (through Pumps 1 - 4)
- iv. First Hill Pressure Reducing Valve Limit Switch
  - 1. PRV Open
- v. First Hill Exhaust Fan 1
  - 1. Run
- vi. First Hill Exhaust Fan 2
  - 1. Run
- vii. First Hill ATS
  - 1. ATS in normal
- viii. Refer to Section 3.7 for common monitoring functions:
  - 1. Common panel hardwired status points
- b. Software:
  - i. Refer to Section 3.7 for common monitoring functions:
    - 1. Communication interfaces
    - 2. Site PLC monitoring
- c. Network:
  - i. Refer to Section 3.10 for network data exchange requirements for monitoring and control parameters exchanged between the PLC/SCADA and the following equipment via Profibus:
    - 1. Variable Frequency Drives
      - a. First Hill Pumps 1 - 6
    - 2. Power Monitors
      - a. First Hill Power Monitor
    - 3. Water Quality Analyzers
      - a. First Hill Water Quality Analyzer/Transmitter

#### 4.1.7 Alarming

- A. In addition to the common alarms specified in Section 3.6.4, the following alarms are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. First Hill Exhaust Fan 1
      - 1. Overload
    - ii. First Hill Exhaust Fan 2
      - 1. Overload
    - iii. First Hill Flood Switch
      - 1. Flood alarm

- iv. First Hill Intrusion Switch
  - 1. Intrusion alarm
- v. First Hill Generator
  - 1. Run
  - 2. Trouble
  - 3. Low fuel alarm
- vi. First Hill ATS
  - 1. ATS in generator
- vii. First Hill Pump 5
  - 1. Run (alarm if a 40 HP pump is running)
- viii. First Hill Pump 6
  - 1. Run (alarm if a 40 HP pump is running)
- ix. Refer to Section 3.7 for common alarm functions:
  - 1. Common panel hardwired alarms
- b. Software:
  - i. Refer to 3.9.3 for 'Insufficient Pumps in Ready State' alarm.
    - 1. Require a minimum of two 1.5 HP pumps and one 40 HP pump to be in the Ready State, or generate an alarm.
  - ii. Refer to Section 3.7 for common alarm functions:
    - 1. Communication interface alarms
    - 2. Site PLC alarms
  - iii. First Hill Water Quality Analyzer
    - 1. Low, low-low, high, high-high chlorine
    - 2. Low, low-low, high, high-high pH
- c. Network:
  - i. Refer to Section 3.10 for network data exchange requirements for alarm parameters exchanged between the PLC/SCADA and the following equipment via Profibus:
    - 1. Variable Frequency Drive
      - a. First Hill Pumps 1 - 6
    - 2. Power Monitors
      - a. First Hill Power Monitor
    - 3. Water Quality Analyzers
      - a. First Hill Water Quality Analyzer/Transmitter

### 4.1.8 Calculations

- A. In addition to the common calculations specified in Sections 3.1 and 3.2, the following calculations are performed and displayed at the SCADA HMI:
  - a. First Hill Flow Meter/Transmitter
    - i. Flow pulse totalization
  - b. Pump starts
    - i. Refer to Section 3.2.3 for equipment starts.
  - c. Pump run times
    - i. Refer to equipment run times in Section 3.2.2.
  - d. Generator run times
    - i. Refer to equipment run times in Section 3.2.2.

### 4.1.9 Operation on Generator

- A. Loss of Power
  - a. On a loss of power, the pumps that were running prior to the power failure are started in sequence (Lead, Lag1, etc.) with delays between starts to avoid a potential generator surge if all were started at the same time.
  - b. Equipment automatically restarts when power is returned. For multiple pumps, stagger pump starts.
  - c. The VFD should be configured such that loss of communication is not faulting on loss of power to prevent restart.

## 4.2 SPU Station 171

SPU Station 171 (located at the Boat Ramp) is one of three metered connections through which the City receives water supply from SPU. The station provides water supply directly to the “canyon line,” which feeds some of the smaller (low) pressure zones. The station can also supply the Reservoir Pump Station via the canyon line. SPU Station 171 is typically used during off peak demand periods. The station is unable to keep up during high demand periods.

The station consists of a flow meter and flow control valve. The purpose of the station is to regulate the amount of water supply from SPU. The station monitors chlorine residual and pH levels in the supply entering the distribution system through this site, and the supply is isolated if levels are outside the acceptable range. Upstream/downstream system pressures are also monitored.

**Control Overview.** The position of the flow control valve is adjusted to maintain an operator adjustable flow set point.

**Upstream/Downstream Pressure Transmitters.** Station upstream and downstream pressures are monitored by two pressure transmitters.

**Magnetic Flow Meter.** A magnetic flow meter measures the flow from SPU. The flow signal provides feedback for valve control. The flow meter also has a pulse output signifying 100 gallons of water through the meter. This pulse output is used for a flow totalization calculation in the PLC.

**Flow Control Valve.** A flow control valve (FCV) is located downstream of the magnetic flow meter. The flow control valve is a Cla-Val™ with three solenoid valve operators: an open solenoid, a close solenoid, and an enable solenoid. The position of the FCV is adjusted to maintain a flow set point using the solenoid valves. The close solenoid allows upstream flow into the valve dome to move it in the closed position. The open solenoid allows flow to leave the valve dome to move it in the open position. The enable solenoid needs to be energized, or else the valve defaults to hydraulic operation based on local pilot settings.

A limit switch monitors the closed position of the FCV to indicate a valve failure.

**Water Quality Analyzer.** An analyzer monitors chlorine, pH, and water temperature. This analyzer measures the water quality of the SPU supply so that supply through the SPU Station 171 site can be isolated if chlorine residual or pH levels are outside the acceptable range. The analyzer is housed in a separate water quality analyzer (WQA) panel enclosure. The WQA panel has its own flood switch to detect a leak in bottom of the panel.

#### 4.2.1 Equipment

Table 4-5. SPU Station 171 Equipment	
Tag Number	Description
WA_WS_SPU171_FCV1003	SPU Station 171 Flow Control Valve

#### 4.2.2 Instruments

Table 4-6. SPU Station 171 Instruments	
Tag Number	Description
WA_WS_SPU171_PT1001	SPU Station 171 Upstream Pressure Transmitter
WA_WS_SPU171_PT1004	SPU Station 171 Downstream Pressure Transmitter
WA_WS_SPU171_FIT1002	SPU Station 171 Flow Meter/Transmitter
WA_WS_SPU171_ZSC1003	SPU Station 171 Valve Limit Switch
WA_WS_SPU171_AIT1005	SPU Station 171 Water Quality Analyzer/Transmitter
WA_WS_SPU171_YS0001	SPU Station 171 Intrusion Switch
WA_WS_SPU171_LSH0002	SPU Station 171 Flood Switch
WA_WS_SPU171_LSH1005	SPU Station 171 WQA Panel Flood Switch

#### 4.2.3 Operation

- A. A local control station in the valve vault has OPEN/CLOSE/HOLD/AUTO selection and operates as follows:
  - a. Local Manual Control:
    - i. OPEN and CLOSE allow local operation of the flow control valve. AUTO enables SCADA to control the valve position. When the local control station is in the OPEN/CLOSE/AUTO positions, the enable solenoid valve must be energized to allow operation of the open/close solenoid valves.

- ii. The open solenoid is called SV1, the closed solenoid is called SV2, and the enable solenoid is called SV3.
  - iii. When in OPEN, SV1 is energized open to open the valve (increase flow). The PLC tracks the status of the OPEN position selection.
  - iv. When in CLOSE, SV2 is energized open to close the valve (decrease flow). The PLC tracks the status of the CLOSE position selection.
  - v. When in HOLD, the valve holds its current position by not energizing SV1 or SV2.
  - vi. SV3 is energized while in OPEN, CLOSE, HOLD, or AUTO.
- b. Local Hydraulic Control
- ii. When commanded by the operator or on loss of power in the PLC panel, the enable solenoid valve SV3 is de-energized, and the valve operates hydraulically based on the pilot settings on the valve.
- c. SCADA Manual Control:
- i. When the local selector switch is in AUTO, SCADA control is enabled. The operator can then select between SCADA Manual and SCADA Auto control of the valve at the SCADA HMI.
  - ii. When SCADA Manual control is selected, the valve operates as follows:
    - 1. The operator can manually close the valve or manually set the valve position (% open) via the SCADA HMI.
- d. SCADA Auto Control:
- i. When SCADA Auto control is selected, the valve operates as follows:
    - 1. Station flow is monitored by a magnetic flow meter (WA\_WS\_SPU171\_FIT1002) upstream of the flow control valve. The valve position is adjusted to maintain an operator adjustable flow set point within the control deadband (initially set at 2400 GPM).
    - 2. When in SCADA Auto, the PLC compares the measured flow rate to the flow set point. Based on the difference in flow, the PLC calculates the amount of time to command the valve to open or close.

#### 4.2.4 Hardwired Interlocks

- A. The following are hardwired interlocks active in LOCAL or SCADA control:
- a. None.

#### 4.2.5 Software Interlocks

- A. The following are PLC logic interlocks active in SCADA control:
- a. Low-low upstream pressure causes the valve to close or prohibit open. The interlock automatically resets after the low-low upstream pressure condition clears.
  - b. Low-low chlorine causes the valve to close or prohibit open until reset by the operator.
  - c. High-high chlorine causes the valve to close or prohibit open until reset by the operator.
  - d. Low-low pH causes the valve to close or prohibit open until reset by the operator.

- e. High-high pH causes the valve to close or prohibit open until reset by the operator.
- f. In the event of a signal of station flow out-of-range alarm, the valve maintains its current position until the signal returns.

#### 4.2.6 Monitoring

- A. The following statuses are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. SPU Station 171 Upstream Pressure Transmitter
      - 1. Upstream Pressure
    - ii. SPU Station 171 Downstream Pressure Transmitter
      - 1. Downstream Pressure
    - iii. SPU Station 171 Flow Meter/Transmitter
      - 1. Flow
    - iv. SPU Station 171 Water Quality Analyzer
      - 1. Free chlorine
      - 2. pH
      - 3. Water temperature
    - v. SPU Station 171 Flow Control Valve Limit Switch
      - 1. Valve closed
    - vi. Refer to Section 3.5.2 for common monitoring functions:
      - 1. Common valve hardwired status points
    - vii. Refer to Section 3.7 for common monitoring functions:
      - 1. Common panel hardwired status points
  - b. Software:
    - i. Refer to Section 3.7 for common monitoring functions:
      - 1. Communication interfaces
      - 2. Site PLC monitoring

#### 4.2.7 Alarming

- A. The following alarms are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. SPU Station 171 Station Flood Switch
      - 1. Station flood alarm
    - ii. SPU Station 171 WQA Panel Flood Switch
      - 1. WQA panel flood alarm
    - iii. SPU Station 171 Intrusion Switch
      - 1. Intrusion alarm



- iv. Refer to Section 3.7 for common alarm functions:
  - 1. Common panel hardwired alarms
- b. Software:
  - i. Refer to Section 3.5.2 for common alarm functions:
    - 1. Common valve alarms
  - ii. Refer to Section 3.7 for common alarm functions:
    - 1. Communication interface alarms
    - 2. Site PLC alarms
  - iii. Water Quality Analyzer
    - 1. High, high-high, low, low-low chlorine
    - 2. High, high-high, low, low-low pH

#### 4.2.8 Calculations

- A. In addition to the common calculations specified in Sections 3.1 and 3.2, the following calculations are performed and displayed at the SCADA HMI:
  - a. SPU Station 171 Flow Meter/Transmitter
    - i. Flow pulse totalization

#### 4.2.9 Operation on Loss of Power

- A. Loss of Power
  - a. On a power failure, the valve operates hydraulically based on the pilot settings on the valve. There is not a standby generator at this site. On loss of power, the City does not use this source due to loss of the ability to monitor water quality. In this scenario, City would need to go out to the site and manually close the valve upstream of the meter/flow control valve to isolate the source.

### 4.3 North Fire Station (Pressure)

North Fire Station is one of two remote sites within the distribution system where pressure is monitored and communicated back to the SCADA system. North Fire Station monitors distribution system pressure in the Gravity pressure zone.

**Control Overview.** There is no water system control at North Fire Station. This site is for monitoring only.

**Pressure Transmitter.** Water system pressure is monitored by a pressure transmitter.

**Water Quality Analyzer.** The control strategy and panel hardware include provisions for a future water quality analyzer at the North Fire Station if the City wants to monitor chlorine and pH at this location in the future.

#### 4.3.1 Equipment (Not Used)

### 4.3.2 Instruments

**Table 4-7. North Fire Station Instruments**

Tag Number	Description
WA_DST_NFS_PIT1001	North Fire Station Pressure Transmitter
WA_DST_NFS_AIT1002	North Fire Station Water Quality Analyzer/Transmitter (Future)

### 4.3.3 Operation (Not Used)

### 4.3.4 Hardwired Interlocks (Not Used)

### 4.3.5 Software Interlocks (Not Used)

### 4.3.6 Monitoring

- A. The following statuses are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. North Fire Station Pressure Transmitter
      - 1. Pressure
    - ii. North Fire Station Quality Analyzer (Future)
      - 1. Free chlorine (Future)
      - 2. pH (Future)
    - iii. Refer to Section 3.7 for common monitoring functions:
      - 1. Common panel hardwired status points
  - b. Software:
    - i. Refer to Section 3.7 for common monitoring functions:
      - 1. Communication interfaces
      - 2. Site PLC monitoring

### 4.3.7 Alarming

- A. The following alarms are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. Refer to Section 3.7 for common alarm functions:
      - 1. Common panel hardwired alarms
  - b. Software:
    - i. Refer to Section 3.7 for common alarm functions:
      - 1. Communication interface alarms
      - 2. Site PLC alarms
    - ii. North Fire Station Pressure Transmitter
      - 1. High, high-high, low, low-low pressure

- iii. North Fire Station Water Quality Analyzer (Future)
  - 1. High, high-high, low, low-low chlorine
  - 2. High, high-high, low, low-low pH

#### 4.3.8 Calculations (Not Used)

#### 4.3.9 Operation on Loss of Power (Not Used)

### 4.4 South Fire Station (Pressure)

South Fire Station is one of two remote sites within the distribution system where pressure is monitored and communicated back to the SCADA system. South Fire Station monitors distribution system pressure in the High pressure zone.

**Control Overview.** There is no water system control at South Fire Station. This site is for monitoring only.

**Pressure Transmitter.** Water system pressure is monitored by a pressure transmitter.

**Water Quality Analyzer.** The control strategy and panel hardware include provisions for a future water quality analyzer at the South Fire Station if the City wants to monitor chlorine and pH at this location in the future.

#### 4.4.1 Equipment (Not Used)

#### 4.4.2 Instruments

**Table 4-8. South Fire Station Instruments**

Tag Number	Description
WA_DST_SFS_PIT1001	South Fire Station Pressure Transmitter
WA_DST_SFS_AIT1002	South Fire Station Water Quality Analyzer/Transmitter (Future)

#### 4.4.3 Operation (Not Used)

#### 4.4.4 Hardwired Interlocks (Not Used)

#### 4.4.5 Software Interlocks (Not Used)

#### 4.4.6 Monitoring

- A. The following statuses are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. South Fire Station Pressure Transmitter
      - 1. Pressure
    - ii. South Fire Station Quality Analyzer (Future)
      - 1. Free chlorine (Future)
      - 2. pH (Future)

- iii. Refer to Section 3.7 for common monitoring functions:
  - 1. Common panel hardwired status points
- b. Software:
  - i. Refer to Section 3.7 for common monitoring functions:
    - 1. Communication interfaces
    - 2. Site PLC monitoring

#### 4.4.7 Alarming

- A. The following alarms are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. Refer to Section 3.7 for common alarm functions:
      - 1. Common panel hardwired alarms
  - b. Software:
    - i. Refer to Section 3.7 for common alarm functions:
      - 1. Communication interface alarms
      - 2. Site PLC alarms
    - ii. South Fire Station Pressure Transmitter
      - 1. High, high-high, low, low-low pressure
    - iii. South Fire Station Water Quality Analyzer (Future)
      - 1. High, high-high, low, low-low chlorine
      - 2. High, high-high, low, low-low pH

#### 4.4.8 Calculations (Not Used)

#### 4.4.9 Operation on Loss of Power (Not Used)

### 4.5 Reservoir Pump Station

The Reservoir Pump Station consists of two reservoirs (North and South) and a booster pump station that feed two major pressure zones (PZ): Gravity PZ and High PZ.

The function of the reservoirs is to store and protect water until it is needed. The storage capacity ranges are continually monitored and modulated to both maintain operational storage ranges and provide sufficient turnover to mitigate water quality issues. The outlet on each reservoir supplies water directly into the Gravity PZ. The inlet on each reservoir can also serve as outlets when they are not filling. When this occurs, the reservoir inlets can supply the suction side of the booster pumps.

The booster pump station consists of five pumps, all operating on variable frequency drives (VFDs), which supply the High PZ. The suction side of the booster pump station is connected to the reservoir inlet header. As a result, the suction side of the booster pumps can draw water from the two reservoirs or from the main station supply. When the reservoirs are filling, the main pump station supply largely bypasses the reservoirs to directly supply the booster pumps. The purpose of the pump station is to boost the system pressure to an acceptable level for customers in the High PZ and provide fire suppression supply to the PZ.

The City is currently in the design phase for the Booster Chlorination System project at the Reservoir Pump Station. The project may include piping rearrangements, control valve additions, and updates to the overall control scheme at the Reservoir Pump Station. This control strategy will be updated at a later date to reflect control changes resulting from the Booster Chlorination System project.

**Control Overview – Reservoir Storage.** The reservoirs are filled routinely to maintain operational and fire storage ranges. Reservoir fill cycles are started and stopped based on reservoir level. During reservoir fills, two inlet valves control the amount of water entering the reservoirs.

**North/South reservoir level transmitters.** Reservoir level is monitored by a differential pressure transmitter (with port to atmospheric pressure) at each reservoir. The operator selects which level transmitter (North Reservoir Level Transmitter or South Reservoir Level Transmitter) is the primary measurement for overall reservoir level control.

**Reservoir inlet control valves.** The two reservoir inlet control valves control the filling of the North and South Reservoirs. The valves are Cla-Val™ type with two solenoid valve operators: an open solenoid and a close solenoid. The reservoir inlet control valves provide flow to a common header, which feeds the North and South Reservoirs and the suction side of the booster pumps. When in fill mode, the inlet control valves are modulated to maintain a flow set point.

**Reservoir inlet flow meters.** A magnetic flow meter monitors flow upstream of each reservoir inlet control valve. The reservoir inlet flow meter signals provide feedback for reservoir inlet valve control.

**Reservoir inlet/outlet isolation valves.** Each reservoir has an inlet and outlet isolation valve. The valves are motorized valves with local and SCADA control capability. The valves can be closed to isolate the reservoirs from the rest of the system.

**Reservoir outlet flow meters.** A magnetic flow meter monitors flow at the outlet of each reservoir.

**Station inlet pressure transmitter.** A pressure transmitter monitors the station inlet pressure upstream of Reservoir Inlet Control Valve 2.

**Control Overview – Booster Pumping.** The variable speed booster pumps are started and stopped and have their speed adjusted to maintain an operator adjustable discharge pressure set point. The VFDs communicate to the PLC panel through a Profinet network link.

**Reservoir booster pumps.** A set of five (5) 100 HP variable speed pumps at the Reservoir Pump Station supply the High PZ.

**Reservoir booster recirculation PRV.** A pressure reducing valve (PRV) connects the pump discharge header back to the suction header and opens on high discharge pressure. The PRV is intended to provide pressure reduction when the pumps are running at minimum operating speed, and the discharge pressure is still too high. The PRV recirculates flow to the suction side of the pumps. This PRV is not monitored or controlled by SCADA.

**High zone pressure transmitter.** Booster pump station discharge pressure is monitored by a pressure transmitter on the discharge header. The discharge pressure signal provides feedback for pump control.

**High zone flow meter/transmitter.** Booster pump station discharge flow is monitored by a magnetic flow meter on the discharge header. The flow signal is used for pump control to determine flow demand and the number of pumps required to operate.

**Reservoir pump station low pressure switch.** A pressure switch on the booster pump suction header alarms and shuts down the pumps on low pressure conditions.

**High zone PRV.** The High zone PRV is a Cla-Val™ with local and SCADA (remote) control capability. The PRV was originally designed to allow bypass of the booster pumps during low demand conditions when SPU supply pressure was sufficient to maintain pressure in the High PZ. This practice was discontinued<sup>2</sup> to facilitate reservoir turnover and water quality, and the PRV is closed under normal operation. However, the City wishes to keep the existing local and SCADA control capability. Any SCADA (remote) control requires operator initiation.

**Water Quality Analyzers.** Two separate analyzer panels at the Reservoir Pump Station monitor chlorine and pH levels in sample points at the site. Source water samples are drawn from five locations using solenoid valves controlled by the PLC. The five locations include the Reservoir inlet control valves (2), North Reservoir outlet, South Reservoir outlet, and the High PZ (booster pump discharge pipe).

**Standby Generator.** Reservoir Pump Station has a standby generator to supply backup power to the station. The generator has capacity to supply power to XX. The generator is monitored by SCADA. The City has plans to replace the existing generator in 2022, at which time additional generator and automatic transfer switch (ATS) parameters will be monitored by SCADA.

**Emergency well.** The City has an emergency well located at the Reservoir Pump Station that provides emergency water supply to the City. This source is not connected to the water distribution system. The emergency well is self-contained and utilizes standby power from the reservoir site. The emergency well is monitored by SCADA for alarm conditions. Control of the emergency well is not available from SCADA.

#### 4.5.1 Equipment

Tag Number	Description
WA_RES_RS_FCV1002	Reservoir Inlet Control Valve 1
WA_RES_RS_FCV2002	Reservoir Inlet Control Valve 2
WA_RES_RS_XV1003	South Reservoir Inlet Isolation Valve
WA_RES_RS_XV1006	South Reservoir Outlet Isolation Valve
WA_RES_RS_XV2003	North Reservoir Inlet Isolation Valve
WA_RES_RS_XV2006	North Reservoir Outlet Isolation Valve
WA_RES_BP_PRV0150	High Zone PRV
WA_RES_BP_BP0101	Reservoir Booster Pump 1
WA_RES_BP_BP0201	Reservoir Booster Pump 2
WA_RES_BP_BP0301	Reservoir Booster Pump 3
WA_RES_BP_BP0401	Reservoir Booster Pump 4
WA_RES_BP_BP0501	Reservoir Booster Pump 5
WA_RES_BP_PRV0601	Reservoir Booster Recirculation PRV
WA_RES_RS_GEN0701	Reservoir Standby Generator
WA_RES_RS_ATS0702	Reservoir Automatic Transfer Switch (ATS)

<sup>2</sup> Technical Memorandum 1: Chlorination System Optimization, City of Mercer Island, January 2020 (draft).

## 4.5.2 Instruments

**Table 4-10. Reservoir PS Instruments**

Tag Number	Description
WA_RES_RS_PIT0110	Station Inlet Pressure Transmitter
WA_RES_RS_FIT1001	Reservoir Inlet 1 Flow Meter/Transmitter
WA_RES_RS_FIT2001	Reservoir Inlet 2 Flow Meter/Transmitter
WA_RES_RS_ZSC1002	Reservoir Inlet Control Valve 1 Limit Switch
WA_RES_RS_ZSC2002	Reservoir Inlet Control Valve 2 Limit Switch
WA_RES_RS_ZSC1003	South Reservoir Inlet Isolation Valve Limit Switch
WA_RES_RS_LIT1004	South Reservoir Level Transmitter
WA_RES_RS_ZSC1006	South Reservoir Outlet Isolation Valve Limit Switch
WA_RES_RS_FIT1007	South Reservoir Outlet Flow Meter/Transmitter
WA_RES_RS_ZSC2003	North Reservoir Inlet Isolation Valve Limit Switch
WA_RES_RS_LIT2004	North Reservoir Level Transmitter
WA_RES_RS_ZSC2006	North Reservoir Outlet Isolation Valve Limit Switch
WA_RES_RS_FIT2007	North Reservoir Outlet Flow Meter/Transmitter
WA_RES_BP_PSL0120	Reservoir Pump Station Low Pressure Switch
WA_RES_BP_PIT0130	High Zone Pressure Transmitter
WA_RES_BP_FIT0140	High Zone Flow Meter/Transmitter
WA_RES_BP_ZSC0150	High Zone PRV Limit Switch
WA_RES_BP_LSH0002	Reservoir Pump Station Flood Switch
WA_RES_CL2_AIT0003	Water Quality Analyzer/Transmitter 1
WA_RES_CL2_AIT0004	Water Quality Analyzer/Transmitter 2
WA_RES_RS_LQ0005	Reservoir Pump Station Rain Gauge Counter
WA_RES_RS_MS0006	Seismic Switch
WA_RES_RS_TSL0801	Emergency Well Low Temperature Switch
WA_RES_RS_LSH0801	Emergency Well High Water Switch
WA_RES_RS_YS0801	Emergency Well Intrusion Switch
WA_RES_RS_GS0801	Emergency Well Smoke Detection

### 4.5.3 Operation – Booster Pumping

- A. The local HAND/OFF/AUTO (HOA) selector switch at the VFD panel for Reservoir Booster Pumps 1 – 5 operates as follows:
  - a. Local Manual Control:
    - i. HAND allows local control from the VFD's human interface module (HIM), OFF stops the pump, AUTO enables SCADA to control via a Profinet network communication link. The HIM at the VFD panel sets the pump speed when running in HAND.
  - b. SCADA Manual Control:
    - i. When the VFD panel HIM is in AUTO, SCADA control is enabled via a Profinet network communication link. The operator can then select between SCADA Manual and SCADA Auto control of the equipment at the SCADA HMI.
    - ii. When SCADA Manual control is selected, the pumps operate as follows:
      1. The operator can manually start and stop the pump and manually adjust the pump speed via the SCADA HMI.
  - c. SCADA Auto Control:
    - i. When SCADA Auto control is selected, the pumps operate as follows:
      1. During operation, up to four pumps operate as Lead/Lag 1/Lag 2/Lag 3. The fifth pump is a standby pump.
      2. Pressure is monitored by a pressure transmitter (WA\_RES\_BP\_PIT0130) on the discharge header of the pump station. The pumps operate to maintain an operator adjustable pressure set point within the control deadband (initially set at XX PSI).
      3. Pump speed is determined by the Multiple Pump Variable Speed PID Control function described in Section 3.6.6. While pumps are running, speed is adjusted using feedback from the pressure transmitter as described in the Multiple Pump Variable Speed PID Control function.
      4. Modifications to the Control function for Reservoir Pump Station are as follows:
        - a. Flow is monitored by a magnetic flow meter (WA\_RES\_BP\_FIT0140) on the discharge header of the pump station. The flow rate is used to determine the number of pumps in operation. Flow ranges A, B, C, and D are set by the operator at the SCADA HMI, with Range A set at 0 – X gpm, and so on, with Range D set as the highest flow range. For each flow range, a certain number of pumps are assigned to operate to meet the flow demand. As flow demand transitions from one range to the next, a pump is added or subtracted from operation. The pump flow ranges are summarized in the table below.



Range Name	Flow Range (gpm)	Pumps in Operation
A	0 - X	Lead Pump
B	X - X	Lead/Lag 1 Pumps
C	X - X	Lead/Lag 1/Lag 2 Pumps
D	X - X	Lead/Lag 1/Lag 2/Lag 3 Pumps

- b. Pump transition steps for bringing on/off a pump are detailed in the table below. Initial step up/down set points will be determined in the field during start up. Time delay setpoints are also adjustable and will be determined in the field during startup.

Pump Transition	Step Up (% of Speed)	Step Down (% of Speed)
1-to-2	FIELD DETERMINE	FIELD DETERMINE
2-to-3	FIELD DETERMINE	FIELD DETERMINE
3-to-4	FIELD DETERMINE	FIELD DETERMINE

5. While in SCADA Auto, pump alternation is determined by the PLC, which is programmed to alternate pumps as described in Section 3.6.7. The five pumps are assigned Lead/Lag 1/Lag 2/Lag 3/Standby. The lead pump alternates after an operator adjustable time (entered as the number of hours between lead change).
- B. The High Zone PRV is a Cla-Val™ with local and SCADA control capability. The PRV has local field controls with CLOSE/AUTO selection and operate as follows:
- a. Local Manual Control:
    - i. When in CLOSE, the valve is commanded to the fully closed position. During normal operation, the selector switch is in the CLOSE position. AUTO enables local hydraulic control or SCADA to control the valve position.
  - b. SCADA Manual Control:
    - i. When the local selector switch is in AUTO, SCADA Manual control is also enabled.
    - ii. When in SCADA Manual, the valve operates as follows:
      1. The operator can manually CLOSE the valve or place the valve in BYPASS mode via the SCADA HMI.
      2. When in CLOSE, the valve is commanded closed.
      3. When in BYPASS, the valve (Cla-Val™) operates hydraulically based on the pilot settings on the valve to maintain the downstream pressure set point.
    - iii. On loss of power, the valve defaults to BYPASS mode.

- c. SCADA Auto Control:
  - i. None.

#### 4.5.4 Operation – Reservoir Storage

- A. Reservoir Inlet Control Valves 1 and 2 are Cla-Val™ type with local and SCADA control capability. The valves have local field controls with OPEN/CLOSE/HOLD/AUTO selection and operate as follows:
  - a. Local Manual Control:
    - i. OPEN and CLOSE allow local operation of the valve. AUTO enables SCADA to control the valve position.
    - ii. The open solenoid is called SV1, and the closed solenoid is called SV2.
    - iii. When in OPEN, SV1 is energized open to open the valve (increase flow).
    - iv. When in CLOSE, SV2 is energized open to close the valve (decrease flow).
    - v. When in HOLD, the valve holds its current position.
  - b. SCADA Manual Control:
    - i. When the local selector switch is in AUTO, SCADA control is enabled. The operator can then select between SCADA Manual and SCADA Auto control of the valve at the SCADA HMI.
    - ii. When SCADA Manual control is selected, the valve operates as follows:
      - 1. The operator can manually close the valve or manually set the valve position (% open) via the SCADA HMI.
  - c. SCADA Auto Control:
    - i. When SCADA Auto control is selected, the valves operate as follows:
      - 1. A valve can be designated as “IN SERVICE” or “OUT OF SERVICE.” If the valve is out of service, the valve is commanded closed. If both valves are in service, the valves operate as a system.
      - 2. A reservoir can be designated as “IN SERVICE” or “OUT OF SERVICE.” If a reservoir is out of service, the Reservoir Inlet/Outlet Isolation Valves (WA\_RES\_RS\_XV1003/1006 or WA\_RES\_RS\_XV2003/2006) are commanded closed. If a reservoir is selected as out of service, the level transmitter associated with the in-service reservoir becomes the primary transmitter for level control. Normally, both reservoirs are in service and operate as a system.
      - 3. Reservoir level is monitored by a level-sensing pressure transmitter (WA\_RES\_RS\_LIT1004/2004) at each reservoir. The reservoir level control method (North Reservoir Level Transmitter or South Reservoir Level Transmitter) is operator selectable and displayed on the HMI screen. Reservoir fill and drain cycles are initiated based on operator adjustable Fill Start and Fill Stop level set points.
      - 4. Initial state:
        - a. The level is above the Fill Start level set point, and the Reservoir Inlet Control Valves are closed. Reservoir level decreases based on demand to the Gravity PZ and the High PZ.

- b. When the Reservoir Inlet Control Valves are closed, the reservoir outlets feed the Gravity PZ and the reservoir inlet feeds the suction side of the booster pumps.
  5. Start Reservoir fill:
    - a. When the level reaches the Fill Start level set point and is maintained for an adjustable time period, reservoir fill begins.
    - b. Optionally, the operator can initiate a “RESERVOIR FILL” via the SCADA HMI.
    - c. Reservoir inlet flow is monitored by two magnetic flow meters (WA\_RES\_RS\_FIT1001/2001) upstream of each Reservoir Inlet Control Valve. When in fill mode, the Reservoir Inlet Control Valve position is adjusted to maintain an operator adjustable flow set point.
    - d. There are two different modes used to determine the flow set point. The operator can select between “MANUAL” and “CASCADE” flow modes.
    - e. Using the MANUAL flow mode, the flow set point is set manually by the operators. The set point is a manual calculation based on previous day consumption, weather, and reservoir level.
    - f. Using the CASCADE flow mode, the flow set point is determined based on the current reservoir level. Refer to Section 3.4 for more information on Cascade control.
    - g. The PLC then compares the measured flow rate to the flow set point. Based on the difference in flow, the PLC calculates the amount of time to command the valve to open or close.
  6. Stop Reservoir fill:
    - a. When the level reaches the Fill Stop level set point and is maintained for an adjustable time period, the Reservoir Inlet Control Valves are closed and reservoir fill stops.
    - b. Optionally, the operator can initiate a “RESERVOIR DRAIN” via the SCADA HMI. When reservoir drain is selected, the valve closes and remains closed until the Fill Start level set point is reached.
    - c. The reservoirs then enter another drain cycle.
- B. North/South Reservoir Inlet/Outlet Isolation Valves are motorized valves with local and SCADA control capability. The valves have local field controls with OPEN/CLOSE/AUTO selection and operate as follows:
- a. Local Manual Control:
    - i. OPEN and CLOSE allow local operation of the valve. AUTO enables SCADA to control the valve position.
    - ii. When in OPEN, the valve is commanded to the fully open position.
    - iii. When in CLOSE, the valve is commanded to the fully closed position.

- b. SCADA Manual Control:
  - i. When the local selector switch is in AUTO, SCADA Manual control is enabled.
  - ii. When in SCADA Manual, the valve operates as follows:
    - 1. The operator can manually open and close the valve via the SCADA HMI.
  - iii. During normal operation, the valves are in the Auto position and fully open.
- c. SCADA Auto Control:
  - i. None.

#### 4.5.5 Operation – Water Quality Analyzers

- A. Two separate analyzer panels at the Reservoir Pump Station monitor chlorine and pH levels in sample locations at the site. Source water samples are drawn from five locations using a system of solenoid valves controlled by the PLC.
  - a. Local Manual Control:
    - i. None.
  - b. SCADA Manual Control:
    - i. The operator can select between SCADA Manual and SCADA Auto control of the water quality analyzers at the SCADA HMI.
    - ii. When in SCADA Manual, the water quality analyzer panel operates as follows:
      - 1. A series of solenoid valves are controlled by the PLC to provide different source water samples to the analyzer panels.
      - 2. In SCADA Manual, the operator can manually select the location of the source water sample for Water Quality Analyzer 1 and Water Quality Analyzer 2 via the SCADA HMI. Only one sample source location can be sampled at a time per analyzer.
      - 3. Location of the sample sources include:
        - a. Water Quality Analyzer/Transmitter 1:
          - i. North Reservoir outlet
          - ii. South Reservoir outlet
          - iii. High Zone outlet (Booster pump station discharge pipe)
        - b. Water Quality Analyzer/Transmitter 2:
          - i. Reservoir inlet control valve 1
          - ii. Reservoir inlet control valve 2
      - 4. When a source location is sampled, its sample solenoid valve is energized open.
      - 5. During sample transitions, a sample time period of approximately 5 minutes (operator adjustable) is used to flush the sample line and sensor before measurement begins. During flushing, the sample source is opened and allowed to flow through the line. Measurements are not taken during this time.

6. The last read values for each source location are displayed on the SCADA HMI.
- c. SCADA Auto Control:
    - i. When SCADA Auto control is selected, the water quality analyzer panels operate as follows.
      1. A series of solenoid valves are controlled by the PLC to provide different source water samples to the analyzer panels. The source water samples are automatically rotated after an operator adjustable time (initially set at 3 minutes), for Water Quality Analyzer 1 and Water Quality Analyzer 2 based on the locations above. The operator can select the rotation order of the samples. When a source location is sampled, its sample solenoid valve is energized open.
      2. During sample transitions, a sample time period of approximately 5 minutes (operator adjustable) is used to flush the sample line and sensor before measurement begins. During flushing, the sample source is opened and allowed to flow through the line. Measurements are not taken during this time.
      3. The last read values for each source location are displayed on the SCADA HMI.

#### 4.5.6 Hardwired Interlocks

- A. The following are hardwired interlocks active in LOCAL or SCADA control:
  - a. VFD fault causes pump to stop or prohibit start until the alarm resets.

#### 4.5.7 Software Interlocks

- A. The following are PLC logic interlocks active in SCADA control:
  - a. Booster Pumping:
    - i. Low suction pressure alarm causes the pumps to shutdown or prohibit start until reset by the operator.
    - ii. High-high discharge pressure causes the pumps to shutdown or prohibit start until reset by the operator.
    - iii. Low flow (operator adjustable) as measured by the High Zone Flow Meter/Transmitter (WA\_RES\_BP\_FIT0140) causes the pump to shutdown or prohibit start until reset by the operator.
    - iv. In the event of a discharge pressure out-of-range alarm as measured by the High Zone Pressure Transmitter (WA\_RES\_BP\_PIT0130), the pumps maintain their current speed until the signal returns.
    - v. In the event of loss of network communication, the VFD maintains its current speed until communication returns.
    - vi. While on standby generator power, restrict pump operation to XX pumps.

- vii. If the High Zone PRV is in the AUTO position and operating in BYPASS mode:
  - 1. After an adjustable period of time, generate an alarm. This alarm is intended to alert operations if the PRV is left open for an extended period of time.
  - 2. The Reservoir Booster Pumps shall not be allowed to run.
- b. Reservoir Storage:
  - i. North Reservoir high-high level as measured by North Reservoir Level Transmitter (WA\_RES\_RS\_LIT1004) causes Reservoir Inlet Control Valves 1 and 2 (WA\_RES\_RS\_FCV1002/2002) to close until reset by the operator.
  - ii. South Reservoir high-high level as measured by South Reservoir Level Transmitter (WA\_RES\_RS\_LIT2004) causes Reservoir Inlet Control Valves 1 and 2 (WA\_RES\_RS\_FCV1002/2002) to close until reset by the operator.
  - iii. If an out-of-range alarm on the primary Reservoir level transmitter (WA\_RES\_RS\_LIT1004 or WA\_RES\_RS\_LIT2004) is active, the secondary Reservoir level transmitter (WA\_RES\_RS\_LIT2004 or WA\_RES\_RS\_LIT1004) becomes the primary until the alarm clears.

#### 4.5.8 Monitoring

A. The following statuses are continually monitored and displayed at the SCADA HMI:

- a. Hardwired:
  - i. Station Inlet Pressure Transmitter
    - 1. Pressure
  - ii. Reservoir Inlet 1 Flow Meter/Transmitter
    - 1. Flow
  - iii. Reservoir Inlet 2 Flow Meter/Transmitter
    - 1. Flow
  - iv. Reservoir Inlet Control Valve 1 Limit Switch
    - 1. Open
  - v. Reservoir Inlet Control Valve 2 Limit Switch
    - 1. Open
  - vi. North Reservoir Inlet Isolation Valve Limit Switch
    - 1. Closed
  - vii. North Reservoir Level Transmitter
    - 1. Level
  - viii. North Reservoir Outlet Isolation Valve Limit Switch
    - 1. Closed
  - ix. North Reservoir Outlet Flow Meter/Transmitter
    - 1. Flow

- x. South Reservoir Inlet Isolation Valve Limit Switch
  - 1. Closed
- xi. South Reservoir Level Transmitter
  - 1. Level
- xii. South Reservoir Outlet Isolation Valve Limit Switch
  - 1. Closed
- xiii. South Reservoir Outlet Flow Meter/Transmitter
  - 1. Flow
- xiv. High Zone Pressure Transmitter
  - 1. Pressure
- xv. High Zone Flow Meter/Transmitter
  - 1. Flow
- xvi. Water Quality Analyzer/Transmitter 1
  - 1. Chlorine residual
  - 2. pH
  - 3. Temperature
- xvii. Water Quality Analyzer/Transmitter 1
  - 1. Chlorine residual
  - 2. pH
- xviii. Reservoir Generator
  - 1. Day tank pump run
  - 2. Ready (Future)
  - 3. Fuel level (Future)
  - 4. Battery level (Future)
- xix. Reservoir ATS (Future)
  - 1. ATS in normal (Future)
  - 2. Utility power status (Future)
- xx. Reservoir Pump Station Rain Gauge Counter
  - 1. Pulse
- xxi. Refer to Section 3.5.2 for common monitoring functions:
  - 1. Common valve hardwired status points
- xxii. Refer to Section 3.7 for common monitoring functions:
  - 1. Common panel hardwired status points

- b. Software:
  - i. Refer to Section 3.7 for common monitoring functions:
    - 1. Communication interfaces
    - 2. Site PLC monitoring
- c. Network:
  - i. Refer to Section 3.10 for network data exchange requirements for monitoring and control parameters exchanged between the PLC/SCADA and the following equipment via Profinet:
    - 1. Variable Frequency Drives
      - a. Reservoir Booster Pumps 1 - 5

#### 4.5.9 Alarming

- A. In addition to the common alarms specified in Section 3.6.4, the following alarms are continually monitored and displayed at the SCADA HMI:
  - a. Hardwired:
    - i. North Reservoir Overflow Switch
      - 1. Overflow
    - ii. South Reservoir Overflow Switch
      - 1. Overflow
    - iii. Reservoir Pump Station Low Pressure Switch
      - 1. Low suction pressure
    - iv. Reservoir Pump Station Flood Switch
      - 1. Flood alarm
    - v. Reservoir Generator
      - 1. Run
      - 2. Fail
      - 3. Low fuel alarm
    - vi. Reservoir ATS (Future)
      - 1. ATS in generator (Future)
    - vii. Emergency well
      - 1. Low temperature
      - 2. High water
      - 3. Intrusion
      - 4. Smoke
    - viii. Seismic Switch
      - 1. Seismic alarm



- ix. Refer to Section 3.7 for common alarm functions:
  - 1. Common panel hardwired alarms
- b. Software:
  - i. Refer to Section 3.5.2 for common alarm functions:
    - 1. Common valve alarms
  - ii. Refer to 3.9.3 for 'Insufficient Pumps in Ready State' alarm.
    - 2. Require a minimum of 4 pumps to be in the Ready State, or generate an alarm.
  - ii. Refer to Section 3.7 for common alarm functions:
    - 1. Communication interface alarms
    - 2. Site PLC alarms
  - iii. Water Quality Analyzer 1
    - 1. North Reservoir Outlet high, high-high, low, low-low chlorine
    - 2. North Reservoir Outlet high, high-high, low, low-low pH
    - 3. South Reservoir Outlet high, high-high, low, low-low chlorine
    - 4. South Reservoir Outlet high, high-high, low, low-low pH
    - 5. High PZ high, high-high, low, low-low chlorine
    - 6. High PZ high, high-high, low, low-low pH
  - iv. Water Quality Analyzer 2
    - 1. Reservoir Inlet Control Valve 1 high, high-high, low, low-low chlorine
    - 2. Reservoir Inlet Control Valve 1 high, high-high, low, low-low pH
    - 3. Reservoir Inlet Control Valve 2 high, high-high, low, low-low chlorine
    - 4. Reservoir Inlet Control Valve 2 high, high-high, low, low-low pH
- c. Network:
  - i. Refer to Section 3.10 for network data exchange requirements for alarm parameters exchanged between the PLC/SCADA and the following equipment via Profinet:
    - 1. Variable Frequency Drive
      - a. Reservoir Booster Pumps 1 - 5

#### 4.5.10 Calculations

- A. In addition to the common calculations specified in Sections 3.1 and 3.2, the following calculations are performed and displayed at the SCADA HMI:
  - a. Reservoir Inlet 1 Flow Meter/Transmitter
    - i. Flow pulse totalization
  - b. Reservoir Inlet 2 Flow Meter/Transmitter
    - i. Flow pulse totalization

- c. North Reservoir Outlet Flow Meter/Transmitter
  - i. Flow pulse totalization
- d. South Reservoir Outlet Flow Meter/Transmitter
  - i. Flow pulse totalization
- e. High Zone Flow Meter/Transmitter (Total Flow to High Zone)
  - i. Flow pulse totalization
- f. Reservoir Pump Station Total Inlet Flow
  - i. Total flow from Reservoir Inlet 1 Flow Meter/Transmitter (WA\_RES\_RS\_FIT1001) and Reservoir Inlet 2 Flow Meter/Transmitter (WA\_RES\_RS\_FIT2001).
- g. Reservoir Pump Station Total Outlet Flow
  - i. Total from South Reservoir Outlet Flow Meter/Transmitter (WA\_RES\_RS\_FIT1007), North Reservoir Outlet Flow Meter/Transmitter (WA\_RES\_RS\_FIT2007), and High Zone Flow Meter/Transmitter (WA\_RES\_BP\_FIT0140).
- h. Total Flow to Gravity Zone
  - i. Total from South Reservoir Outlet Flow Meter/Transmitter (WA\_RES\_RS\_FIT1007) and North Reservoir Outlet Flow Meter/Transmitter (WA\_RES\_RS\_FIT2007).
- i. Reservoir Pump Station Rain Gauge Counter
  - i. Counter totalization
- j. Pump starts
  - i. Refer to Section 3.2.3 for equipment starts.
- k. Pump run times
  - i. Refer to equipment run times in Section 3.2.2.
- l. Generator run times
  - i. Refer to equipment run times in Section 3.2.2.

#### **4.5.11 Operation on Generator**

- A. Loss of Power
  - a. On a loss of power, the pumps that were running prior to the power failure are started in sequence (Lead, Lag1, etc.) with delays between starts to avoid a potential generator surge if all were started at the same time.
  - b. Equipment automatically restarts when power is returned. For multiple pumps, stagger pump starts.
  - c. The VFD should be configured such that loss of communication is not faulting on loss of power to prevent restart.

## Section 5

# Limitations

This document was prepared solely for City of Mercer Island in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Mercer Island and Brown and Caldwell dated April 4, 2019. This document is governed by the specific scope of work authorized by City of Mercer Island; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Mercer Island and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Further, Brown and Caldwell makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared.

All data, drawings, documents, or information contained this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of Brown and Caldwell unless otherwise provided by the Agreement pursuant to which these services were provided.

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## Section 6

# References

*2015 Water System Plan*, City of Mercer Island, 2015.

S&B, Inc., *Operation Description: First Hill Pump Station Control System*, City of Mercer Island, 2011.

S&B, Inc., *Remote Telemetry System Operation Description*, City of Mercer Island, 2013.

S&B, Inc., *Seattle Inlet (Boat Ramp Site) Operation Description*, City of Mercer Island, 2017.

*SCADA and Smart Utility Standards*, City of Mercer Island, 2019 (draft).

*Technical Memorandum 1: Chlorination System Optimization*, City of Mercer Island, January 2020 (draft).

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SECTION 40 63 43

PROGRAMMABLE LOGIC CONTROLLERS AND INTERFACE TERMINALS

**PART 1 GENERAL**

**1.01 DESCRIPTION**

A. Scope

1. This Section specifies requirements for programmable logic controllers (PLC) designed to execute discrete and continuous control logic with high reliability in industrial applications. This Section also specifies panel-mounted operator interface terminals (OIT) and industrial personal computers (PC) to serve as graphical user interfaces for local control, monitoring, alarming, and data logging.
2. Mount PLCs, OITs, and industrial PCs in existing control panel enclosures or new panel enclosures as specified. Enclosures and components not specific to the PLC platform are specified in Section 40 67 00.
3. Software licensing will be purchased by the Owner.

B. PLC Schedule

1. Provide each site with a PLC as indicated in the schedule below. Refer to Section 40 67 00A Panel Schedule and the Drawings for site OIT or industrial PC requirements. Refer to Section 40 67 00A Panel Schedule for site PLC processor and memory card requirements. Size PLC based on minimum I/O card requirements in Section 40 67 00A Panel Schedule and per Section 40 61 93A Input/Output List.

Site	Panel No.	PLC No.	Testing
First Hill Pump Station	WA_DST_FHL_CAB7000	WA_DST_FHL_PLC7001	40 61 21
SPU Station 171	WA_WS_SPU171_CAB7000	WA_WS_SPU171_PLC7001	40 61 21
South Fire Station	WA_DST_SFS_CAB7000	WA_DST_SFS_PLC7001	40 61 21
North Fire Station	WA_DST_NFS_CAB7000	WA_DST_NFS_PLC7001	40 61 21
Reservoir Pump Station	WA_RES_RS_CAB7000	WA_RES_RS_PLC7001	40 61 21

C. General Requirements

1. General requirements shall be as specified in Sections 40 61 13 and 40 67 00.

**1.02 QUALITY ASSURANCE**

A. References

1. This Section contains references to the following documents that are part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid or on the effective date of the Agreement if there were no Bids.

3. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
4. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
IEC 61131-3	Programmable Controllers – Part 3: Programming Languages
NEMA IA 2.2	Programmable Controllers – Equipment Requirements and Tests
NEMA IA 2.3	Programmable Controllers – Programming Languages

- B. This Section references other sections with associated work specified therein:
  1. Section 40 61 21 Process Control System Testing
  2. Section 40 61 93 Process Control System Input/Output List
  3. Section 40 67 00 Control System Equipment Panels and Racks

### 1.03 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Requirements: Section 40 61 13.
- C. Action Submittals:
  1. Submit under Section 40 67 00, including:
    - a. A copy of this Specification Section, with addendum updates included, and all referenced and applicable Sections, with addendum updates included, with each paragraph check-marked to indicate Specification compliance or marked to indicate requested deviations from Specification requirements. A check mark shall denote full compliance with a paragraph as a whole.
    - b. If deviations from the Specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
    - c. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications.
    - d. *Failure to include a copy of the marked-up Specification Sections, along with justification(s) for any requested deviations to the Specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*
  2. Submittal requirements per Section 40 67 00 for the equipment specified herein.
  3. PLC Input/Output (I/O) interconnection diagram drawings.
  4. Internal power distribution schematic diagram drawings.
  5. PLC power supply loading calculations.
  6. List of spare parts to be provided.



D. Closeout Submittals:

1. Submit under Section 40 61 21 and per the requirements of this Section.
  - a. Operating and maintenance information shall be provided in accordance with Section 01 78 23. Include the following for the PLC system:
    - 1) Manufacturer, Representative, and Supplier contact information.
    - 2) Manufacturer instruction manuals shall include only the following as applicable to the PLC system:
      - a) Safety Precautions.
      - b) Environmental Conditions.
      - c) Troubleshooting guides and diagnostic techniques.
      - d) Component connection diagrams.
      - e) Removal and replacement instructions.
    - 3) Warranty information.
    - 4) Final reviewed submittal.
    - 5) As-built drawings with record of switch and jumper settings for all components.
    - 6) List of spare parts provided.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

A. Manufacturer

1. The PLC manufacturer and model shall be Siemens ET200SP family of PLC controllers.
2. Manufacturers and models shall be as specified for the purpose of compatible and efficient utilization of existing equipment, supplies, and personnel training and experience; no substitutions are permitted.
3. Where there is conflict in the part numbers between the drawings and this Section, this Section shall prevail.

B. Materials

1. Equipment and/or products shall be new and unused at the time of system assembly.

### **2.02 PROGRAMMABLE LOGIC CONTROLLER**

A. Manufacturer:

1. Siemens.

B. Processor:

1. Siemens 1510SP-1 PN.
  - a. Part number: 6ES7510-1DJ01-0AB0.
2. Siemens 1512SP-1 PN.
  - a. Part number: 6ES7512-1DK01-0AB0.

3. Accessories:
  - a. SD Memory card
    - 1) 4MB storage. Part number: 6ES7954-8LC03-0AA0.
    - 2) 12MB storage. Part number: 6ES7954-8LE03-0AA0.
  - b. Bus Adapter – 2 RJ 45 ports. Part number: 6ES7193-6AR00-0AA0.
  
- C. Networking Connections: Provide all communication interfaces, network cables, taps, terminators, power supplies, and accessories for a complete operating network.
  1. DNP3 Module.
    - a. Part number: 6GK7542-6VX00-0XE0.
  2. Profibus DP Module.
    - a. Part number: 6ES7545-5DA00-0AB0.
    - b. Accessories:
      - 1) Bus Adapter. Part Number: 6ES7972-0BB70-0XA0.
  
- D. Input and Output Modules:
  1. Digital Inputs:
    - a. Part number: 6ES7131-6BH01-0BA0.
  2. Digital Outputs:
    - a. Part number: 6ES7132-6BH01-0BA0.
  3. Analog Inputs:
    - a. Part number: 6ES7134-6GD01-0BA1.
  4. Analog Outputs:
    - a. Part number: 6ES7135-6HD00-0BA1.
  5. Accessories:
    - a. Separated Base Unit. Part number: 6ES7193-6BP00-0DA0.
    - b. Jumpered Base Unit. Part number: 6ES7193-6BP00-0BA0.
  6. Spare Input/Outputs (Installed):
    - a. Refer to Section 40 67 00A Panel Schedule for minimum I/O card requirements by site.
  
- E. Miscellaneous:
  1. Provide all cables, taps, terminators, power supplies, and accessories for a complete operating PLC system.

## **2.03 OPERATOR INTERFACE TERMINAL**

- A. Manufacturer:
  1. Siemens.
  
- B. Operator Interface Terminal:
  1. 12" Comfort Panel. SIMATIC HMI TP1200 Comfort.
    - a. Part number: 6AV2124-0MC01-0AX0.
  2. 7" Comfort Panel. SIMATIC HMI TP700 Comfort.
    - a. Part number: 6AV2124-0GC01-0AX0.

3. Accessories:
  - a. SD Memory card – 2GB storage. Part number: 6AV2181-8XP00-0AX0.

## **2.04 INDUSTRIAL PC**

- A. Manufacturer:
  1. Siemens.
- B. Industrial PC:
  1. 12" SIMATIC IPC277E Panel PC.
    - a. Part number: 6AV7882-0HB20-8EA0.

## **2.05 SPARE PARTS**

- A. The following spare parts shall be provided:
  1. One of each unique processor card.
  2. One of each unique communication card.
  3. One for each ten, minimum of one for each unique I/O card.
  4. Three of each unique terminal base unit.

## **2.06 CONTROL PANEL FABRICATION**

- A. Refer to Section 40 67 00.
- B. Detail shop drawings showing field connections and any terminal block jumpering required.
- C. Terminate all used and spare I/O wiring to terminal blocks.
- D. Refer to Section 40 67 00 for wire numbers.
- E. Refer to input/output card drawings for terminal connections.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Refer to Section 40 67 00. PLC to be DIN rail mounted inside control panels as specified in Section 40 67 00 and on the Drawings.
- B. Connect input and output devices to the PLC via control panel terminal blocks, not directly to the PLC.

### **3.02 FIELD INSPECTION AND TESTING**

- A. Refer to Section 40 67 00.

- B. Systems Integrator: The supplier of each PLC system shall provide a qualified service representative to perform the following:
  - 1. Inspect the PLC, OIT and industrial PC installation including I/O and network systems, hardware configuration switch and jumper settings.
  - 2. Monitor all PLC system diagnostic indicators, both hardware and software, and certify that the PLC, OIT, and industrial PC system performance meets or exceeds the Manufacturer's published specifications.
  - 3. Assist in all testing. The Systems Integrator's time on site shall be based on Section 01 32 16 - Construction Progress Schedule.
  - 4. Coordinate with Project Programmer for modification to PLC programs as required.
  - 5. Certify in writing to the Engineer that the PLC system has been installed and configured in accordance with the Manufacturer's published guidelines.
- C. Contractor
  - 1. Fault or trouble conditions shall be investigated and resolved by the Contractor to the satisfaction of the PLC supplier.

### **3.03 TRAINING**

- A. Training shall conform to the requirements of Section 01 79 00.
- B. In addition to Section 40 61 13 requirements, training shall be provided to the Owner's personnel on the product components/hardware and include:
  - 1. Power-up and power down of hardware.
  - 2. Description of status and trouble indication lights.
  - 3. Definition and identification of fault and trouble codes.
  - 4. Installation, removal and replacement of components/hardware parts.
  - 5. Ensure component is properly networked and the network is active.

**END OF SECTION**

SECTION 40 67 00  
CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

**PART 1 GENERAL**

**1.01 DESCRIPTION**

A. Scope:

1. This section specifies requirements for process control system (PCS) control panels.
2. This section specifies requirements for power supply and conditioning equipment required to support the instrumentation and communication systems specified.
3. Provide the instrument, control, and monitoring features indicated on the drawings. Panels shall be arranged to separate control and instrument devices from power wiring. Panel shall be arranged for dedicated field wiring terminations rated for 600 Vac or less for power, control, and instrument signal wiring, in accordance with NEC Article 409.
4. Panels shall be fabricated by a UL-508A recognized facility and shall bear the appropriate UL 508A Industrial Control Panel label. Panels shall be labeled in accordance with Article 409 of the National Electrical Code.
5. Panels that contain programmable logic controllers (PLC) and operator interface terminal (OIT) units shall be as indicated in the Panel Schedule. Programmable controllers and OITs shall comply with Section 40 63 43. The Panel Schedule is located at the end of this section as Attachment A.
6. Specific panel devices are specified herein and in Section 26 05 00.
7. Field modifications require a UL inspector site inspection for approval of panel corrections and to re-label the panel after the field modifications are completed.
8. Contractor custom panels are specified herein and shown on the drawings.
9. Seismic anchoring and bracing: Sections 40 61 13.

B. Panel Design:

1. General:
  - a. Additional panel hardware is specified in other Sections within Division 40.
2. Control Power Distribution:
  - a. Panel containing 120-volt powered equipment shall use the din-rail power distribution method with fuses and blown fuse indication. Power is restricted to 120 Vac and 24 Vdc as shown on the Drawings.
3. Power Supplies:
  - a. Panel containing direct current powered instruments or serving as the termination point for transmission loop powered field instruments shall contain direct current power supply system as specified herein.
4. Electrical Control Devices:
  - a. Pushbuttons, indicating lights, selector switches, and similar equipment located in panels specified in this section shall comply with the requirements of Section 26 05 00.
5. Uninterruptible Power Supplies:
  - a. Panel mounted 120 Vac input/120 Vac output and 24 Vdc input/24 Vdc output uninterruptible power supplies are specified herein.

C. Panel Schedule:

1. The Panel Schedule, located in Attachment A at the end of this section, lists Contractor custom panels required for the project along with specific requirements for each panel. Specific custom panel requirements are specified on the panel layout referenced in the Panel Schedule.
2. Refer to paragraph 3.08 for description of headings.

**1.02 QUALITY ASSURANCE**

A. References:

1. This section contains references to the following documents that are part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid or on the effective date of the Agreement if there were no Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.
3. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
EIA RS-310C	Racks, Panels, and Associated Equipment
NEMA 250	Enclosures for Electrical Equipment
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508A	Industrial Control Panels
NFPA 79	Electrical Standard for Industrial Machinery
NFPA 70	National Electrical Code (NEC)
NEMA ICS 6	Industrial Control and Systems: Enclosures
ANSI/UL 497-1995	Standard for Protectors for Paired Conductor Communications Circuits
UL 1012	Power Supplies
UL 1449	UL Standard for Safety for Surge Protective Devices

4. This Section references other sections with associated work specified therein:
  - a. Section 26 05 00 specifies raceways, conductors, and device requirements.
  - b. Section 40 61 21 Process Control System Testing
  - c. Section 40 63 43 Programmable Logic Controllers

B. Listed Products:

1. Equipment and components shall be Underwriters Laboratory (UL) listed for the purpose or UL recognized.

2. The control panels, including new back panels, shall be fabricated by a UL 508A recognized facility and shall bear the appropriate UL 508A Industrial Control Panel label.
  3. All panels shall be labeled in accordance with NEC Article 409.
  4. Panels that do not comply with the specified products shall not be accepted. Cost to retrofit the panel as specified shall be borne by the panel supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier's facility for corrections, testing, relabeling and inspection.
- C. Factory Testing:
1. Prior to shipment, the manufacturer shall test the functional operation of the control panel as described in the control description Section 40 61 21.
- D. Shipment, Protection and Storage:
1. Equipment shipment, protection and storage shall conform to the requirements specified in Section 01 66 00.

### 1.03 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Requirements: Section 40 61 13.
- C. Action Submittals:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.
    - a. A check mark shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
    - b. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
    - c. *Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.*
  2. A marked copy of Section 40 61 13.
  3. A marked copy of Section 40 61 21.
  4. A marked copy of Section 40 61 93.
  5. A marked copy of Section 26 05 00.

6. A copy of the contract documents relating to the submitted equipment, with addendum updates that apply to the equipment in this section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.
7. Marked product literature of all the enclosure electrical devices and components mounted on or within the control panel.
8. List of miscellaneous items, cables, spare and replenishment parts, and chemicals to be provided, including Safety Data Sheet (SDS) information.
9. Dimensioned drawings:
  - a. Exterior panel and layout
  - b. Interior devices and layout
  - c. Door-in-door construction devices, where required
10. Panel assembly drawings including sections showing clearances between face and rear mounted equipment.
11. Nameplate engraving schedule:
  - a. Indicate engraving by line
  - b. Character size
  - c. Nameplate size
  - d. Panel and equipment tag number and description
12. Heat load calculations demonstrating cooling requirements for each cabinet based on device-rated temperatures (minimum and maximum), highest ambient temperature listed in Section 40 61 13, and humidity for the area in which the subject panel will be located.
13. Power supply sizing calculations demonstrating that selected power supply is sufficient to supply total connected loads plus an additional 20 percent for future expansion.
14. UPS and UPS battery sizing calculations demonstrating the UPS is sufficient to supply total connected loads plus an additional 50 percent for future expansion and can meet battery backup time requirements.
15. Wiring drawings:
  - a. Schematic diagrams
  - b. Internal wiring diagrams
  - c. Connection diagrams
  - d. Panel power distribution drawings
  - e. Power and control single line diagrams to comply with NEC Article 409.
  - f. Interconnection diagrams
16. Network block diagrams
17. Section 40 61 93 I/O List, updated to reflect any necessary modifications during construction.



- D. Informational Submittals:
1. The following data shall be provided in accordance with Section 01 33 00:
    - a. Manufacturer's certification for the performance of features of the specified equipment that cannot be readily inspected.
    - b. Special requirements for delivery of the information such as time, manner, place, or quantity.
    - c. Installation and training forms specified in Part 3.
- E. Closeout Submittal:
1. Manufacturer's operation and maintenance information as specified in Section 01 78 23. Manual shall include final reviewed submittal and separate record of all final configuration, jumper, and switch settings.
  2. As-built record drawings incorporating all modifications to the originally submitted panel drawings; as-built record drawings must be provided in both AutoCAD and Portable Document Format (PDF) format.
  3. Test results as specified in Section 40 61 21.
  4. List of spare parts provided.

#### **1.04 ENVIRONMENTAL CONDITIONS**

- A. Refer to Section 40 61 13.

### **PART 2 PRODUCTS**

#### **2.01 FABRICATION**

- A. General:
1. Brace equipment and panel supports shall be designed per installation detail drawings. Equipment panels shall be capable of operation following a disturbance.
  2. Nameplates with tag number and equipment description shall identify face-mounted instruments. Instruments shall be mounted for access to components and ease of removal. Cutouts for future equipment shall be blanked off with suitable covers. Instrument tag numbers shall be identified on the panel rear.
  3. Face-mounted equipment shall be flush or semi-flush with flat-black escutcheons. Face-mounted instruments that are more than 6 inches deep, weigh more than 10 pounds, or exert more than a 4 ft-lb moment force on the face of the panel shall be supported underneath at the rear by a 1-inch x 1/8-inch thick steel angle.
  4. Panels less than 60 inches high shall be provided with floor stands to raise the top of the panel to 60 inches above the floor or work platform. Panels that weigh less than 100 pounds may be wall mounted.
  5. Panels with specified requirements including stainless steel or aluminum mounting requirements that are indicated on the project drawings or on the project details take precedence over the panel types or panel features indicated herein.
  6. Provide short-circuit current rating as required to meet NEC 409.110 (4) marking, or identify panel for exception to NEC 409.110 (4) during submittal process.

- B. Panel Layout:
  - 1. Provide 20 percent spare contiguous sub-panel area for future expansion.
  - 2. Provide minimum of 20 percent spare terminal blocks, with a minimum of 10 analog, discrete, power.
  - 3. Provide minimum of 12 inches clear space from the bottom of the panel to the bottom of the subpanel, or as shown on the drawings.
  - 4. Face-mounted equipment flush or semi-flush with flat-black escutcheons.
  - 5. Panel tops of wall-mounted panels: mounted at the same elevation.
  - 6. Panel inner door contains a copy of the record elementary and wiring diagrams, or reference as allowed per NEC Article 409.
  - 7. Panel inner door contains a drawing holder.
  - 8. Panel drawings enclosed in a transparent, protective jacket.
  - 9. Panel functions as specified.
  - 10. Panels with floor stands, to raise the top of the panel to 60 inches above the floor or work platform.
  - 11. Wall mounting of panel weighs less than 100 pounds, where wall space is available,
- C. Enclosures:
  - 1. Panel enclosures shall comply with the requirements of NEC Article 409 and NEMA 250.
  - 2. Manufacturer:
    - a. Hoffmann Enclosures, Inc.
    - b. Rittal.
    - c. Or equal.
- D. Back Panels:
  - 1. Manufacturer:
    - a. Hoffmann Enclosures, Inc.
    - b. Rittal.
    - c. Or equal.
- E. Side Panels:
  - 1. Manufacturer:
    - a. Hoffmann Enclosures, Inc.
    - b. Rittal.
    - c. Or equal.

## **2.02 ENVIRONMENTAL CONTROL**

- A. Forced air ventilation shall be provided for panels where indicated on the Drawings or if the cabinet's heat load calculations indicate that the interior temperature of the cabinet will exceed 115 degrees F, under worst case conditions.

- B. Ventilation for control panels shall be venturi fans provided on 5-1/2-inch high-notched panel. Ventilation for consoles shall be similar to that for panels except EIA RS-310 mounting is not required. Fans shall be equipped with UL-approved, NEMA 12 rated, replaceable filters. Fans shall provide at least 240 cubic feet per minute (CFM), or sized per submitted heat load calculations. Fans shall be thermostatically controlled. Noise level at 3 feet from exterior wall and 30 degrees off axis shall not exceed 60 NC units.
- C. Where specified, panels shall also be provided with thermostatically controlled space heaters. Space heater surface temperature that exceeds 120 degrees F requires an expanded metal guard. Thermostats shall be Honeywell T631 series, Penn Controls A28AA-4, or equal.
- D. Panel air conditioning cooling requirements shall be a cooling system that does not exchange cabinet interior air with ambient air. The cooling system shall be either a closed glycol loop heat exchange system or a CFC-free refrigeration system as required for the specified equipment and instrument complement and ambient temperature conditions.
- E. Panel air conditioner shall be NEMA rated based on the installed area environment and the coils shall be Heresite, or equal coated and protected from corrosion and premature failure.

### **2.03 PROTECTION COATING AND FINISH**

- A. Panels located outdoors or located in corrosive areas shall be bottom coated with waterproof coatings.

### **2.04 NAMEPLATES**

- A. External door-mounted components and the panel description shall be identified with plastic nameplates. Machine embossed metallic adhesive labels shall identify tag number of instruments inside panels. Nameplates shall be attached to panel surfaces, not to instruments.
- B. The machine engraved laminated black phenolic nameplates with white lettering shall be provided for panel-mounted equipment. Nameplate engraving shall include the instrument tag number and description in 3/32-inch minimum size lettering.
- C. The machine embossed metallic adhesive labels shall identify tag number of instruments inside panels. Nameplates shall be attached to panel surfaces, not to instruments.
- D. The nameplates shall be attached to the panel with a minimum of two self-tapping 316 stainless steel screws. Provide RTV sealant for nameplates for NEMA-4X stainless steel panels.
- E. The nameplate wording may be changed without additional cost or time prior to commencement of engraving. Submit nameplate legend with the panel submittal.

## 2.05 PANEL FEATURES

- A. Interconnection Wiring: Panel Interconnecting Wiring:
1. Panel control wiring: Single conductor stranded copper NEC rated Type MTW No. 16 AWG minimum (rated 10 A per NFPA 79, Table 12.5.1), with an exception for factory supplied PLC wiring harnesses that are UL approved.
  2. Panel instrument wiring: Twisted No. 16 AWG shielded pair or tri conductors.
  3. Panel power wiring: Conductors specified in Division 26 and meet the NEC requirements for power including phase, grounded, and grounding conductors.
  4. Wiring shall be supported independently of terminations by lacing to panel support structure or by slotted flame retardant plastic wiring channels.
  5. Wiring channels shall comply with UL 94, Type V.
  6. Plastic wireway with covers shall be used to route groups of wires. Wireway fill shall be sized to provide 50% maximum fill.
  7. Plastic spiral wrap shall be used for exposed wires. Wires that cross door hinges shall be enclosed in plastic spiral wrap.
- B. Conductor Identification:
1. Wiring shall be tagged at every termination with machine printed plastic sleeves or pre-printed self-sticking labels as manufactured by W.H. Brady, 3M, or approved equal. No hand-written labels are permitted.
  2. Three-part wire numbers for instrument and control panel internal conductors:
    - a. Part-1: Prefix of the wire number shall be the instrument loop number or equipment tag number.
    - b. Part-2: Code letter and wire colors per the following tables.
    - c. Part-3: Number that identifies individual circuit conductor Terminal Number.

Code	120 Vac Conductor	Color
L	Power	Black
C	Control	Red
N	Neutral	White
PG	Ground	Green

Code	V dc Conductor	Color
PS	24 Vdc Power	Blue
CS	24 Vdc Control	Light blue
COM	24 Vdc Common (0 Vdc)	White w/ blue
S+	Signal (+)	Black
SG	Signal Ground	White
EG	Equipment Ground	Green
FV	Panel Foreign Voltage	Yellow

- C. Conductor Installation and Protection:
1. Power and control wiring shall be carried in covered channels separate from low voltage signal circuits. An interior steel barrier shall be provided between AC control devices and the electronic equipment.

2. Terminal blocks shall be strap screw type rated for 300 or 600 volts. Each terminal strip shall have a unique identifying alphanumeric code at one end and a vinyl-marking strip running the entire length of the terminal strip with a unique number for each terminal. Numbers shall be machine printed and 1/8 inch high.
3. No more than two connections shall be made to one terminal. In the case of two connections, a twin-wire insulated ferrule shall be used.
4. Wire connectors shall be insulated ferrule crimp type terminals. Systems Integrator shall prepare wires and wire labels for interconnections between field and control panels.
5. Terminal blocks shall be DIN rail mounted, screw type, rated for 600 volts or 300 volts, and have a width between 6 and 7 mm. Knife disconnect terminal blocks shall be provided for electrical circuit isolation where foreign voltage enters control panel. Fuse terminal blocks shall be tip-out or draw-out type with LED blown fuse indicators and shall be provided with fuse sized per circuit requirements. Terminal blocks candidate manufacturers:
  - a. Phoenix Contact UT 4 series (current rating as required).
  - b. Or equal.

D. Field Wiring:

1. Field wiring shall be connected to separate dedicated terminal blocks or terminal-style relays in a dedicated part of the panel where the field cables enter the panel. Provide a dedicated raceway on the field side of the terminal block for field wiring use only.

E. Fuse and Fuse Holders:

1. Fuses for 120 Vac circuits shall have a minimum of 12,000-amperes interrupting capacity and blown fuse indicators.
2. Fuses for 24 Vdc circuits shall be fast acting glass tube type rated 1/8 or 1/10 amp for 4-20 mA loops.
3. Fuses for 24 Vdc circuits shall be 1/2 amp for the power supply to individual instruments.
4. Fuse holders shall be tip-out or draw-out type with blown fuse indication.
5. Provide Phoenix Contact or equal products.

F. Circuit Breakers:

1. Provide circuit breaker for branch circuit protection. Circuit breaker UL rated, 10kA interrupting capacity, DIN rail mounted, and trip current rating to be determined based on the circuit load by Contractor.
2. Allen Bradley 1489 series, or equal.

G. Control Power:

1. 120 Vac control power source: Single power source for all control and DC power.
  - a. Provide direct current power supplies, as required for the load.
  - b. Provide UPS power, 120 Vac or 24 Vdc, as indicated on the drawings.

H. Panel Power:

1. Provide a 120 Vac circuit for the panel light, receptacle, heating, fan, or heat exchanger as required.
2. Receptacle shall comply with Section 26 05 00.

I. Accessories:

1. Panels greater than 30" high x 30" wide shall include GFCI convenience receptacles and LED utility lights with separate on/off switch, or as indicated on the drawings.
2. Receptacles and utility lights shall not be powered by the UPS, where included.
3. Print pocket.
4. Panels greater than 30" high x 30" wide shall include a fold-up shelf of sufficient size, sufficient weight capacity, and the proper angle for supporting a laptop computer mounted to the inside of the enclosure.

J. Corrosion Inhibitors:

1. All control panels shall be provided with vapor-emitting corrosion inhibitors to protect the control panel electrical components against corrosion. Corrosion inhibitors shall provide a minimum of 24 months of protection before replacement is required. Each inhibitor shall provide protection for a minimum of 11 cubic feet of panel volume. Manufacturer/model: Cortec Corporation VpCI-111 or approved equal.

K. Fail-Safe Wiring:

1. Fail-safe wiring of control relay or other on/off device or instrument provides the condition that will occur upon loss-of-power or internal failure in the device such that the relay is de-energized in the failure or loss-of-power condition such that the control relay contact operation provides for equipment failing in a safe mode.

## 2.06 CONTROL DEVICES

A. Pushbuttons and selector switches shall comply with Section 26 05 00.

B. Control Relays:

1. Provide:
  - a. DIN rail-mounted, terminal block style.
  - b. Coil rating: 24 VDC/VAC or 120 VAC/VDC, as required by application.
  - c. Contact rating (120 VAC): 30 A (break) and 3 A (make).
  - d. Contact rating (24 VDC): 1 A (break/make).
  - e. Contact type: gold-plated SPDT or DPDT, as required by application.
  - f. Built-in reverse DC polarity protection and surge protection.
  - g. LED indicator light to show when coil is energized.
  - h. Rated for Class I, Division 2 hazardous locations, as required by application.
2. Manufacturer/model: Allen-Bradley 700-HL Series or equal.

## 2.07 INDICATING LIGHTS

A. Indicating lights shall be equipped with colored lenses as specified in Section 26 05 00.

## 2.08 POWER SUPPLY AND CONDITIONING EQUIPMENT

- A. Except for power supply units which form an integral part of an individual piece of equipment, all power supply and conditioning equipment shall comply with UL 1012 and shall be approved by UL, CSA, or FM for the application.
- B. Power supply equipment shall be provided in redundant configurations, where shown on the drawings, such that failure of a single unit will not disable all or any part of the instrumentation and communication systems.
- C. Direct-Current Power Supplies:
  - 1. Nominal 24-volt direct-current instrumentation and control power supply:
    - a. DIN rail-mounted with integral input fuse.
    - b. Capable of withstanding six times nominal current for 12 milliseconds (ms) to allow for coordination with downstream circuit protection devices.
    - c. Nominal input voltage range: 100 to 240 Vac.
    - d. Input voltage range: 85 to 264 Vac.
    - e. Frequency range: 45 to 63 Hz.
    - f. Mains buffering:  $\geq 20$  ms.
    - g. Nominal output voltage: 24 Vdc  $\pm$  3 percent.
    - h. Output voltage setting range: 22.8 to 28 Vdc.
    - i. Nominal output current: per 24 Vdc power supply sizing calculations.
    - j. Output ripple voltage: < 150 millivolts (mV) peak-to-peak.
    - k. Load regulation (dynamic, 10 to 90 percent): < 2 percent.
    - l. DC OK indication: visual LED indication and SPST contact rated for at least 0.3 A at 60 Vdc.
    - m. Operating temperature: -13 to 158 degrees F.
    - n. Maximum operating temperature before derating: 140 degrees F.
    - o. Relative humidity range: 5 to 95 percent.
    - p. MTBF:  $\geq 520,000$  hours.
    - q. FM Approved or UL Listed for Class I, Division 2 hazardous locations, as required.
    - r. The panel supplier shall calculate the required VA rating at 120 percent of connected load. Submit load calculations, schematic diagrams, and wiring connection diagrams.
    - s. Manufacturer:
      - 1) Siemens SITOP PSU100S.
      - 2) Or equal.
- D. Uninterruptible Power System (UPS) – 120 Vac:
  - 1. Provide on-line, industrial-grade, double conversion type UPS, with electrical isolation including output neutral:
    - a. Nominal input voltage: 120 Vac.
    - b. Nominal output voltage: 120 Vac.

2. The online UPS system shall be provided with integral sealed no maintenance, hot-swappable batteries, with extended battery modules as required to provide full capacity backup power for 40 minute minimum at connected load with integral battery charger.
  3. The panel supplier shall calculate the required kVA rating at 150 percent of connected load. Submit load calculations, schematic diagrams, and wiring connection diagrams. Provide battery cabling and other required cabling for a complete system.
  4. The UPS shall be mounted within the panel on a pedestal or tray with stainless-steel legs to provide space for wire entry and passage. UPS and battery system shall be physically secured to panel while still allowing access for maintenance and removal.
  5. The UPS shall be configured with a plug and receptacle to allow ease of removal from the panel; and to allow the panel to operate on utility power.
  6. Provide relay output contacts for remote monitoring of UPS on battery, UPS alarm, and UPS low battery. Provide visual LED indication and SPST contact rated for at least 0.1 A at 30 Vdc.
  7. Manufacturer:
    - a. Eaton 9SX series.
    - b. Or equal.
- E. Uninterruptible Power System (UPS) – 24 Vdc
1. Provide industrial-grade UPS with electrical isolation. UPS shall consist of direct current power supply, charge controller, and sealed backup battery pack:
    - a. Nominal input voltage: 24 Vdc
    - b. Nominal output voltage: 24 Vdc
  2. Provide rechargeable battery backup system with sealed no maintenance batteries.
  3. DIN rail mount UPS and battery.
  4. Provide relay output contacts for remote monitoring of UPS on battery, UPS alarm, and UPS low battery. Provide visual LED indication and SPST contact rated for at least 0.1 A at 30 Vdc.
  5. Size UPS system for 45 minutes of backup time on batteries at 100% load + 50% of load for future growth. Submit load calculations, schematic diagrams, and wiring connection diagrams.
  6. Manufacturer:
    - a. Siemens SITOP UPS1600 with UPS1100 battery module.
    - b. Or equal.

## 2.09 SURGE PROTECTION

- A. General:
1. Surge protection shall be provided to protect the electronic instrumentation systems from surges propagating along the signal and power supply lines. The protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, be maintenance free, and self-restoring.



2. Provide lightning and surge protection devices at all antennas, as well as signal lines, communication networks, and power feeds for all lines that originate or are routed outside a building on any part of the existing or proposed circuits.
  3. Lightning and surge protection devices shall provide full protection from line to line and from line to ground. Units shall be DIN-rail mounted, rated for a minimum of 10kA maximum surge current and voltage suitable for the type of circuit being protected. Reaction time shall be on the order of nanoseconds.
- B. Panel Power Supply:
1. Requirements for incoming panel power supply surge protection devices are as follows:
    - a. DIN rail-mounted, one-pole, Type 2, plug-in type selected to protect the equipment.
    - b. Removable without changing the impedance of the circuit.
    - c. Nominal voltage: 120 Vac, single-phase.
    - d. Maximum operating voltage: 150 Vac.
    - e. Nominal discharge current: 15 kA.
    - f. Surge current capacity: 40 kA.
    - g. Voltage protection level (line-neutral):  $\leq 700$  V.
    - h. Response time:  $\leq 25$  ns.
    - i. Surge protection fault indication: visual indication and SPDT contact rated for at least 0.5 A at 120 Vac and 30 Vdc.
    - j. Operating temperature: -40 to 176 degrees F.
  2. Manufacturer/model: Bussmann BSPM1A series or equal.
- C. Power and Control Circuits (120 Vac):
1. Requirements for SPDs on 120 Vac power and control circuits are as follows:
    - a. DIN rail-mounted, two-pole, Type 4, plug-in type selected to protect the equipment.
    - b. Removable without changing the impedance of the circuit.
    - c. Nominal voltage: 120 Vac, single-phase.
    - d. Maximum operating voltage: 150 Vac.
    - e. Nominal load current: 25 A.
    - f. Nominal discharge current: 2 kA.
    - g. Total discharge current: 4 kA.
    - h. Voltage protection level (line-neutral):  $\leq 640$  V.
    - i. Response time:  $\leq 25$  ns.
    - j. Surge protection fault indication: visual indication.
    - k. Operating temperature: -40 to 176 degrees F.
  2. Manufacturer/model: Bussman BSPH2A series or equal.
- D. Power and Control Circuits (24 Vdc):
1. Requirements for SPDs on 24 Vdc power and control circuits are as follows:
    - a. DIN rail-mounted, two-pole, Type 4, plug-in type selected to protect the equipment.

- b. Removable without changing the impedance of the circuit.
  - c. Nominal voltage: 24 Vdc.
  - d. Maximum operating voltage: 30 Vdc.
  - e. Nominal load current (AC): 25 A.
  - f. Nominal discharge current: 1 kA.
  - g. Total discharge current: 2 kA.
  - h. Voltage protection level (line-neutral):  $\leq 180$  V.
  - i. Response time:  $\leq 25$  ns.
  - j. Surge protection fault indication: visual indication.
  - k. Operating temperature: -40 to 176 degrees F.
2. Manufacturer/model: Bussman BSPH2A series or equal.
- E. Signal Circuits (4-20 mA):
- 1. Requirements for SPDs on 4–20 mA signal circuits are as follows:
    - a. DIN rail-mounted, four-pole, plug-in type selected to protect the equipment.
    - b. Removable without signal interruption.
    - c. Nominal voltage: 24 Vdc.
    - d. Maximum operating voltage: 33 Vdc.
    - e. Nominal current: 0.75 A.
    - f. Total lightning impulse current: 10 kA.
    - g. Total nominal discharge current: 20 kA.
    - h. Series impedance per line: 1.8 ohms or less.
    - i. Operating temperature: -40 to 176 degrees F.
  - 2. Manufacturer/model: Bussman BSPD24DING or equal.

## 2.10 INTRINSIC SAFETY ISOLATORS (NOT USED)

- A. Single-channel, galvanically isolated intrinsic safety isolators for all non-fieldbus networked discrete and analog signals to instruments, not rated as explosion-proof, located in classified areas. The intrinsically safe isolators shall be:
- 1. DIN rail mounted.
  - 2. EMI/RFI compliant with IEC 801.1-5.
  - 3. Support 24 Vdc or 120 Vac signals, depending on application.
  - 4. FM Approved or UL Listed for application.
- B. Manufacturer: Phoenix Contact or equal.

## 2.11 SIGNAL CURRENT ISOLATORS/CONVERTERS

- A. Provide isolators/converters where:
- 1. Galvanic isolation of milliampere transmission signals from 2-wire, 3-wire, or 4-wire transmitters with inadequately isolated output circuits is required.
  - 2. Conversion from active to passive current signals is required.
  - 3. Conversion from RTD signals (or voltage-based signals) to 4-20 mA signals is required.

- B. The operating power shall be 24 Vdc and the device shall be DIN rail mounted. Provide DIP switch set up to allow for easy configuration of the converters.
- C. Input signals shall be 4 to 20 mA, unless otherwise specified. Output signals shall be 4 to 20 mA and error shall not exceed 0.1 percent of span. Input resistance shall not exceed 550 ohms with an output load of 250 ohms. The output signal shall be active or passive as specified.
- D. Manufacturer: Phoenix Contact MINI, or equal.

## **2.12 PANEL GROUNDING**

- A. Each panel shall be provided with two copper ground bars.
  - 1. One bar (NEC required) shall be bonded to the panel or panel frame or back-plate and to the facility grounding system.
  - 2. Second (signal) ground bar shall be mounted on insulated stand-offs and shall be bonded to the panel ground bar only at one point.
- B. Signal circuits, signal cable shields, and low-voltage DC power supply commons shall be bonded to the signal ground bar.
- C. Field analog wiring shields shall only be grounded at the signal ground bar. Test to verify that single ground point at panel signal ground bar.
- D. Surge protectors and separately derived AC power supplies shall be bonded to the frame ground bar.
- E. Panels exceeding 36-inches width shall contain ground bars shall be 1/4- by 1-inch copper bars extending the entire length of the panel interior at the bottom of the panel.

## **2.13 NETWORK SWITCHES**

- A. Managed Ethernet Switch:
  - 1. Power: 24 VDC.
  - 2. Ports: Eight (8) or Sixteen (16), as shown on the drawings, 10/100 Mbps ports, RJ45 sockets with ESD and Surge Protection on all Built-In ports.
  - 3. Configurable alarm contact; SPST contact rated for at least 0.1 A at 30 Vdc.
  - 4. LED status light for fault/alarm indication.
  - 5. Mounting: 35 mm DIN rail.
  - 6. Managed Features:
    - a. DHCP per port
    - b. SNMP (Simple Network Management Protocol)
    - c. Port security: MAC address based filtering
    - d. Monitoring: Include software
    - e. Port Mirroring
    - f. Port Trunking
    - g. 802.1p QoS and Port QoS
  - 7. Store and forward technology.

8. Auto sensing 10/100 Base TX, Duplex, and MDIX
9. Supported Protocols:
  - a. RSTP (Rapid Spanning Tree Protocol)
10. Environmental Conditions:
  - a. Operating Temperature: -40 to 60 degrees C.
  - b. Relative Humidity: 5 to 95% condensing fanless operation.
11. Switch shall be UL approved for application.
12. Manufacturer:
  - a. Siemens SCALENCE XC.
  - b. Or equal.

#### **2.14 DC TO DC CONVERTERS**

- A. DC/DC Converter shall provide NEC Class 2 output with 24 VDC input and 24VDC output.
  1. DIN rail mounted.
  2. Efficiency: 90.5%.
  3. Manufacturer:
    - a. PULS CD5.241-L1.
    - b. Or equal.

#### **2.15 INTRUSION DOOR SWITCHES**

- A. Magnetic reed switch, hermetically sealed, for installation on enclosure doors for intrusion alarm detection.
- B. Contacts rated for switching currents from 20 to 100 mA at 24 volts DC, Form C, DPDT.
- C. Manufacturer:
  1. Hoffman.
  2. Or equal.

#### **2.16 PANEL DRAWING PROTECTION**

- A. Provide wiring diagrams in accordance with Section 01 33 00. Provide a panel-wiring diagram and schematic for each panel in a plastic bag or plastic container to avoid water damage and aging.

#### **2.17 SWING-OUT PANEL**

- A. Swing-out panel shall be powder coated mild steel.
- B. Swing-out panel shall be hinged to allow access to back panel components.
- C. Provide handle or mechanism to secure swing-out panel in place while door is closed or swing-out panel-mounted components (i.e. OIT) are in use.

## **2.18 SPARE PARTS**

- A. The following spare parts shall be provided:
  - 1. Three LED panel light replacements.
  - 2. Five of each type and rating of fuse used.
  - 3. Five of each type of circuit breaker used.
  - 4. Five of each type primary protector surge suppressor used.
  - 5. Two of each type of surge protective device used.
  - 6. One 24 Vdc power supply.
  - 7. One UPS of each type.
  - 8. Three UPS batteries of each type.
  - 9. Five of each type of control relay used.
  - 10. One network switch.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Floor mounted cabinets shall be mounted and shimmed to precise alignment, so doors operate without binding. Sealant shall be provided for conduit entering the panels.
- B. Floor-mounted panels except in dry control rooms or electrical equipment rooms shall be mounted on 3-1/2-inch minimum height concrete pads, grouted bases, or as shown on the drawings. Coating shall be provided for outdoor panels in contact on concrete. Field panels and cabinets shall be mounted in compliance with Section 40 61 13.
- C. Terminals and terminal blocks shall be sprayed after all terminations have been completed with a silicone resin conformal coating, Fine-L-Coat Type SR, Dow Corning, or equal. Spray coating only required for control panels in corrosive or classified installation environments.
- D. Provide panels with the Record As-built schematic, connection, and interconnection diagrams mounted behind panel document holder on the inside of the door. Place documentation in a water proof clear bag in the panel document holder.
- E. Vacuum clean control panels and cabinets in accordance with Sections 01 74 23 and 40 61 13.
- F. Verify that all panels have been labeled with Arc Flash warning labels per NEC 110.16. Provide labels, with Arc Flash protection boundary and PPE levels.

### **3.02 MOUNTING**

- A. Mount new back panels within existing enclosures as specified. In some cases, the migration from old to new requires the existing back panel to stay in service while transitioning the wiring over to the new back panel. Provide a temporary support structure to locate the existing back panel and allow the new back panel to be installed and circuited.

- B. Control panels supported directly by concrete or concrete block walls shall be spaced out not less than 5/8 inch by framing channel between instrument and wall. Sills shall be leveled so panel structures will not be distorted. Panels shall be shimmed to precise alignment so doors operate without binding and mounted where shock or vibration will impair its operation.
- C. Support systems shall not be attached to handrails, process piping or mechanical equipment. Control panels supported directly by concrete or concrete block walls shall be spaced out from the wall to provide for air circulation around the panels.
- D. Steel used for support of equipment shall be 316 stainless steel. Support systems including panels shall be designed to prevent deformation greater than 1/8 inch under the attached equipment load and an external load of 200 pounds in any direction.
- E. Floor-mounted cabinets, except in dry control rooms or electrical equipment rooms, shall be mounted on 3-1/2-inch minimum height concrete pads, grouted bases, or as shown on the drawings.
- F. Panels shall be shimmed to precise alignment, so doors operate without binding. Sealant shall be provided under panels not located in dry control or electrical equipment rooms.
- G. Center-line of wall-mounted panels shall be 48 inches above the floor.
- H. Panel tops of wall-mounted panels shall be mounted at the same elevation.

### **3.03 PANEL DOOR CUT-OUTS**

- A. Remove existing panel mounted OIT and install new OIT, where shown on the drawings. Modify door as needed to accommodate new OIT size. Provide mounting gaskets and other appurtenances as needed to fill in any gaps in door cut-outs and to retain the enclosure's NEMA rating.

### **3.04 NETWORK SWITCHES**

- A. Coordinate the configuration setting of the network switches with the Owner and Engineer prior to SCADA networking.

### **3.05 PANEL POWER SUPPLY**

- A. Power supply and conditioning equipment shall be mounted and connected in compliance with the manufacturer's instructions.
- B. Line side disconnect switches shall be provided for power supply and conditioning equipment. Line and load side overcurrent protection shall be provided for power supply and conditioning equipment in compliance with NFPA 70.
- C. Small power supply and conditioning equipment may be mounted in the panel served. Larger units shall be mounted adjacent to the equipment served. Where unconditioned power is brought into control panels, it shall be enclosed in metallic raceways within the panel.

- D. Power supply and conditioning equipment larger than 5 kVA load capacity supported from surfaces other than concrete shall be provided with sound isolators.
- E. Final raceway connections shall be a flexible conduit in compliance with Division 26.

**3.06 FACTORY TESTING**

- A. The control panel shall be assembled, interconnected, and functionally tested at the assembly shop prior to shipment. The Owner/Engineer shall have the option of witnessing the functional shop test. The Contractor shall notify the Owner/Engineer at least two (2) weeks in advance prior of the scheduled functional shop test.

**3.07 FIELD TESTING**

- A. Field verify the following for Instrument and Control Panels:
  1. Control circuits grounded with one terminal of each load device connected to the grounded conductor.
  2. Control contacts installed in the ungrounded side of the circuit.
  3. Panel signal and control wiring separated and installed in separate wireways with barriers between the power wiring and the signal and control wiring.
  4. Barriers between the power wiring and the signal and control wiring.
  5. Connected to the site grounding system, as specified.
  6. Inner door contains a copy of the Record elementary and wiring diagrams, in a protected drawing holder. Drawings shall be enclosed in a transparent, protective jacket.
  7. Panel Functions as specified.
  8. Mounted with stainless steel Unistrut, fittings, and fasteners.
  9. Tested in accordance with Section 40 61 21.

**3.08 ATTACHMENTS**

- A. 40 67 00 Attachment A: Panel Schedule
  1. Description of headings in the Panel Schedule.

Field or Heading	Example	Comment or Description
Utility	Water	Utility identification.
Site	First Hill Pump Station	Site name.
Panel Tag	WA_DST_FHL_CAB7000	Panel tag name.
Back Panel Installation Location	Existing Enclosure	Identifies where new back panel is to be located.
Existing Enclosure Size (H x W x D) (inches)	60 x 24 x 12	Existing enclosure size, if applicable.
New Enclosure Size (H x W x D) (inches)	N/A	New enclosure size, if applicable.
Back Panel Size (H x W) (inches)	57 X 21	Identifies new back panel size.
Enclosure Location	In Vault	Identifies where enclosure is located (indoor/outdoor/vault).

<b>Field or Heading</b>	<b>Example</b>	<b>Comment or Description</b>
Panel Layout Drawing	I-1001	Reference to the panel layout drawing number.
NEMA Rating	12	NEMA rating of existing enclosure (if being reused) or new enclosure (if being replaced).
Processor	Siemens 1510SP-1 PN; 4MB Memory Card	Identifies the PLC processor model for the panel and the SD memory card size.
Local Panel-Mounted Display	12" Comfort Panel	Identifies whether the panel design includes a local panel-mounted display and type.
Installation Detail	Not applicable (N/A)	Reference to the installation detail for new enclosures.
Minimum I/O Module Count by Type (DI, DO, AI, AO)	2, 1, 2, 1	Identifies the minimum input/output module count by type. Refer to panel layout drawing for more details.
Site Notes	Back panel to be installed in existing enclosure.	Optional, as required for clarification.

**END OF SECTION**



**SECTION 40 67 00\_ CONTROL SYSTEM EQUIPMENT PANELS AND RACKS**  
**ATTACHMENT A**  
**PANEL SCHEDULE**

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SECTION 40 67 00 ATTACHMENT A

PANEL SCHEDULE

Item	Utility	Site	Panel Tag	Back Panel Installation Location	Existing Enclosure Size (H x W x D) (inches)	New Enclosure Size (H x W x D) (inches)	Back Panel Size (H x W) (inches)	Enclosure Location	Panel Layout Drawing	NEMA Rating	Processor	Local Panel-Mounted Display	Installation Detail	Minimum I/O Module Count by Type				Site Notes
														DI	DO	AI	AO	
1	WATER	FIRST HILL PUMP STATION	WA_DST_FHL_CAB7000	EXISTING ENCLOSURE	60 x 24 x 12	N/A	57 x 21	IN VAULT	I-1001	12	SIEMENS 1510SP-1 PN; 4MB MEMORY CARD	12" COMFORT PANEL	N/A	2	1	2	1	BACK PANEL TO BE INSTALLED IN EXISTING ENCLOSURE.
2	WATER	SPU STATION 171	WA_WS_SPU171_CAB7000	EXISTING ENCLOSURE	72 x 24 x 18	N/A	69 x 24	OUTDOOR	I-2001 I-6001	4X	SIEMENS 1510SP-1 PN; 4MB MEMORY CARD	7" COMFORT PANEL	I-6001 DETAIL D	2	1	3	1	BACK PANEL TO BE INSTALLED IN EXISTING ENCLOSURE. LOCAL DISPLAY TO BE MOUNTED ON INTERIOR SWING-OUT PANEL WITHIN ENCLOSURE.
3	WATER	SOUTH FIRE STATION	WA_DST_SFS_CAB7000	NEW ENCLOSURE	N/A	30 x 24 x 10	27 x 21	INDOOR	I-3001	12	SIEMENS 1510SP-1 PN; 4MB MEMORY CARD	NONE	I-6001 DETAIL B	1	0	1	0	NEW ENCLOSURE TO BE INSTALLED IN LOCATION OF EXISTING ENCLOSURE.
4	WATER	NORTH FIRE STATION	WA_DST_NFS_CAB7000	NEW ENCLOSURE	N/A	30 x 24 x 10	27 x 21	INDOOR	I-4001	12	SIEMENS 1510SP-1 PN; 4MB MEMORY CARD	NONE	I-6001 DETAIL B	1	0	1	0	NEW ENCLOSURE TO BE INSTALLED IN LOCATION SHOWN ON DRAWING I-4601.
5	WATER	NORTH FIRE STATION	WA_DST_NFS_TJB7000	EXISTING ENCLOSURE	20 x 16 x 10	N/A	AS REQUIRED FOR TERMINATION OF EXISTING I/O	INDOOR	N/A	12	N/A	NONE	N/A	N/A	N/A	N/A	N/A	EXISTING ENCLOSURE TO SERVE AS A TERMINAL JUNCTION BOX FOR ROUTING NEW CONDUIT/WIRE TO NEW ENCLOSURE LOCATION.
6	WATER	RESERVOIR PUMP STATION	WA_RES_RS_CAB7000	NEW ENCLOSURE	N/A	72 x 60 x 24	56 x 56 (BACK PANEL) 60 X 14 (SIDE PANEL)	INDOOR	I-5001	4	SIEMENS 1512SP-1 PN; 12MB MEMORY CARD	INDUSTRIAL PC	I-6001 DETAIL C	8	4	12	3	NEW ENCLOSURE TO BE INSTALLED IN LOCATION SHOWN ON DRAWING I-5701.
7	WATER	RESERVOIR PUMP STATION	WA_RES_RS_TJB7000	EXISTING ENCLOSURE	72 x 24 x 18	N/A	AS REQUIRED FOR TERMINATION OF EXISTING I/O	INDOOR	N/A	4	N/A	NONE	N/A	N/A	N/A	N/A	N/A	EXISTING ENCLOSURE TO SERVE AS A TERMINAL JUNCTION BOX FOR ROUTING NEW CONDUIT/WIRE TO NEW ENCLOSURE LOCATION.

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